PD-ABI-123

A MODEL APPROACH TO TECHNOLOGY - BASED BUSINESS DEVELOPMENT IN DEVELOPING COUNTRIES

FINAL REPORT

MARCH 1993

Prepared for: USAID/G/EG/EM
Technology Assessment Policy Analysis Project
AID Contract No. PDC-0091-C-00-9092-00

Prepared by: The Center for the Interdisciplinary
Study of Science and Technology
International Business Development Program
Northwestern University

Prime Contractor: SRI International

Summary

This report summarizes the activities undertaken by the International Business Development Program of the Center for the Interdisciplinary Study of Science and Technology (CISST), Northwestern University under the "Promotion of New Forms of Business Collaboration Between U.S. and Developing Country Firms Initiative," funded by the Technology Assessment Policy Analysis Project of AID/G/EG/EM.

The rationale for this initiative was based on the premise that economic growth in developing countries is increasingly dependent on their ability to develop technology-based, high value-added manufacturing enterprises to enhance global competitiveness. The CISST initiative sought to support technology transfer to developing countries by facilitating business collaboration between developing country and U.S.-based firms.

This initiative was a pilot activity designed to test the validity of a service delivery mechanism developed by CISST known as the "Second Generation Business Incubation System." Under this model, a variety of business support services are to be delivered to developing country firms to serve their specific needs, such as industrial technology, market knowledge, access to financing, etc.

CISST carried out a pilot project in Jamaica in 1993. Based on a set of criteria, CISST selected the agro-processing sector for further assessment of its competitiveness and strengths. CISST proceeded to select one firm -- Technosol -- to receive further assistance, including technology sourcing needs assessment, foreign market intelligence, and the identification of potential business collaboration partners in the United States. The pilot project resulted in a series of studies completed by CISST, including a "Technosol Company Profile," a "Jamaica Pilot Project Market Report," and the "Technosol Service Plan" (See Appendix 3-5).

While the pilot project has demonstrated the potential value of a service delivery mechanism to technology based enterprises, the complete development and testing of the CISST approach were constrained by the limited resources available under the project.

This report also includes a discussion of current project status and the relevance of the model to USAID, as well as the background studies conducted to support the pilot project.

Table of Contents

Introduction.....1

Rationale for Model.....1

Key Role of Technology.....3

Guiding Principles and Structure.....4

Service Delivery Mechanism.....7

The Jamaican Pilot Project.....9

Project Initiation.....10
Identification of Target Sector.....10
Assessment of Agro-processing Sector.....11
Assessment of Functional Capabilities.....12
Client Selection.....15
Preliminary Selection of Candidates.....15
Selection of TBE Client.....16
Technology Needs Assessment.....17
Client Service Plan.....17
Target Market Analysis.....19
Assessment of Technical Requirements.....20
Business Collaboration.....21
Identification and Screening.....21
Next Steps.....22

Implications.....22

Conclusions: Current Project Status.....23

Relevance of Model to USAID.....25

Appendix 1: Jamaica Pilot Project Workplan

Appendix 2: Report of Initial Fact-Finding Mission to Jamaica

Appendix 3: Technosol Company Profile

Appendix 4: Jamaica Pilot Project Market Report

Appendix 5: Technosol Service Plan

INTRODUCTION

The following report describes the activities of the International Business Development program of the Center for the Interdisciplinary Study of Science and Technology (CISST), Northwestern University, in the USAID/SRI/TAP project "Promotion of New Forms of Business Collaboration Between U.S. and Developing Country Firms." It lays the foundation and rationale for a model to guide USAID in the design of private sector development programs based on collaboration between U.S. industry and the productive sectors of some USAID countries.

The CISST project is composed of two pilot projects which provide the basis on which the model has been constructed. These pilot projects are being conducted in Ukraine and Jamaica. The Ukraine pilot has focused on facilitating U.S. investment in the Ukrainian meat processing sector. In the Jamaican project, CISST is assisting entrepreneurs in the agro-processing sector to access the technology necessary to develop competitive, high value-added products for domestic and foreign markets and fostering cooperation between Jamaican processors and U.S. technology providers. This report deals with the Jamaican experience and its implications for a new model of U.S. - Developing Country business collaboration, and discusses possibilities for expanded activities based on this model.

Many aspects of the model represent an evolution and refinement of the small business incubator concept, adapted to suit the needs of technology-based business development in developing countries. In constructing the model, CISST has drawn on experiences gained in technology-based business development projects in Mexico and Eastern Europe, as well as the pilot project in Jamaica. In formulating objectives, criteria and procedures, care has been taken to ensure compatibility with USAID policies, including restrictions on incentives to relocate U.S. businesses or jobs.

RATIONALE FOR MODEL

In the modern global economy, economic growth in developing countries is based less on classical forms of comparative advantage in commodity products and low cost labor, and more on competitive advantage derived from a well developed manufacturing sector capable of converting local resources into high value products which can compete successfully in global markets. This emerging economic reality requires new models for economic development based on supporting the creation and expansion of competitive, technology-based, high value-added manufacturing enterprises.

This is particularly true in countries undergoing policy reforms of liberalized trade and privatization, exposing their productive sectors simultaneously to dramatic internal restructuring and unprecedented foreign competition. In these cases, the economic policies of protectionism are rapidly being dismantled, but they are not being replaced by equally comprehensive support structures based on free market

competition. The result has been uneven development of key economic sectors. In Jamaica, for example, our assessment indicates that the financial sector has received intensive attention from policymakers and assistance agencies and has made major strides, but the manufacturing sector has not kept pace. The banking system is now reasonably well capitalized, but its effectiveness is limited by the lack of a manufacturing base that can effectively use this capital to develop competitive industries. The cost of capital remains high, while return on investment in manufacturing generally remains low. Under these circumstances, the financial and manufacturing sectors are not well integrated and the effectiveness of both are limited.

An important element which is missing in the manufacturing base is the ability to identify and acquire innovative production technology which can be used to convert local agricultural and mineral resources into a wide range of industrial chemicals, food additives, processed food products, and a variety of other high value products which are in demand in global markets. The expanded use of technology in manufacturing will help local economies diversify and increase export earnings by producing more products from the existing resource base, while capturing higher profits.

For this to occur, a process must be created to assist manufacturing companies and entrepreneurs to identify technology-based enterprise (TBE) opportunities in the marketplace and to identify and acquire the technologies needed to compete, combined with assistance to the financial sector to improve its ability to assess technical business proposals and to manage the risks inherent in financing innovative business ventures. In this way, the capital now available in domestic and multilateral financing systems can contribute more effectively to the competitiveness of the economy.

The model approach to TBE development created by CISST seeks to establish a process for collaboration between local business support structures in the public and private sectors and bilateral assistance agencies to identify high-potential TBE business opportunities and promote the creation of profitable businesses based on them. The approach builds on the following basic procedures:

- identification of target industry sectors which have a high potential for supporting TBE growth
- identification of specific business opportunities within that sector
- identification of specific market opportunities
- identification of entrepreneurs or existing businesses capable of capitalizing on the business opportunities
- identification of technical requirements for meeting market demands

- identification of technology suppliers

- facilitate buyer-supplier communications and other linkages necessary for successful enterprise development.

KEY ROLE OF TECHNOLOGY

Underlying this process is a deep appreciation of the key role that technology plays in competitiveness, and of the need to marshal technological resources of all kinds for the purpose of developing competitive industry.

In this regard, it is important to recognize the following features of technology as an agent of economic development:

- The true value of technology must be measured by its ability to enhance market competitiveness. Technology is a means of improving production efficiency, product quality or the process of developing new products in order to be more responsive to customer needs. Decisions regarding the acquisition or development of industrial technologies must be driven by an understanding of opportunities which exist in the marketplace. Knowledge of market demands for product quality, product features, delivery requirements and similar factors form an important basis for determining the technical requirements of the enterprise.

- The emergence of multiple poles of technological development. Technology is being developed in a number of countries, not only in the most industrialized.

- Technology has no nationality. Though many developing countries are attempting to mobilize their own indigenous technological resources, the importance to domestic industrial competitiveness of technologies developed elsewhere must not be underestimated. The "not invented here" syndrome is as important to overcome at the national level as it is at the firm level. Most of the dramatic success stories of industrialization in recent decades - Japan, Korea, Taiwan - have depended heavily on the acquisition and adaptation of externally developed technologies to accelerate industrialization processes.

- Technology is changing rapidly in all industrial sectors, and high technology is penetrating many formerly low-tech, labor intensive industries.

- Technology pervades all aspects of economic and industrial activity; it is no longer limited to equipment, but includes the entire range of knowledge associated with competitive business activity in all phases

and functions (e.g. marketing, administration, product design, etc.) that determines the overall productivity and competitiveness of an enterprise.

- Technology is no longer a determinate and static aspect of manufacturing; like human resources, it is a variable in the production process which can be changed, improved, and modified through innovative management.

- Incremental and small improvements in technology are often more important to industrial competitiveness than radical breakthroughs. While incorporating new technology is important, conventional technologies and skillful adaptations play a key role in economic development. While electronics and biotechnology may be high profile areas of new technology development, the potential contributions of innovations in areas such as conventional chemical processing technology often have higher potential for economic development.

GUIDING PRINCIPLES AND STRUCTURE

This perspective on technology requires the CISST approach to combine features of technological capability development and export promotion models into a single program. But the approach differs in important ways from these traditional models. The CISST approach differs from previous models of technology-based economic development in that less emphasis is placed on enhancing the capacity to develop technology locally and more emphasis is placed on tapping technology sources, wherever they exist, which are useful in developing competitive TBEs. The approach differs from traditional export promotion models in that it is driven by demand rather than supply. Rather than focusing on commodities and other products already produced locally, the CISST approach seeks to identify new export market opportunities for high value, competitive products which could be produced locally using local inputs and suitable technology.

Although the model stresses the sourcing of suitable technology on a global basis, the pilot project focused sourcing activities in the U.S. For U.S. industry, which is a leader in technical development in a wide range of industries, this approach presents an opportunity to penetrate new and growing markets. Because the TBE development process focuses on the development of new business enterprises, the opportunities created for U.S. exports are usually for equipment and expertise that have not previously been in great demand in that developing country market. Therefore, these opportunities are not typically revealed through ordinary market channels that U.S. companies can tap on their own. Rather, they are created by the emergence of new industrial activity which has high potential for future growth. The sourcing activities of the CISST approach thus open new export opportunities for U.S. industry and promote industrial cooperation which is beneficial to both countries.

The CISST model has been designed to promote technology-based business development capabilities within the productive sector of developing countries by facilitating access to information and intelligence on relevant technologies and markets and assisting TBEs to establish the international business linkages which are necessary to access needed equipment and expertise and penetrate foreign markets. The model focuses on establishing a process involving the public and private sectors to encourage and support the growth of competitive TBEs and to enhance their probability of success. The model is based on the following principles:

- The growth of technology-based business is non-deterministic. The success of a TBE is often based on its ability to innovate, by integrating new and existing technologies and raw materials in novel ways to produce new products and penetrate new markets. There are no set formulas for success in such ventures. A TBE development system must therefore be flexible, using a probabilistic approach to **identify and enhance factors that affect new business success in the local environment**, recognizing that each TBE has unique strengths and problems and that its needs will change at different stages of growth. A central objective of the CISST model is to expand and strengthen these capabilities within TBEs and within public agencies and industrial associations.

- Economic development in a free market environment must ultimately occur at the level of individual enterprises, so the CISST model takes a "ground up" approach which seeks to **address barriers to TBE development at the level of the enterprise** and to use this experience to design macro-level support structures which are responsive to the practical needs of the business community.

- A sustainable TBE development process must be cost effective, placing less emphasis on creating large new programs and focusing instead on **enhancing and strengthening the existing system** of business support agencies, industry associations and research institutes to better address the real needs of the private sector. This is accomplished through a carefully constructed program of capability development, the design of business support programs which focus on direct service to businesses, and coordination of all support organizations to create a comprehensive program that is responsive to the real needs of businesses.

Using these principles, CISST has developed a process for expanding U.S.-Developing Country business collaboration based on enhancing the probabilities of success of TBEs in developing countries, which in turn creates new demand for U.S. equipment and expertise. This model attempts to establish procedures and criteria for a TBE development process and to consolidate local public and private support organizations to implement the process on an on-going basis. The model uses direct service to enterprises as a means of refining the policy approach to private enterprise

development in developing countries to ensure that the process is responsive to real needs which affect the probability of TBE success in the local environment. CISST has identified several key factors influencing successful TBE development in the developing world. These include:

a) Technology and Equipment Sourcing and Intelligence

The ability to identify, assess, acquire, adapt and efficiently use technologies developed anywhere in the world that further the objectives of the TBE.

b) Market Intelligence and Access

Acquiring knowledge of foreign markets and identifying their changing demands, predicting future markets, and developing strategies to access these markets. While technology plays a fundamental role in the development of TBEs, the ultimate determinant of success is the ability of the TBE to produce products or services that meet a market need, and to develop an effective strategy for delivering the product to the customer.

c) Financing and Investment

Access to innovative financing mechanisms capable of assessing technology-based business plans and managing the risks inherent in financing new process testing, pilot plant development and penetration of new markets.

d) Human Resource Development

Developing a skilled workforce that can effectively perform the broad range of demanding tasks required in companies that produce world-class quality products.

e) International Business Linkages

Identifying and developing relationships with overseas businesses for technology sourcing, market access, technical assistance or joint research and development.

In the CISST approach, the primary factors influencing TBE success are seen as **functional capabilities** which are needed within TBE organizational structures in order to maximize the probabilities of long-term commercial viability. TBEs generally do not possess the full range of skills and experience needed to grow a successful

business. They may have technical expertise, or several years of relevant business experience, or access to raw materials, or knowledge of a specific market, or ready access to financing, but they will rarely possess all of these within the business organization, particularly at the start-up phase. The support services delivered by the model program provide the TBE with the business development functions the new organization lacks.

SERVICE DELIVERY MECHANISM: A SECOND GENERATION BUSINESS INCUBATION SYSTEM

To deliver needed services to TBEs, CISST has developed a mechanism which extends and greatly modifies the small business incubator concept popular in the U.S. and many other countries, to create a structure that is responsive to the real needs of the business communities of developing countries.

A traditional business incubator provides space, shared equipment, and business/technical support services to small start-up firms. Incubator management develops a network of pre-screened contacts within the public and private business support and consulting communities and assists tenants to access these networks in ways that meet the tenants' specific needs. This support has been shown to reduce the time required to launch a business and to significantly increase the prospects for success of a new enterprise. As tenant firms grow and begin to achieve a stable financial footing and a market presence, they "graduate" from the facility and move into their own location.

Our approach significantly alters the incubator concept to produce a unique mechanism for implementing TBE development programs. This plan for focusing and delivering business support services to small businesses and entrepreneurs can be thought of as a "second generation" incubator. Conventional incubators are individual buildings which tend to have a local focus, drawing tenants from the immediate community. Most are subsidized with public funds and have few direct links with existing businesses beyond those that are potential service providers for tenants. Perhaps most importantly, conventional incubators are "reactive" in that they support entrepreneurs and new businesses that have already developed their product or technology ideas.

The model described here serves this purpose as well, but also develops new TBE business projects based on known market demands and actively seeks private entrepreneurs and businesses to implement them. This approach minimizes costs because it does not require a building or the establishment of expensive new programs. Rather, it creates a structure which functions as a "virtual" incubator, developing needed capabilities within existing support organizations and accessing these services in ways that best meet the needs of an individual TBE. The primary purposes of this approach are:

- to serve as a proactive outreach program to promote the development of

successful, market-oriented, value-added industries,

- and to realize the successful development of these businesses by helping them access needed collaboration with U.S. industry in the form of U.S. exports of equipment, technical assistance and other support services.

The main points of difference between conventional incubators and the CISST service delivery mechanism are outlined in figure 1.

Figure 1
COMPARATIVE INCUBATOR FEATURES

CONVENTIONAL INCUBATORS	2ND GENERATION
• Domestic Technology Focus	• Global Technology Focus
• One Location/Site	• Many Organizations (No Walls)
• Local Orientation	• Global
• Subsidized	• Oriented to Sustainability
• Real Estate Dimension	• Value-Added Emphasis
• Service Oriented	• Business Generation
• Weak Links with Existing Firms: Focus on New Start-Ups	• Broad Clientele: - New - Existing - Domestic/Foreign
• Based on Technology "Push"	• Based on Market "Pull"
• Reactive to Technology	• Proactive to Technology

In developing and organizing business support capabilities, the emphasis must be on combining public and private elements to develop a system that will gain the respect and confidence of all participants in the development process, including policymakers, bureaucracies, banks, large firms - domestic and foreign - and small businesses. Only by integrating all of these elements can sustained economic development be achieved.

THE JAMAICAN PILOT PROJECT

The Jamaican pilot project had two primary objectives:

1. To develop a model program to assist Jamaican small businesses and entrepreneurs to access the technology necessary to develop competitive, high value-added products for domestic and foreign markets.

2. To use the increased demand for technologies created by Objective 1 activities as a basis for fostering cooperation between Jamaican processors and U.S. equipment and technology providers.

The pilot was used to create an integrated model including technology needs assessment and U.S.-Jamaican business collaboration which facilitates business agreements for U.S. suppliers, while addressing a more fundamental issue by contributing to the development of competitive TBEs in developing countries.

Specific procedures and activities carried out in the Jamaican pilot were designed to be transparent and replicable in developing economies which are:

- undergoing privatization and trade liberalization
- have an underutilized or inefficiently utilized resource base to which technology can be applied to create significant value-added business opportunities.

Key decisions regarding selection of target sectors, TBE clients, target markets, technologies and U.S. collaborators were all made based on criteria which has been tested and refined during the pilot project.

In keeping with the Jamaica pilot project workplan submitted to SRI and USAID/PRE on June 8, 1993 (see Appendix 1), CISST identified a single Jamaican agro-processor to serve as the subject of a case study for testing and modifying the model approach.

The project was conducted in accordance with the following workplan:

I. Project Initiation

- Identification of target sector
- General assessment of target sector
- Assessment of functional capabilities in target sector

II. TBE Client Selection

- Preliminary selection of TBE candidates
- Selection of TBE client for pilot project

III. Technology Needs Assessment Component

- Preparation of client business service plan
- Target market identification and analysis
- Assessment of technical requirements

IV. Business Collaboration Component

- Interaction with key U.S. associations of relevant processing equipment suppliers
- Identification and screening of prospective U.S. suppliers
- Facilitate communications between client TBE and potential technology suppliers

PROJECT INITIATION

Identification of Target Sector

At the outset of the Jamaica component of the project, CISST conducted a preliminary assessment of Jamaican industry to identify sectors which offered the best opportunities for creating value-added businesses based on existing resources.

Criteria for sector selection were:

- Quality and availability of local production inputs
- Potential market opportunities for value-added products
- Level of current sectoral development in terms of:
  - size and structure of the sector
  - current value added
  - technical expertise
  - extent of existing relationships with U.S. industry

- Competitiveness and suitability of U.S. products and services which could support TBE development

CISST identified raw materials in three primary areas which appeared to be underutilized in terms of their value-added potential:

- marine resources for food processing
- agricultural products for food and chemical processing
- non-metallic minerals such as limestone and silica.

CISST selected agro-processing because it was more evolved than the others, with some examples of entrepreneurial success at a variety of levels, such processing of jams and jellies from local fruit for export, raw spice production, and production under private label agreements for major foreign food store chains. While technological capabilities in this sector tend to be low, limited investment capital exists for upgrading, and a recognition exists among the agro-processing business community and relevant government agencies of the potential for establishing more profitable ventures through improvements in technology and marketing. In addition, our preliminary survey of the sector indicated that the dominant export business strategy was to produce traditional Jamaican processed food products and market them to Caribbean ethnic groups in the U.S., Canada and Britain. However, an examination of the available agricultural inputs indicated that many other products could be produced, with appropriate U.S. technologies, to penetrate far larger, more mainstream markets in the region and the industrialized world.

General Assessment of Agro-Processing Sector

Our assessment of this sector indicates that Jamaica is rich in high-quality fruits, vegetables, spices, herbs and other botanicals which are now generally grown wild or are cultivated primarily as commodities for fresh produce markets. The raw materials could, however, be processed to produce oils and resins which could be marketed as flavoring and scent agents, pharmaceutical inputs, industrial chemicals and other high value products of globally competitive quality. Some of these products are being produced by small businesses in Jamaica, but only a fraction of the full potential has been realized.

The information gathered during the initial fact-finding trip by CISST (see Appendix 2 - "Report of the CISST/IBD Fact-Finding Mission on the Jamaican Agro-Processing Industry") indicates that the agro-processing sector is likely to play a central role in Jamaica's economic growth. As a small island economy, Jamaica's raw materials base is limited, both in volume and diversity. With a population of about two and a half million people, the local market for goods and services is small, meaning that growth must always be fueled by a significant export component. In this environment, industries such as agro-processing, which add value to existing resources and produce globally competitive products, are high-potential sources of

foreign exchange-based profits and sustained growth.

Critical barriers to the expansion of this sector include lack of knowledge regarding the specific demands of foreign markets, difficulty in identifying, acquiring, modifying and operating processing equipment that will satisfy these market demands most efficiently, and difficulty in obtaining financing - particularly seed capital. These barriers represent the the primary areas of functional capability which are currently lacking in this sector.

By assisting Jamaican agro-processors to identify untapped foreign markets in which their agricultural resources provide a potential competitive advantage, demand for U.S. equipment and expertise needed to meet the requirements of these markets can be stimulated. Most of these markets appear to be in food additives, fragrances and specialty foods niches in the industrialized world. These markets are well suited to the high-quality, high-priced fruit-based and herbal products in which Jamaica has a natural advantage, and the volume of production required to develop a strong market presence are often small enough that Jamaica's limited agricultural acreage can provide inputs in quantities that will enable local processors to achieve reliable delivery volumes.

At present, Jamaican processors have successfully penetrated ethnic Caribbean niches in North America and Europe, but a strong emphasis on this ethnic niche has diverted attention away from other opportunities to produce high-quality food, food additive, fragrance and other botanical products that have a broader appeal among mainstream consumers in these markets.

This lack of scope is explainable in part by the fact that food processing in Jamaica developed as an import substitution industry serving local markets. An export focus has emerged in recent years as a response to trade liberalization. Most companies in the industry are small, though some, such as Grace-Kennedy, are among the country's largest domestic firms. Many agro-processing inputs are non-traditional crops in Jamaica, meaning that they have historically not been cultivated, but rather grow wild in widely dispersed areas across the island. These crops include mangoes, guava and other passion fruits, which are processed into purees, jams, juices and sauces; as well as peppers and a variety of herbs which are used to make spices, seasonings and essential oils. Some cultivated crops are also processed, including citrus, pimento (allspice) and coffee, but for non-traditional crops, supply and price fluctuate widely.

Relationships between growers and processors tend to be inefficient. Processors must generally rely on a continuously shifting group of small, independent farmers for their inputs. It is difficult for these small scale farmers to reduce the cost of production to meet the needs of processors. Herbs and other crops used in seasonings are grown specifically for processing, as is a large share of the citrus crop, but in other cases, relations between growers and processors are sporadic. Jamaican

agriculture is strongly focused on the fresh market. Much of the raw materials supply available to processors is excess or rejected fresh produce. Price fluctuations inherent in fresh produce markets carry over into relationships with processors, which are less able to accommodate them.

Assessment of Functional Capabilities in Agro-Processing Sector

Human Resource Development

The human resource base in the industry is dominated by non-technical businessmen and low-skill laborers. Food technology specialists are rare and dispersed widely throughout the sector, which poses a major barrier to the development of innovative new products. This problem is amplified by the domestic consumer packaging industry, whose output is very limited in quantity and variety.

Also lacking is marketing expertise. Most processors interviewed by CISST expressed a strong interest in upgrading their marketing functions in order to compete more effectively overseas. However, in Jamaica, scarce marketing talent tends to gravitate to the tourism industry, where employment opportunities are much more attractive. Agriculture and agro-processing have traditionally operated in protected export markets selling sugar, bananas and other raw or semi-processed commodities at fixed prices, so there is not a strong tradition of competitive marketing in this sector.

Marketing Intelligence and Access

In Jamaica, as in many developing countries, the local market demands significantly less than major export markets in terms of product quality, consistency and diversity. The nature of export marketing expertise is therefore fundamentally different from that of local marketing, and much more complex. The identification of foreign marketing opportunities, and investment in the equipment and knowledge needed to produce for those markets, imposes significantly greater burdens on the resources of Jamaican firms, compared to enterprises operating in more industrialized environments in which domestic standards of competition more closely resemble "world-class" definitions of product quality and reliability. Increasing demand for U.S. products and services by Jamaican industry, and increasing the attractiveness of potential Jamaican firms as customers to U.S. businesses, will depend in large part on the ability of Jamaican firms to identify and exploit foreign market opportunities which demand retooling and operational restructuring. Improved marketing intelligence among Jamaican food processors is therefore needed in order to generate any significant increase in the need to invest in goods and services offered by U.S. industry.

Technology Sourcing and International Linkages

Equipment sourcing capabilities among small processors was found to be

limited. Most subscribe to U.S. industry journals and trade magazines to monitor new products and processes and to identify potential suppliers. The Jamaica Promotions Corporation (JAMPRO), Jamaica's economic development agency, periodically holds seminars on food technology for companies. However, all processors interviewed by CISST said that sourcing the proper technology from the U.S. is difficult. The U.S. processing sector has evolved to serve a large domestic market and processors often compete based on economies of scale. Most major U.S. equipment suppliers produce equipment designed for this environment. In Jamaica, the domestic market is small and the reluctance among processors to conglomerate further accentuates the tendency of Jamaican processors to operate on a very small scale.

Equipment suppliers that advertise prominently in U.S. trade magazines tend to be the ones that produce this high cost, high volume equipment, which exceeds the needs and budgets of even most of the largest Jamaican processors. Smaller U.S. suppliers with innovative systems for producing high quality niche products generally do not have such a high profile in readily available information sources. The perception among Jamaican processors appears to be that suitable technology is not available in the U.S. to the extent that it is in smaller industrialized countries that produce equipment scaled to serve their own domestic market. Italy was identified as a particularly popular source.

The attitude among processors toward U.S. suppliers appears to be very good, although there is some concern about the appropriateness of the scale of most U.S. equipment and technology in the Jamaican context. Even many of the smaller processors have direct experience dealing with U.S. companies such as equipment suppliers, distributors and consultants. Although the results of these collaborations have been mixed, there appears to be a strong perception that further collaboration with U.S. industry is vital for the upgrading of Jamaican agro-processing sector.

Financing and Investment

Financing to upgrade production is difficult to find and expensive. There are no differential interest rates for productive investment, and market rates are currently around 30%. The return on investment in the food processing sector varies from 6 to 40 percent, according to experts at Grace-Kennedy, Jamaica's largest food processing company. In most cases, investments in the stock market or North Coast real estate are more profitable.

There are few fiscal incentives such as accelerated depreciation to encourage capital investment, so taxes on technology-based operations are high. In addition, business insurance for food processors is high due to the likelihood of hurricanes and other natural disasters which can interrupt their supplies.

However, some financial programs do exist to support various aspects of food processing. The Agriculture Credit Bank gives 15% loans in U.S. dollars, and some of

these loans are available to processors. The Jamaica Agricultural Development Foundation also offers special loans to processors, sometimes in U.S. dollars. The European Community and Canada have special loan programs for developing value-added Jamaican agriculture, and local commodity boards offer short-term financing to growers. Currency devaluation has left some banks leery of loans that will not result in an inflow of hard currency, so loan requests for export-oriented projects are often preferred. This can be an advantage for many food processing projects, which tend to focus on exports, but the lack of reliable, low cost inputs and packaging frequently forces processors to import these supplies, reducing the net foreign exchange.

In spite of these difficulties, bank loans appear to be the preferred means of obtaining additional capital. According to various government experts, Jamaican firms have historically resisted bringing in new equity. Conglomeration is rare, except in cases where large companies acquire much smaller ones. This has tended to keep production small scale and to make investment resources scarce.

CLIENT SELECTION

Preliminary Selection of TBE Candidates

To identify the case study subject, CISST worked through a local collaborator, Dr. Arnoldo Ventura, Special Advisor for Science and Technology in the Office of the Prime Minister, to obtain meetings with relevant industry associations (The Jamaican Manufacturers' Association Food Group, and the Small Food Processors' Association) and selected food processing enterprises. The criteria for selecting the case study enterprise included an assessment of the following characteristics of the company or entrepreneur:

- level of interest and commitment to creating a technology-based enterprise to produce high-value processed agricultural products
- market potential of proposed processed products
- level of technical sophistication and knowledge of relevant production processes
- access to capital to finance the acquisition of needed equipment and expertise
- availability of raw materials.

In addition to these criteria, CISST also assessed the likelihood of obtaining measurable results for the client within the relatively brief six-month term of the Jamaican component of the pilot project, so that the efficacy of the model could be tested as fully as possible. This time constraint was considered idiosyncratic to the

pilot project, although it did influence decisionmaking. It was determined that each element of the model could be most fully tested by selecting a client seeking technology that was available from a limited number of U.S. sources and interested in producing products for a concentrated market. This would allow the information gathering and analysis to be conducted thoroughly in a relatively brief time.

Using these criteria, CISST made an initial selection of project candidates which included:

Technosol, Ltd., a start-up company seeking to process essential oils from various local plants. Dr. Lyndon Johnson, a Food Technologist at the Scientific Research Council of Jamaica, and Chairman of Technosol, requested that CISST provide assistance in obtaining marketing information on essential oils and botanicals, and information on essential oil and oleoresin extraction equipment in the U.S. CISST concluded that Technosol's business idea was viable and that the services requested fell within the scope of the pilot project.

The Jamaica Banana Growers Association, considered the strongest commodity organization in Jamaica, wanted to expand its food processing operations and construct a high-volume, state-of-the-art processing plant to produce 12,000 cases per month of jerk seasonings in various forms, and vacuum packed sliced fruit. The association has well established marketing channels overseas, particularly in England and Europe. A representative of the association informally requested CISST assistance in identifying market-led new product ideas for the new plant, and to provide some assistance in sourcing equipment.

Canco, Ltd., a small food processor producing jams, jellies and cakes which is establishing a relationship with two other small processors to produce a fruit salad for export. The venture will permit the partners to access the wide range of inputs needed for such a product, and to pool capital equipment resources in order to produce at the higher volumes needed to reduce costs and fill foreign orders. Canco expressed interest in working with the project to better structure its marketing program and to assist in the identification of equipment for its fruit salad venture.

Selection of TBE Client

The Jamaica Banana Growers Association was considered too large and their equipment needs too varied and complex to pursue within the constraints of the pilot project. Purchasing for the plant was already underway when CISST conducted its initial visit in June, and installation was scheduled to begin in September, which allowed insufficient time for preparation. Canco Ltd. expressed interest in the marketing assistance elements of the model approach, but was not in a position to take advantage of the full service package at the time the project had to be conducted. The small processors association was still in the formative stages, and the equipment required for the planned processing venture was common industrial technology

available from many sources around the world.

Technosol, Ltd., the company established by Dr. Johnson, was selected because it best met the criteria of the model and afforded CISST the best opportunity to test all aspects of its model approach. It should be noted that all three of the candidates could have provided useful inputs into the model and benefited from its services. In a program with greater time and financial resources, all of these enterprises, as well as a great many others, could be effectively served (see Appendix 3: Technosol Company Profile).

Technosol is interested in producing high quality essential oils, oleoresins and other extracts from a range of botanical products, and has access to land for growing these products if other local sources are not available. The company also has immediate access to steam distillation facilities under lease, but has plans to identify and acquire more sophisticated processing equipment for producing very high purity extracts once a reasonable cash flow has been established. The technical experience of Dr. Johnson in food processing technology was considered a further advantage, because it increased the likelihood that the company would be able to produce high quality products if the appropriate equipment could be found.

TECHNOLOGY NEEDS ASSESSMENT

Client Service Plan

The design of the specific service package for Technosol was based on the companies current status relative to the functional capabilities described above, which were determined by interviews with the company. These capabilities were assessed in light of the companies objective, which was to penetrate foreign markets with high quality botanical extracts made from local inputs. For each area of capability, CISST attempted to determine whether Technosol's current strength was:

a) a barrier to short-term competitiveness
b) adequate to meet short-term company objectives but barriers to achieving higher value-added production
c) advanced enough to compete in higher value markets

Using this approach, CISST concluded that all functional areas were adequate to meet the company's current objectives, which were to produce commodity extracts on a small scale to serve a limited base of local customers. The human resources area was the company's strongest competitive advantage. Technical skills already resident in the organization were found to be very sophisticated by the standards of small Jamaican agro-processors, and were good enough to effectively incorporate processing technologies more advanced than any currently in use in Jamaica (level c).

Other capabilities were at the intermediate level: adequate for achieving the

companies short-term objectives, but barriers to higher value production. Financing required to initiate the production of extracts using steam distillation had been acquired. New financing would be needed in order to upgrade production to meet the needs of quality-conscious buyers. The company had no relationships with overseas firms, either as suppliers or as customers. Such relationships were not necessary to achieve current objectives, but were critical to the companies expansion plans. Technology sourcing and marketing intelligence capabilities were not well developed, and it was apparent that these two areas would have to be served in order to identify the financing and international linkage requirements. It was necessary to conduct market and technical analyses before a strategy of production upgrading could be developed. The pilot project service plan therefore included the following components:

- Preliminary foreign market intelligence to identify market opportunities. CISST would use its network of government and industry contacts worldwide and its in-house market research expertise to identify market opportunities for technology-based products that can be competitively produced by local firms. Market intelligence services included:

  - preliminary foreign market demand analysis to identify target markets and determine product specifications

  - competitor analysis of alternative products or competing firms in the target market

  - segmentation analysis to identify niche market opportunities

  - distribution channel analysis to assist the client in entry strategy development.

- Technology sourcing services to assist the client to identify the technical requirements of new processing ventures and to acquire the needed equipment and training. Upon completion of a preliminary market analysis, technology sourcing assistance will be provided in the areas of:

  - assessment of equipment and personnel requirements

  - assessment of investment requirements

  - assistance in training and monitoring of relevant technology developments to help client companies to continuously improve their processes.

Target Market Identification and Analysis

A preliminary assessment of the market for botanical extracts revealed that the overall market for these products was tight and that global price trends in recent years have not kept pace with inflation. However, opportunities for very high quality extracts existed among a limited number of large spice, food processing and fragrance producers as well as smaller companies involved in newer, growing niches such as aromatherapy and homeopathic products. These customers are willing to pay a premium price for extracts which meet demanding specifications (see Appendix 4: "Business Opportunities in the Botanical Extracts Market"). Lower quality extracts, particularly those produced using steam distillation (the technology most often used in Jamaica), are marketed as commodities and there has been a downward trend in prices for these products since the 1970s.

The global market for commodity extracts is tight due to oversupply and increasing competition from cheaper synthetic substitutes. High quality extracts, which have higher purity and which capture a fuller range of the compounds responsible for flavor and aroma, are in demand among producers of high quality or "natural" processed food and fragrance products. In this market, there is less competition from synthetics and profit margins for extract producers are higher. However, the supply and quality of these extracts has been unreliable.

They tend to be produced in small amounts by small scale processors around the world, using raw materials that grow wild. Jamaica could grow a wide range of these raw materials commercially and apply advanced technology to process them into extracts which could meet market demands for quality.

The report examined several extract products which Technosol believed they could produce, and provided information to assist the company in prioritizing these possible products according to market potential, processing requirements and cultivation requirements. To acquire this information, CISST worked with a range of industry associations, government agencies, extract producers and extract buyers (see source appendix to Business Opportunities report). Recommended products included paprika oleoresin used as a coloring agent in food processing, essential oil from allspice used as a flavoring agent, geranium oil for perfume, ginger oil for food flavoring and perfumes, and vetiver oil for perfume.

The market analysis provided a basis for determining general categories of technologies which could be acquired from the U.S. and used to upgrade production at Technosol in order to meet market requirements for these extracts. These general categories guided a first level search, which was refined according to technology supplier search criteria discussed below. According to the market analysis, the production process was the key to the market entry strategy because it was the source of the quality advantage. CISST therefore initiated a search process to identify technologies for high quality extraction of oils and resins from botanicals. In this

process, CISST drew on the resources of spice trade associations, chemical process engineers from research institutions and industry, as well as large spice, food processing and fragrance producers which have their own extraction capabilities. In addition, CISST initiated contacts with major essential oil buyers and the U.S. Food Chemical Codex to determine the quality parameters for high purity extracts (see Appendix 2 of Business Opportunities report).

Assessment of Technical Requirements

Based on this research and further consultations with Technosol, CISST determined that extraction processes using supercritical fluid solvents could produce the needed quality and offer Technosol a unique business opportunity. Jamaica is well known as a source of many of the world's finest raw botanical products, including fruits and spices; however, no Jamaican processor has acquired advanced extraction technologies to produce high quality extracts that capture the maximum value from the raw material. Preliminary inquiries made to major extract buyers indicated that initial interest in purchasing such products existed (see Appendix 5 - "Technosol Service Plan" for details of the supercritical extraction process).

Technosol is a small start-up company which requires a process that can cost-effectively produce high quality extracts in low volumes. Per-unit profit margins for these products are high, so the objective was to focus on quality more than quantity. In addition, a low-volume operation was less likely to lead to the raw material supply problems mentioned earlier. The capacity to use a range a botanical materials as inputs was also important, in order to achieve year-round production and to diversify sources of supply. Many Jamaican botanicals are seasonal, and processors which focus on a single input, such as pimento (allspice), are able to produce for only a few months per year. The capital investment required for supercritical extraction could not be justified without continuous production. Because supercritical extraction is a fairly new industrial technology, even in the U.S., it was necessary that training and service programs be made part of the technology acquisition package. However, because the process is in limited commercial use and the number of suppliers is small, most suppliers do offer training programs. In addition, major spice buyers such as McCormick are familiar with the technology and also offer training for some suppliers.

Based on this information, a technology search effort has been launched using the following technology needs profile:

- efficient processing at low volumes, perhaps modular design
- the capability to process the range of inputs to be determined by the research findings
- training in operation and maintenance offered either as part of the supplier's package or as part of purchasing agreement with an extract

customer

- a service agreement acceptable to both parties, to include access to spare parts and technical assistance in repair and maintenance.

BUSINESS COLLABORATION

Identification and Screening of Potential U.S. Suppliers

Criteria were established to guide the identification of the U.S. collaborating firm in order to ensure a good "match" in which both parties benefit and no policies of the agencies which implement or support a TBE development program are compromised. In general, U.S. firms selected to participate in such a program will fall into one or more of the following categories:

- supplier of equipment
- supplier of technical expertise or training
- investor or joint venture partner
- customer.

For each of these categories, criteria must be established to provide the basis for an objective, replicable search procedure. These criteria must be somewhat flexible to accommodate the unique requirements of each search engagement and can only be developed after interviews with the client TBE to assess business objectives, access to financing, capabilities and technologies which must be sourced, and the overall feasibility of the enterprise being planned. This assessment is necessary to establish specific search criteria to identify U.S. companies which can contribute to the TBE in its current state of development. In the Jamaican pilot project, the search was undertaken for U.S. companies in the first two categories - suppliers of equipment and technical expertise. In this particular search, the guiding criteria were:

- quality of output
- production volume
- range of processing capabilities
- availability of spare parts and training
- modification costs.

CISST then initiated a search for U.S. suppliers of supercritical extraction technologies and expertise and identified six companies:

Phasex of Lawrence Massachusetts
SKW Chemicals, Inc. of Marietta, Georgia
Chemac, Inc. of Leonia, New Jersey
Fluitron, Inc. of Ivyland, Pennsylvania
National Forge Company of Andover, Maryland

Xytel Technologies of Mount Prospect, Illinois

At the time of drafting this report, initial communications with these companies have been made by CISST. Information on equipment specifications and costs as well as training capabilities are currently being collected and assembled for analysis by CISST and Technosol.

Next Steps

The market and technology needs assessments and information on supercritical extraction technology suppliers have been delivered to Technosol and communications are on-going with the company. Based on these discussions, CISST will:

- Assess CISST service plan with Dr. Johnson in light of the report findings and supplier information and determine next steps
- Continue discussions with potential buyers to refine market entry strategies and quality requirements
- As appropriate, introduce Technosol to sources of financing for SCF process testing and pilot plant development.

IMPLICATIONS

The pilot project has clearly demonstrated that this model for promoting U.S.-Developing Country business collaboration is viable and indeed essential for the continued development and diversification of the Jamaican economy and to increase the volume of business transactions with the United States. This conclusion is supported by several factors:

1. Jamaica has embarked on a bold program of trade liberalization and privatization at the policy level, but has yet to replace its protectionist programs with an equally comprehensive business support structure based on open competition. An expanded CISST program could directly address many policy issues related to business support in a free market environment and work with relevant public and private organizations to create the comprehensive structure which is needed. The timing is therefore ideal for such a program.

2. Under any circumstances, it is difficult for technology-based businesses to develop in Jamaica, given the limited domestic market. Entrepreneurs attempting to launch such businesses must acquire and perhaps modify imported technologies and penetrate complex foreign markets at a much earlier stage than their counterparts in the industrialized world. Exacerbating this problem is the lack of business support structures and financing mechanisms. No national agency has targeted this type of

business development as a top priority. The Jamaican Promotions Corporation (JAMPRO), Jamaica's economic development agency, focuses on investment promotion and expansion of existing industries, not on promoting new technology-based value-added businesses.

3. The model developed by CISST in Jamaica introduces many of the structures and services which are currently lacking in the Jamaican manufacturing sector (i.e. market intelligence, technology sourcing, alliance formation), which will stimulate demand for collaboration with U.S. industry and promote the market-led development of technology-based Jamaican enterprises. This approach creates an opportunity for continued and expanded bilateral support to develop sustainable Jamaican programs in the public and private sectors which can result in the development of successful value-added businesses based on collaboration with U.S. technology and technical assistance suppliers. In the course of this pilot project, CISST has established several relationships within the Jamaican expatriate community in the U.S., and has received high levels of interest in participating in such an effort by providing technical assistance, identifying U.S. business collaborators, and investing in Jamaican ventures.

The CISST approach directly addresses the basic policy issues related to TBE development in the context of developing countries undergoing economic restructuring. By working from the ground up, serving the specific interests and needs of technology-based companies and entrepreneurs, this approach promotes the formation of effective, responsive programs which can be continuously assessed and improved based on their actual value in promoting free market competitiveness of TBEs. This approach, when implemented in collaboration with local business support providers in the public and private sectors, identifies and facilitates the formation of needed structures, feedback loops, and delivery mechanisms within the local business support infrastructure.

CONCLUSIONS: CURRENT PROJECT STATUS

The pilot project conducted in Jamaica has demonstrated the potential value of the CISST approach to TBE development, but complete development and testing was not possible within this single pilot effort due to limited resources. CISST has entered into discussions with the Trafalgar Development Bank and Mutual Life Assurance Company in Kingston regarding possible expansion of the pilot project as a private sector initiative. Both organizations have expressed concrete interest in supporting the completion of the effort involving botanical extracts as well as other projects involving TBEs in other sectors. The objective of this initiative would be to identify and develop a portfolio of projects that are based upon:

1. A careful assessment of the potential global market for a product and the capacity to gain access to a share of that market. In many cases, this may entail the identification of an opportunity to produce a product that is not

currently being made in Jamaica, but for which there is a demand and a possibility for a Jamaican enterprise to compete.

2. The identification of the technological needs to produce the product at the price and quality that is demanded by the market, and the wherewithal to acquire and use that technology productively.

3. A focus on those projects that have a significant value added component.

4. An assessment of the financial requirements for the project in terms of risk, venture and investment capital, and of the potential returns on these investments.

5. A clear identification of the business entities - corporations or entrepreneurs - with an interest and an ability to make the enterprise competitive.

6. An analysis of all the possible "dealbreakers" to the successful implementation of the project.

7. An assessment of the social gains from the project in terms of employment, income generation and social equity, as well as of its environmental implications.

During the course of conducting the pilot project, CISST identified several projects derived from these considerations. These suggestions serve as illustrative examples of projects which could be developed to the "pre business plan" stage as part of a one-year TBE development program. They include:

- Several bio-fermentation technologies to convert blackstrap molasses into high value specialty chemicals such as lactic esters and sodium citrate dihydrate. These are high priced specialty chemicals in increasing demand around the world because they are environmentally benign.

- New extraction processes to remove high quality oleoresins and essential oils from native crops such as pimento and ginger. There is growing demand for high quality extracts and Jamaica has a unique advantage in the quality of its raw produce.

- Niche tourism products such as specialty tourism aimed at the needs of the active retired market (mature market). This is one of the largest markets in the world and a tourism product that addresses their needs would allow Jamaica to enter a large and high value niche market.

- A new flexible technology to manufacture IV bags for the health care industry. The technology allows for much smaller scales of production than the industry norm and if located in Jamaica, could target the regional market for IV bags.

Establishing such a portfolio of TBE projects and identifying companies or entrepreneurs interested in taking them on will create local demand for TBE support services. CISST will work in collaboration with local public and private business support organizations to identify and respond to these service needs. Through this process, a practical, sustainable business incubation program for the creation and development of new TBEs in Jamaica can be established.

RELEVANCE OF MODEL TO USAID

For USAID, this model approach to TBE development offers new opportunities to contribute constructively to the sustained economic growth of countries and regions such as Jamaica. Because the model deals with structural issues and the development of actual enterprises simultaneously, it facilitates USAID intervention at two levels: the structure/policy level, and the direct business assistance level. Features of the model which are particularly relevant to USAID's interest and mission regarding structural enhancement include the following:

- It is firmly grounded in the local context, while at the same time taking full account of global economic realities related to competitive manufacturing

- It provides the basis for developing practical business support policy options

- It fosters and facilitates collaboration with U.S. industry which does not involve relocation of U.S. companies or loss of U.S. jobs, but which can contribute substantially to economic growth in Jamaica

- It provides a practical and focused vehicle for encouraging collaboration between the public sector, academic and research institutes, and industry

- It leverages USAID resources by building on the capabilities and activities of existing local business support organizations, leading to a sustainable local support system

At the level of direct assistance to business, the model offers USAID an opportunity to contribute modest resources to a program which can mobilize far larger amounts of financing directed to investment in viable TBEs. The experiences gained in the pilot project indicate that the Jamaican private sector is averse to risk. The limited availability and high cost of capital tend to concentrate investment in projects such as

real estate developments, which have a proven track record of yielding high returns in the short and medium term. Technology-based business may offer better opportunities to diversify the economy, expand business ownership and create high quality jobs, but first round investment in these projects is inherently high risk. Investments must be made in process testing, pilot plant development and new market research before the commercial potential of the enterprise can be determined accurately. Many investments made at this stage will not pay off, but those that do can yield very high returns and stimulate much larger, more secure investments at the second and third rounds. The lack of investment available at this critical stage of TBE development could be addressed by USAID grant programs connected to a CISST model program, which could "prime the pump" of selected TBEs. Such a program might resemble the Small Business Innovation Research (SBIR) grants provided in the U.S. by the Small Business Administration, and could build on initiatives such as the Agricultural Export Services Program now being implemented by USAID-Kingston.

CISST/IBD

Center for the Interdisciplinary Study of Science and Technology, Northwestern University

USAID/SRI/TAP Project

A Model Approach to Technology-Based Business Development in Developing Countries

Appendix 1:

Jamaica Pilot Project Workplan

Structure and Workplan elements for Jamaica component of AID/PRE project, "Promotion of New Forms of Business Collaboration Between U.S. and Developing Country Firms."

Revised June 8, 1993

IBD has developed the following approach to establish an industrial cooperation program in Jamaica in fulfillment of the second country requirement of the USAID/PRE industrial cooperation model development project.

The proposed program will have two primary objectives:

1.To develop a model program to assist Jamaican small businesses and entrepreneurs in the agro-processing sector (excluding citrus) to access the technology necessary to develop competitive, high value-added products for domestic and foreign markets.

2.To use the increased demand for food processing technologies created by objective 1 activities as a basis for fostering cooperation between Jamaican processors and U.S. equipment and technology providers.

The proposed program will thereby create an integrated model including technology needs assessment and U.S.-Jamaican business collaboration. Such a model will not only facilitate business agreements for U.S. suppliers, it will also address a more fundamental issue by contributing to the expansion of the market for U.S. capital goods and technical services in developing countries.

Technology Needs Assessment Component

IBD will develop a model program to provide technology sourcing and market intelligence, which are fundamental to the development of value-added agro-processing industries, and which in turn create demand for U.S. technology and a favorable environment for increased U.S.-Jamaican business collaboration. Specific IBD services in this area will include:

- Technology sourcing services to assist the client to identify the technical requirements of new processing ventures and to acquire the needed equipment and training. Upon completion of a preliminary market analysis, technology sourcing assistance will be provided in the areas of:

  - assessment of equipment and personnel requirements

- assessment of investment requirements

- assistance in training and monitoring of relevant technology developments to help client companies to continuously improve their processes.

• Preliminary foreign market intelligence to identify market opportunities. IBD will use its network of government and industry contacts worldwide and its in-house market research expertise to identify market opportunities for technology-based products that can be competitively produced by local firms. Market intelligence services will include:

- preliminary foreign market demand analysis to identify target markets and determine product specifications

- competitor analysis of alternative products or competing firms in the target market

- segmentation analysis to identify niche market opportunities

- distribution channel analysis to assist the client in entry strategy development.

Business Collaboration Component

Upon completion of the technology needs assessment, the IBD program will advance to the Business Collaboration phase. This component is designed to identify needed U.S. suppliers of equipment and expertise needed to allow the Jamaican processor to produce products that satisfy target market demands in terms of product quality, packaging, reliable delivery and price competitiveness, and which give the processor the production flexibility needed to rationalize inventory (particularly for perishable items) and to meet changing market needs. Without the technology transfer assistance activities which precede this level, relatively few small and mid-size Jamaican enterprises would be in a position to make profitable use of high-quality U.S. food processing technology or expertise, keeping the market for these goods and services quite small.

The Collaboration component of the model will include the following steps:

• Compilation of information on the Jamaican food processing sector and developed during the technology needs assessment phase.

• Recruitment of key associations of U.S. processing equipment suppliers.

• Recruitment of appropriate external financing sources including U.S. Trade and Development Agency, World Bank, OPIC, Exim Bank. Direct financial services such as identification of financing sources, loan packaging and financial consulting will be performed by local collaborators including JAMPRO.

- Visits to Jamaica organized by IBD for selected U.S. industry representatives to assess the Jamaican food processing sector and meet selected processors. It is anticipated that inclusion of business representatives at this stage will facilitate implementation by enhancing the credibility of the IBD program within the U.S. private sector.

- In collaboration with U.S. industry representatives, identify high potential business opportunities for U.S. firms and identify prospective U.S. suppliers.

- Obtain company and product information from prospective U.S. suppliers, and prepare profile of selected Jamaica food processor for U.S. supplier.

- Facilitate initial communications between potential supplier and buyer, obtain answers to initial questions and alleviate potential conflicts resulting from differing national negotiating styles and business assumptions.

Likely Institutional Actors and Beneficiaries

Jampro (contact - Lennox A. Picart, Director, Agro-Industry Division)
Small Processors Association (contact - Norman McDonald, Chairman, Canco Ltd. Food Processors)
Jamaica Manufacturers Association, Food Group
Jamaica Agricultural Development Foundation (JADF)
Scientific Research Council (SRC)

Beneficiaries: Participants in JAMPRO, JADF and SRC agricultural projects interested in pursuing market-oriented food processing export business opportunities.

End of Project Status and Indicators

To maximize the experiences gained in Jamaica during the relatively brief period remaining in the initial model development phase of the Business Cooperation project, IBD foresees testing and refining this industrial cooperation model by focusing intensively on one agro-processing project. It is likely that one project can be carried through the technology needs assessment and business collaboration assistance levels within the time remaining. This will allow IBD to test all elements of the model and will provide the most comprehensive study possible for assessment and determination of next steps.

However, the program will include, as stated above, a broad initial assessment of the Jamaican food processing sector as a whole within the Business Collaboration phase, and the Technology Needs Assessment phase will include a preliminary identification and assessment of market-driven business opportunities which have not yet been exploited by local processors. High potential business collaboration opportunities which emerge from these activities will be developed and fostered by IBD and other

program participants on an opportunistic basis.

At the conclusion of the model development study project, IBD will prepare a detailed model for U.S.-Developing Country Business Collaboration based on experiences in Ukraine and Jamaica, which will have the transparency and objectivity needed to generalize the procudures throughout much of the developing world. The model will include objectives, rationale and general implementation workplans for:

- assessing an industrial sector in a developing country in terms of level of technological capability, potential for capturing market share in processed food markets, and major catagories of goods and services such businesses will require

- assessing the potential for U.S. industry to supply the goods and services that value-added conversion will require

- providing technology transfer support services to selected developing country firms and entrepreneurs to help them launch and sustain a competitive agro-processing enterprise

- providing market research as needed to determine product and delivery specifications

- assessing technical requirements of the enterprise

- assisting developing country technology goods and service buyers and U.S. suppliers to identify one another and facilitating meaningful negotiations and information exchange.

In addition, the Jamaica component of the study will provide concrete results for the local food processing beneficiary that is selected for the case study, to include:

- preliminary analysis of initial business plan

- assistance in selection and analysis of target export market with adaquate detail for determining product and packaging specifications, and to form a basis for determining equipment and technology requirements.

Workplan Schedule

Project Term: June 1, 1993 (proposed) - December 31, 1993 (31 total weeks)

<u>Activities and Approximate Durations</u>

I. Project Initiation (4 weeks)

Inventory and assessment of Jamaican agricultural raw materials and

processing capabilities (3 weeks)

Initial selection of agro-processing project candidates (1 week)

II. Technology Needs Assessment Component (13 weeks)

Selection of agro-processor for model development case study (2 weeks)

Development of client business service plan (2 weeks)

Target market identification and analysis (6 weeks)

Assessment of technical requirements (3 weeks)

III. Business Collaboration Component (11 weeks)

Preparation of information package on the Jamaican food processing sector for use by potential U.S. suppliers (2 weeks)

Recruitment of key U.S. associations of relevant processing equipment suppliers (2 weeks)

Visit to Jamaica by U.S. industry representative (1 week preparation + 1 week visit = 2 weeks)

Selection and screening of prospective U.S. suppliers by IBD, industry representatives and associations (2 weeks)

Prepare Jamaican processor profile and obtain U.S. supplier company and product information. Exchange information (1 week)

Facilitate initial buyer-seller communications, identify and assess "roadblocks" (2 weeks)

IV. Preparation of model program description document (3 weeks)

CISST/IBD

Center for the Interdisciplinary Study of Science and Technology, Northwestern University

USAID/SRI/TAP Project

A Model Approach to Technology-Based Business Development in Developing Countries

Appendix 2:

Trip Report from Initial Fact-Finding Mission

CISST/IBD

Center for the Interdisciplinary Study of Science and Technology, Northwestern University

Report of the CISST/IBD Fact-Finding Mission on the Jamaican Agro-Processing Industry

USAID/PRE
Model Development Project:

Promotion of New Forms of Business Collaboration Between U.S. and Developing Country Firms

July, 1993

626 Library Place, Evanston, Illinois 60208 • (708) 491-5617 • Fax: (708) 491-4251

I. Introductory Overview

In keeping with the workplan for the U.S.-Developing Country Industrial Cooperation model development project submitted to SRI and approved by USAID in May, 1993, the International Business Development program of the Center for the Interdisciplinarty Study of Science and Technology (CISST/IBD) of Northwestern University conducted a fact-finding trip to Kingston, Jamaica the week of June 21-25, 1993 to assess the potential for U.S. participation in the Jamaican agro-processing sector. The findings of the trip, elaborated here, will serve as the basis for identifying subsectors, companies, entrepreneurs and industry organizations within the Jamaican agro-processing industry which offer the highest potential to benefit from the services of the project and generate mutually beneficial business arrangements with U.S. suppliers of technology and expertise in the processing area.

The trip was conducted by Timothy Lavengood of CISST/IBD. Dr. Arnoldo Ventura, special advisor to the Prime Minister of Jamaica for science and technology, was retained to assist in identification of representative firms, industry associations and relevant government personnel for meetings and workshops held during the visit.

The information gathered during the trip indicates that the agro-processing sector is likely to play a central role in Jamaica's economic growth. As a small island economy, Jamaica's raw materials base is limited, both in volume and diversity. With a population of about two and a half million people, the local market for goods and services is small, meaning that growth must always be fueled by a significant export component. In this environment, industries such as agro-processing, which add value to existing resources and produce globally competitive products, are high potential sources of foreign exchange-based profits and sustained growth.

At the same time, a range of Jamaican crops which could be made suitable for world-class processing are greatly under-exploited, due largely to:
1. outdated processing equipment
2. poor international marketing
3. poor integration between subsectors, including agricultural inputs, processing and packaging
4. the high cost of financing

Many of these constraints, particularly the first two, can be addressed effectively by U.S. industry through the U.S.-Developing Country Industrial Cooperation model development project. By assisting Jamaican agro-processors to identify untapped foreign markets in which their agricultural resources provide a potential competitive advantage, demand for U.S. equipment and expertise needed to meet the requirements of these markets can be stimulated. Most of these markets appear to be in specialty foods niches in the industrialized world. These markets are well suited to the high-quality, high-priced exotic fruit products in which Jamaica has a natural

advantage, and the volume of production required to develop a strong market presence are small enough that Jamaica's limited agricultural acreage can provide inputs in volumes that will enable local processors to achieve reliable delivery.

II. Agro-Processing Industry Characteristics

Food processing in Jamaica developed as an import substitution industry serving local markets. An export focus has emerged in recent years as a response to trade liberalization. Most companies in the industry are small, though some, such as Grace-Kennedy, are among the country's largest domestic firms. Intermediate processing dominates among the smaller companies, particularly in production for export. For smaller enterprises, intermediates such as fruit purees and concentrates and pimento oils are more competitive export products because duties in foreign markets are lower. Foreign market entry is typically accomplished through agents or other intermediaries, so direct knowledge and experience with foreign consumer markets among Jamaican processors is quite low. The industry has experienced a decline in foreign investment, which further disconnects the local industry from overseas market intelligence and equipment suppliers.

Many agro-processing inputs are non-traditional crops in Jamaica, meaning that they have historically not been produced as commercial commodities. These crops include mangoes, guava and other passion fruits, which are processed into purees, jams, juices and sauces; as well as peppers and a variety of herbs which are used to make spices, seasonings and essential oils. Some traditional crops are also processed, including citrus, pimento and coffee, but for non-traditional crops, supply and price fluctuate widely.

The industry is characterized by underutilization of capital goods. Most processed crops are seasonal, and most processors work with only one or two of these, so equipment remains idle during off-seasons that last up to eight months. In addition, virtually all processing equipment is imported and spare parts are in short supply, leading to long periods of downtime waiting for repairs. When equipment is in working order, efficiencies are frequently brought down because the technology tends to be old and rudimentary. Jam production, for example, is usually done with old, low volume boilers. Because of a shortage of investment capital, updating of production lines is usually done incrementally, so that old, less efficient equipment and new equipment are often mixed in the same line, leading to bottlenecks which reduce return on investment in new equipment.

The human resource base in the industry is dominated by non-technical businessmen and low-skill laborers. Food technology specialists are rare and dispersed widely throughout the sector. No firm identified by CISST/IBD appears to have the critical mass of expertise needed to generate significant product or process innovation. Also lacking is marketing expertise. Most processors interviewed by CISST/IBD expressed a strong interest in upgrading their marketing functions in order to compete more

effectively overseas. However, in Jamaica, scarce marketing talent tends to gravitate to the tourism industry, where employment opportunities are much more attractive. Agriculture and agro-processing have traditionally operated in protected export markets, primarily in England, selling sugar, bananas and other raw or semi-processed commodities at fixed prices, so there is not a strong tradition of competitive marketing in these industries. Many of the small processors sell most of their product to large food companies such as Grace-Kennedy, in part because they lack the market intelligence skills needed to capture their own share of free markets.

Upstream Integration with Growers

Relationships between growers and processors tend to be inefficient. Investment between these sectors has only recently begun to emerge, so processors must generally rely on a continuously shifting group of small, independent farmers for their inputs. The Jamaican Promotions Corporation (JAMPRO) and USAID's Agricultural Export Services Program (AESP) have recently established programs to help forge links between growers and processors to created integrated operations for growing and processing non-traditional fruits. The objective of these initiatives is to make the processor the hub of a working network of many growers.

Jamaica has approximately 150,000 farmers, most holding less than five acres. The most reliable supplies of processing inputs usually come from large farms (greater than 1,000 acres) with their own financing, but the total output of these operations is not enough to sustain the processing industry. Processors must therefore source their inputs from many different farmers.Most small farms are on hillsides, rain fed, and lacking in labor and capital. It is difficult for these small scale operations to reduce the cost of production to meet the needs of processors. Herbs and other crops used in seasonings are grown specifically for processing, as is a large share of the citrus crop, but in other cases, relations between growers and processors are sporadic. If farmers do not fulfill their contracts, processors have little legal recourse because farmers generally have no money. Grace-Kennedy, which has been in the food processing business in Jamaica for 70 years, has gradually established a fairly reliable network of contract growers. Though it appears that this network is not without problems, in terms of controversies with growers over prices, it is nonetheless the strongest model of grower-processor integration found by CISST/IBD in Jamaica.

In the absence of effective integration, **raw materials supply is unreliable**, hampered by frequent shortages and price fluctuations. Jamaican agriculture is strongly focused on the fresh market. Much of the raw materials supply available to processors is excess or rejected fresh produce. Price fluctuations inherent in fresh produce markets carry over into relationships with processors, which are less able to accommodate them. But growers on the whole appear to be reluctant to commit large percentages of their crop to processors ahead of time because fresh goods usually command a higher price. Also, crop varieties that are best suited to the fresh market are often not the best for processing, but few farmers are able to produce processing

31

varieties in the larger volumes that are required given the lower unit price.

A second problem related to integration is that passion fruit, which has one of the highest unmet potentials for processing, is often **not grown as an organized crop**. Almost all ackee, guava, papaya and other tree-borne fruits in Jamaica grow wild. Harvests are gathered from across the countryside, a few bushels at a time from each landowner who has two or three trees in his yard. This system can be moderately profitable for small scale operators selling the produce fresh, but it is not well suited to processing. Few attempts have been made to cultivate these fruits as orchard crops because farmers are reluctant to dedicate land to long-term tree crops, and information on developing orchards is rare in Jamaica. At present, **demand by processors for these inputs exceeds supply**. Processing these products competitively will require a significant effort to improve efficiencies, which will require more dedicated acreage and lower unit prices than are required for the fresh produce market. Some components of the AESP are designed to promote orchard crops, which could significantly strengthen the supplier base for processors.

Downstream Integration: Packaging

The domestic packaging industry is **limited in quantity and variety**. Some large processors have their own packaging capacity, augmented by imports. Smaller processors are dependent on a few large domestic packaging producers that control the local supply of cans and jars, and expensive imported products. Large local suppliers are able to price large orders from stock competitively, but smaller orders produced to customer specifications are difficult to fill and expensive. Most domestic jars examined by CISST/IBD are outdated designs.

Along with the general lack of skilled food technicians discussed earlier, limits of domestic packaging appear to impose major barriers on new product development. Some growers and processors have begun processing solar dried fruits, but these products require air- and moisture-proof packaging, which is not available locally. Imported packaging seriously reduces profit margins, making the overall enterprise unattractive to large investors.

International Competition

In fruits, Jamaica's major competitor for North American markets is Mexico, which has far more acreage, closer trade ties to the U.S., more advanced processing technologies, and generally better prices. To compete, Jamaican processors must **identify niche markets and improve efficiency**. Mexican production capacity notwithstanding, Jamaica has successfully exploited unique advantages in some hot pepper products (such as PickaPeppa) and in coffee, where they have established strong market positions in Japan and in U.S. gourmet markets.

Of growing concern over the next few years is the increased competition with Latin

America for shares of European commodities markets due to restructuring of trade agreements such as the Lomé Convention. Jamaica has several special trade agreements with the European Community, particularly England, which are likely to be restructured as a result of European economic integration. For example, England has given Jamaica a 105,000 ton quota for bananas this year at a fixed price. If such agreements do not continue, Jamaica will have to compete with lower cost banana producers in Costa Rica and elsewhere in Latin America. These commodity agreements provide the economic foundation for much of Jamaican agriculture. If these relationships become free market-based over the next few years, as most observers believe they will, Jamaican agriculture will undergo significant restructuring, which is likely to have a major impact on supply of inputs to the food processing sector.

III. Marketing in the Jamaican Agro-Processing Sector

As stated in the model development workplan, CISST/IBD focused its inquiries on market intelligence and equipment sourcing issues. Other areas, such as finance, were examined in order to determine their impact on these core areas of concern to the project.

In Jamaica, as in many developing countries, the local market demands significantly less in terms of product quality and diversity than major export markets. **The nature of export marketing expertise is therefore fundamentally different from that of local marketing**, and much more complex. The identification of foreign marketing opportunities, and investment in the equipment and knowledge needed to produce for those markets, imposes significantly greater burdens on the resources of Jamaican firms, compared to enterprises operating in more industrialized environments in which domestic standards of competition more closely resemble **"world-class" definitions of product quality and reliability**. Increasing demand for U.S. products and services by Jamaican industry, and increasing the attractiveness of potential Jamaican firms as customers to U.S. businesses, will depend in large part on the ability of Jamaican firms to identify and exploit foreign market opportunities which **demand retooling and operational restructuring**. Improved marketing intelligence among Jamaican food processors is therefore needed in order to generate any significant increase in the need to invest in goods and services offered by U.S. industry.

Since the 1940s, the marketing of most Jamaican agricultural output has been done through commodity associations which controlled citrus, coffee, bananas, pimento, sugar cane and potatoes. In citrus and coffee, these associations also controlled most processing, but rarely produced end products. Some of these associations have sole export rights for their commodities, and set quality standards. Today, the power of these associations is considerably curtailed. The Coffee Board continues to handle quality control for all Blue Mountain coffee, and banana export remains centrally controlled, but in most other areas, marketing responsibility has gradually been transferred to individual enterprises. In the non-traditional crops, which are particularly

important to small processors, the organization and protection of commodity associations has never existed. There is no authority to curb price fluctuations and no institutional memory of export marketing experience.

The majority of Jamaican successes in exporting processed agricultural products are in the area of ethnic foods, selling traditional Jamaican preparations in expatriate Jamaican markets, or relying heavily on Jamaican connotations in labeling and advertising to attract other customers interested in exotic products. These **export efforts are limited by a strategy of exporting products with specifications that are determined locally**. Jamaican participation in mainstream food markets outside of Jamaica is small. Even large processors such as Grace-Kennedy have focused on exporting traditional products to ethnic markets. Busha-Browne, on the other hand, may be a model of more market-led export growth in food processing. The company has constructed a fully modern plant and designed a product line and packaging based on foreign market demand, sold under the "President's Choice" label. Time constraints did not permit CISST/IBD to conduct a thorough investigation of the Busha Browne strategy during the fact-finding visit. Further follow-up will be conducted during the course of the project.

IV. Equipment Sourcing and Opportunities for U.S. Cooperation

According to figures compiled by JAMPRO, investment in equipment by the Jamaican agro-processing industry totaled more than US$20 million during the last five years. Virtually all of this investment was for imported products, since there are no local equipment producers and only a few local sales representatives. By local standards, this level of investment is considered fairly high for an industry dominated by small firms. Most of this was generated in the form of bank loans. However, many food processors interviewed by CISST/IBD expressed interest in joint ventures and licensing agreements as a means of acquiring new technology and to facilitate access to the U.S. market. The attitude among processors toward U.S. suppliers appears to be very good, although there is some concern about the appropriateness of most U.S. equipment and technology to the Jamaican context. Even many of the smaller processors have direct experience dealing with U.S. companies such as equipment suppliers, distributors and consultants. However, few if any formal, long-term business arrangements exist between Jamaican processors and U.S. businesses at this time. Such investment has declined in recent years. Pillsbury, for example, has recently divested from Jamaica Flour Mills, and Kellogg's has sold its interest in the Jamaican coffee producer Salada Foods.

By their own admission, equipment sourcing capabilities among small processors is limited. Most subscribe to U.S. industry journals and trade magazines to monitor new products and processes and to identify potential suppliers. JAMPRO periodically holds seminars on food technology for companies. However, all processors interviewed by CISST/IBD said that **sourcing the proper technology from the U.S. is difficult**. The U.S. processing sector has evolved to serve a large domestic market and firms

often compete based on economies of scale. Most equipment produced is the U.S. is designed for this environment. In Jamaica, the domestic market is small and the reluctance among processors to conglomerate further accentuates the tendency of Jamaican processors to operate on a very small scale.

Equipment suppliers that advertise prominently in U.S. trade magazines tend to produce high cost, high volume equipment which exceeds the needs and budgets of even most of the largest Jamaican processors. The capacity of U.S. equipment can easily exceed the production volume of a Jamaican processor by 10 times. Smaller U.S. suppliers with innovative systems for producing high quality niche products generally do not have such a high profile in readily available information sources. The perception among Jamaican processors appears to be that appropriate technology is not available in the U.S. to the extent that it is in smaller industrialized countries that produce equipment scaled to serve their own domestic market. Italy was identified as a particularly popular source.

When U.S. equipment is selected, it is often purchased through second-hand dealers in Florida and elsewhere, with little warranty protection or product support. Most processors interviewed related at least one story about investments made in U.S. equipment that the company later regretted, either because the production volume needed to run the equipment efficiently made it difficult to retrofit the new purchase into smaller existing production lines, or because the training required to operate the equipment effectively was more extensive and costly than anticipated, or because the equipment did not perform as the salesperson said it would.

Many of these problems can be traced to a lack of independent, objective information on available U.S. agro-processing technologies.Processors repeatedly claimed that they had been victimized by various forms of dumping. Some purchased "state-of-the-art" equipment that proved to be unsuccessful in the marketplace and was quickly discontinued by the manufacturers. Others had purchased old systems and found that parts were not easily available or that they were unable to use the equipment to produce to competitive specifications. Most processors had received almost all of the information they had on this equipment from dealers representing individual products or suppliers.

But these difficulties, while considered serious, were considered exceptional for the most part and Jamaican processors appear to have a high level of interest in dealing with U.S. suppliers, if appropriate equipment can be found. The demand for this equipment is high, assuming that financing is available. Every processor met by CISST/IBD, including large and small firms, expressed dissatisfaction with their existing production equipment and was aware of specific ways in which production inefficiencies were hurting their bottom line.

V. Financing

Financing to upgrade production is difficult to find and expensive. There are no differential interest rates for productive investment, and market rates are currently around 30%. The return on investment in the food processing sector varies from six to 40 percent, according to experts at Grace-Kennedy. In most cases, investments in the stock market are more profitable.

There are few fiscal incentives such as accelerated depreciation to encourage capital investment, so taxes on technology-based operations are high. In addition, business insurance for food processors is high due to the likelihood of hurricanes and other natural disasters which can interrupt their supplies.

However, some financial programs do exist to support various aspects of food processing. The Agriculture Credit Bank gives 15% loans in U.S. dollars, and some of these loans are available to processors. The Jamaica Agricultural Development Foundation also offers special loans to processors, sometimes in U.S. dollars. The European Community and Canada have special loan programs for developing value-added Jamaican agriculture, and local commodity boards offer short-term financing to growers. Currency devaluation has left some banks leery of loans that will not result in an inflow of hard currency, so loan requests for export-oriented projects are often preferred. This can be an advantage for many food processing projects, which tend to focus on exports, but the lack of reliable, low cost inputs and packaging frequently forces processors to import these supplies, reducing the net foreign exchange.

In spite of these difficulties, bank loans appear to be the preferred means of obtaining additional capital. According to various government experts, Jamaican firms have historically resisted bringing in new equity. Conglomeration is rare, except in cases where large companies acquire smaller ones. This has tended to keep production small scale and to make investment resources scarce. One notable exception identified by CISST/IBD is Canco, Ltd., which is establishing a relationship with two other small processors to produce a fruit salad for export. The venture will permit the partners to access the wide range of inputs needed for such a product, and to pool equipment resources in order to produce at the higher volumes needed reduce costs and fill foreign market orders.

High Potential Technology Areas

As the model development project proceeds, specific criteria will be established for selecting candidates for casework from within the Jamaican agro-processing sector. Based on the initial fact-finding trip, CISST/IBD has made a preliminary identification of high potential subsectors and product areas where the likelihood of mutually beneficial business collaboration between U.S. and Jamaican firms appears to be high, provided the collaboration is based on technologies that are appropriate in terms of at least the following key factors so far identified by CISST/IBD:

- production volume
- product range
- availability of spare parts and training
- modification costs

These product areas include:

1. Aseptic processing and packaging equipment. In Jamaica, only the dairy industry now uses aseptic packaging. However, it is needed in a variety of bulk and finished food product areas in order to enhance export competitiveness. Currently, even orange juice sold locally is packaged in tin cans.

2. Quality packaging for finished specialty products. The local packaging industry lacks the flexibility to respond to changing market requirements in terms of size, shape and materials, and to produce in small batches needed for low volume, high value specialty products. As the specialty foods industry in Jamaica grows, it is probable that local suppliers will adapt to these needs, but this change is probably several years away. In the meantime, a strong business opportunity exists for U.S. packaging suppliers, packaging design consultants and low volume packaging equipment manufacturers.

3. Equipment for processing exotic fruits into jams, jellies, sauces and juices. These product areas are among the most rapidly growing among Jamaican food processors, but processing lines remain rudimentary and inefficient. All boilers, kettles and steam boxes must be imported.

4. Equipment for processing calaloo, ackee and pineapple for local markets. These raw products are readily available in Jamaica and they are common elements in the local diet. However, they are rarely processed into jams, cakes or other ready-to-eat products.

5. Equipment and expertise for obtaining concentrated extracts from botanicals. Papaya, for example, is rich in marketable extracts, including flavoring agents, digestive and fermentation enzymes, and ingredients used to soothe stomachs and heal wounds. Efficiently obtaining some of these agents requires advanced critical extraction technology.

6. A variety of equipment for independent coffee processing. Coffee is one of the most stable, best organized processing industries in Jamaica. While total volume of production is not high by world standards, Jamaica's Blue Mountain coffee is widely exported and considered among the finest in the world. Local processing extends to packaging of individual retail units of roasted beans, ground coffee and instant coffee products. Specific equipment needs include down-line top-off fillers and other equipment for weight control. A leading coffee processor now uses rotary fillers which are less accurate, but adequate for the local market. For export markets, processors

are forced to overfill containers to ensure that they all reach minimum weight. Also, coffee processors need better packaging equipment for vacuum sealed brick packs. The processes now used produce bricks that are not smooth, resulting in non-competitive presentation at retail.

Preliminary Identification of Project Candidates

In fulfillment of Step I of the project workplan, CISST/IBD has made an initial selection of agro-processing project candidates from among the processors visited during the fact-finding trip. These include:

Dr. Lyndon Johnson, Food Technologist at the Scientific Research Council of Jamaica, is establishing a company to process essential oils from various local plants. He has requested in writing that CISST/IBD provide assistance in obtaining marketing information on essential oils and botanicals, and information on essential oil and oleoresin extraction equipment in the U.S. which uses supercritical fluids. Based on a discussion with Dr. Johnson, CISST/IBD has concluded that his business idea is viable and that the services he has requested fall within the scope of the current project.

The Jamaica Banana Growers Association, considered the strongest commodity organization in Jamaica, wants to expand its food processing operations and construct a high-volume, state-of-the-art processing plant to produce 12,000 cases per month of jerk seasonings in various forms, and vacuum packed sliced fruit. The association has well established marketing channels overseas, particularly in England and Europe. A representative of the association has informally requested CISST/IBD assistance in identifying market-led new product ideas for the plant, and to provide some assistance in sourcing equipment. However, purchasing for the plant is already underway, and installation is scheduled to begin in September. Because of the brief period of time available to us, CISST/IBD recommends observing the purchasing process carefully and participating directly in sourcing and market intelligence on an opportunistic basis.

Canco, Ltd., described above, has expressed interest in working with the project to better structure its marketing program and to assist in the identification of equipment for its fruit salad venture.

VI. Assessment of the Jamaican Agro-Processing Industry

In spite of its many difficulties, the foundation of the Jamaican agro-processing industry is good. Issues related to supply of inputs, processing equipment, packaging, and technical expertise must be addressed in the near future in order to sustain the growth of a globally competitive processing sector. However, Jamaica has many high quality crops, particularly exotic fruits, that are clearly underutilized. The ethnic foods markets abroad, while limited, are sufficient to provide the industry with cash flow and

experience that will fuel further expansion into more market-led products. Protecting their share of these foreign markets will require continuous upgrading and diversification of production and of inputs. Caribbean foods are fashionable in many areas of North America and Europe. But an increasing number of these products are being produced in the U.S. and Canada, often using raw Jamaican inputs. These products will set the price points Jamaica will need to meet in order to compete.

To maintain market share for ethnic foods and begin penetration of larger and more profitable mainstream niche markets, the Jamaican food processing sector must expand their network of U.S. equipment suppliers and consultants. This network is currently limited to a few business contacts that have been widely relied on in the past, most of whom are involved in sales. Perhaps equally important, this expanded sourcing network may be needed to maintain competitiveness in local markets. As Jamaican trade barriers continue to fall, the variety of imported processed food products will continue to expand, making the domestic market significantly more complex. Jamaican processors must develop the productive capacity and marketing skills to anticipate and satisfy the needs of this market, or they risk losing even their domestic market base to foreign producers.

VII. Next Steps

Based on the results of the fact-finding trip to Kingston, CISST/IBD is prepared to move to stage II of the U.S.-Developing Country Industrial Cooperation model development project workplan. This stage will include:

A. Selection of agro-processor for the model development case study.

CISST/IBD will conduct further communications with potential project candidates to determine in greater detail the relevance and feasibility of their business development ideas to the project. Generalizable criteria proposed by CISST/IBD to guide the selection process include:

- The use of technology to convert existing resources into higher value-added products.

- The existence of a known market, its size and accessibility.

- Access to needed technology.

- Feasible financial requirements for the project in terms of risk and venture capital, equity and debt financing at different stages in development of the business.

- Existence of potential partners and collaborative organizations.

- An assessment of possible bottlenecks.

- Legal and regulatory considerations (e.g. intellectual property rights, environmental impact, etc.)

- Commitment of the entrepreneur or company.

B. Development of Client Service Plan

Once a client is selected, CISST/IBD will work with the entrepreneur or business to develop a service plan. To be effective, the plan must be tailored to the specific needs of the client. However, the basic structure of the service package is proposed as follows, in accordance with the initial CISST/IBD workplan:

• Technology sourcing services to assist the client to identify the technical requirements of new processing ventures and to acquire the needed equipment and training. Upon completion of a preliminary market analysis, technology sourcing assistance will be provided in the areas of:

- assessment of equipment and personnel requirements

- assessment of investment requirements

- assistance in training and monitoring of relevant technology developments to help client companies to continuously improve their processes.

• Preliminary foreign market intelligence to identify market opportunities. IBD will use its network of government and industry contacts worldwide and its in-house market research expertise to identify market opportunities for technology-based products that can be competitively produced by local firms. Market intelligence services will include:

- preliminary foreign market demand analysis to identify target markets and determine product specifications

- competitor analysis of alternative products or competing firms in the target market

- segmentation analysis to identify niche market opportunities

- distribution channel analysis to assist the client in entry strategy development.

CISST/IBD believes that these service areas address the most immediate needs of the Jamaican food processing sector.

C. Implementation of:

- Target Market Analysis
- Assessment of Technical Requirements

It is anticipated that completing steps A and B will require approximately 4 to 6 weeks. Step C will then commence and will require approximately 9 to 10 weeks.

List of Individuals and Organizations Met

Dr. Arnoldo Ventura, Special Advisor to the Prime Minister for Science and Technology

Aaron Parke, Agro-industry Division, JAMPRO

Dr. Lyndon McLaren, Assistant Director, Jamaica Agricultural Development Foundation

Norman McDonald, owner of Canco, Ltd., and founder of Small Food Processors Association

Dr. Lyndon Johnson, Research Scientist, Scientific Research Council

Dr. Alwyn Lynch, Director, Food Technology Institute, Scientific Research Council

Conrad Ornstein, USAID Kingston Agriculture Officer

Marcia Marville, Ministry of Agriculture

Andre Gordon, Director of New Product Development, Grace-Kennedy Foods

John Fletcher, General Manager, Salada Foods

Jamaica Manufacturers Association Food Group
- Anand James, Bush Boake Allen
- Mr. Watson, Scotts Preserves
- Beverley Miller, Bureau of Standards
- Grethel Hamilton, Seprod
- Lawrence Chinshue, Seprod

Omar Davies, Special Advisor to the Prime Minister

CISST/IBD

Center for the Interdisciplinary Study of Science and Technology, Northwestern University

USAID/SRI/TAP Project

A Model Approach to Technology-Based Business Development in Developing Countries

Appendix 3:

Technosol Company Profile

COMPANY PROFILE

TECHNOSOL LIMITED
79 Sundown Crescent
Kingston 19, JAMAICA, WEST INDIES.

BACKGROUND

Technosol Ltd is a Jamaican limited liabilities company incorporated under the Companies' Act, having its registered office at 79 Sundown Crescent, Kingston 19. The company was incorporated on May 21, 1993 and was established to carry on the business of Consultants, Producers, Processors and Dealers in flavors, fragrances, plant extracts, and other botanically derived products.

Technosol Ltd resulted from the shared dream of a team of Jamaican researchers to be involved in the development of natural products as commercial products.

DIRECTORS

There are four (4) members of the Board of Directors:

Lyndon B.N. Johnson, Ph.D.,	Chairman;
Ian Thompson, Ph.D.,	Secretary;
Hugh McLean, Ph.D.,	Director;
Gregory Simpson, B.Sc.,	Director.

SHARE CAPITAL

The share capital of the company is two thousand dollars ($2,000), divided into 2,000 ordinary shares of $1.00 each. These shares are held equally among the abovementioned directors (500 shares each).

CURRENT ACTIVITY

Technosol Ltd currently operates the Braco essential oil distillery situated at Duncans, Trelawney, Jamaica under terms and conditions of a lease agreement with Braco Estates Limited, owners of the factory. Technosol Ltd also holds the right to reap pimento from the estate which has approximately five hundred acres of pimento.

The agreement took effect on August 1, 1993 and the factory is being used for the production of pimento leaf oil. This operation is being financed by equity capital from an investor in return for an appropriate profit-sharing scheme.

CISST/IBD

Center for the Interdisciplinary Study of Science and Technology, Northwestern University

USAID/SRI/TAP Project

A Model Approach to Technology-Based Business Development in Developing Countries

Appendix 4:

Jamaica Pilot Project Market Report

CISST/IBD

Center for the Interdisciplinary Study of Science and Technology, Northwestern University

USAID/SRI/TAP Project

Business Opportunities in the Botanical Extracts Market

Prepared by

The Center for the Interdisciplinary Study of Science and Technology
International Business Development program

For

Technosol, Ltd.
Kingston, Jamaica, W.I.

November, 1993

CISST/IBD, Northwestern University, 626 Library Place, Evanston, IL. 60208 USA
Phone: 708-491-5617 Fax: 708-491-4251

TABLE OF CONTENTS

	Page
I. Market Overview	
A. Primary Uses	1
B. The U.S. Market	1
C. Major Product Categories	5
1. Essential Oils	5
2. Oleoresins	5
3. Synthetic Substitutes	8
4. Aromatherapy	10
D. Competitiveness Factors	10
E. Distribution Systems and Shipping	12
II. Market Potential of Selected Botanical Extracts	14
III. Potential Buyers	20

Appendices

1. Essential Oil Production Chart
2. Food Chemical Codex Regulations for Essential Oils
3. International Standard Organization Regulations-Essential Oils
4. Selected Botanical Extracts
   - A. Allspice
   - B. Amyris
   - C. Basil
   - D. Black Pepper
   - E. Canella
   - F. Clary Sage
   - G. Geranium
   - H. Ginger
   - I. Marjoram
   - J. Paprika
   - K. Quassia
   - L. Rosemary
   - M. Sarsaparilla
   - N. Lemon Verbena
   - O. Vetiver
5. Potential Buyers
6. Sources
7. Bibliography

TABLES

		Page
Table 1	Essential Oil Uses	2
Table 2	Total U.S. Imports	3
Table 3	U.S. Imports from small countries	4
Table 4	Chemical Prices	6
Table 5	IPP Index for Essential Oil prices	7
Table 6	U.S. Synthetic Flavor and Perfume Materials	9
Table 7	Aromatherapy	11
Table 8	Essential Oil and Oleoresin Distribution Channels	13
Table 9	U.S. Rosemary Essential Oil Imports	15
Table 10	U.S. Black Pepper Oleoresin Imports	15
Table 11	U.S. Paprika Oleoresin Imports	16
Table 12	U.S. Geranium Essential Oil Imports	16
Table 13	U.S. Vetiver Essential Oil Imports	19

I. MARKET OVERVIEW

A. Primary Uses

Essential oils and oleoresins are used in a variety of industries, with total sales of approximately $6.5 - 7 billion worldwide with annual growth measured at 8.7% from 1982 to 1991. About half of all essential oils production is sold to make food flavorings (See Table 1: Essential Oil Uses). An approximate breakdown of the market is as follows:

Food Flavorings	50%
Fragrances	25%
Pharmaceuticals	20%
Aromatherapy	2%
Other	3%

Source: Aromatherapy: To heal and tend the body, Robert Tisserand

The food flavorings market can be segmented as:

Aroma Chemicals	35.0%
Beverages	20.2%
Confectionery/Bakery	13.6%
Dairy Products	9.3%
Snack Foods/Meats	8.8%
Pharmaceuticals	4.9%
Misc. (tobacco, pet food)	6.9%
Other	1.2%

Total worldwide sales: $3.426 billion (1991)

(Source: Investex, Thomson Financial Networks, Sept. 13, 1991)

B. The U.S. Market

The U.S. is the largest market for most botanical extracts used as aroma or flavor agents, importing more than $187 million worth of essential oils in 1992, an increase of 21% over 1991 (See Table 2: Total U.S. Imports and Table 3: U.S. Imports from Small Countries). The largest category of 1992 imports was citrus oils, which accounted for $48 million of the 1992 total. The majority of the raw material sources of extracts cannot be grown competitively in the U.S. due to cost, soil conditions and climate. The majority of extracts examined in this report are not produced in the U.S.; however, in some categories, including citrus, mint, paprika, geranium and others, U.S. production does exist and offers direct competition to imports.

The most important category of U.S. production is peppermint oil, accounting for about 1/3 of the total. Other major product categories include other mint oils and citrus oils.

Many U.S. manufacturers that used to import raw materials and process oils domestically have moved their processing facilities to the source of the raw materials, thus reducing trade in raw materials and increasing trade in

TABLE 1: ESSENTIAL OIL USES

NAME	PRINCIPAL CONSTITUENT OF ESSENTIAL OIL	PRIMARY USES
ALLSPICE	EUGENOL	PHARMACEUTICS, PERFUMERY MIXED PICKLING SPICES CAKES SOUPS VEGETABLE TOMATO CATSUP CHILE SAUCE LUNCH MEATS PICKLED MEATS
BASIL	D-LINALOOL METHYL CHAVICOL	CHICKEN DISHES PIZZA PROCESSED MEATS SAUSAGES STUFFINGS CANNED SPAGHETTI SAUCES CANNED TOMATOES SALAD DRESSINGS
BLACK PEPPER	MONOTERPENES SESQUITARPENES OXYGENATED COMPOUNDS PEPERINE	PHARMACEUTICS ALL PURPOSE SEASONINGS DEHYDRATED AND CANNED SOUPS POULTRY DRESSINGS PICKLES CONDIMENTS BAKED GOODS SPICE MIXES CONFECTIONS CURRY POWDER BLENDS PROCESSED MEATS
CLARY SAGE		PHARMACEUTICS, COSMETICS, PERFUMERY
GERANIUM	GERANIOL CITRONELLOL MENTHOL LINALOOL	PHARMACEUTICS, PERFUMERY, COSMETICS USED AS ROSE ESSENCE SUBSTITUTE IN COSMETICS INDUSTRY
GINGER	CINEOL BORNEOL GERANIOL	PERFUMERY, FOOD INDUSTRY BAKED GOODS BEVERAGES CURRY POWDER BLENDS SAUCES CONDIMENTS MEAT SEASONINGS PROCESSED MEATS SAUSAGES ICE CREAM
MARJORAM	LINALOOL METHYL CHAVICOL CINEOL EUGENOL TERPININEOL	PHARMACEUTICS, FOOD INDUSTRY GRAVIES SOUPS PROCESSED MEATS DRESSINGS FLAVORED VINEGARS
PAPRIKA	NO VOLATILE OIL	FRANKFURTERS BALONGA SAUSAGES TOMATO SAUCE MEXICAN CHILE POWDER CONDIMENTS BAKED GOODS CONFECTIONS SOUPS SALAD DRESSINGS PICKLED PRODUCTS
ROSEMARY	VORNEOL CINEOLE CAMPHOR BORNYL ACETATE	PHARMACEUTICS, VETRINARY FRIED CHICKEN CROUTONS BAKED PRODUCTS CONFECTIONS BEVERAGES
VETIVER	VETIVEROL VETIVER ACETATE VETIVERYL ACETATE	PERFUMERY

TABLE 2: TOTAL U.S. IMPORTS

	1992 $1,000	JAN.-APRIL 1993 $1,000
WORLD	1,227,361	393,817
FRANCE	462,234	156,015
CANADA	119,415	52,813
GERMANY	82,733	28,787
SWITZERLAND	63,566	21;152
ITALY	45,220	15,266
JAPAN	49,048	14,317
UK	72,342	13,596
SPAIN	37,904	11,251
TAIWAN	49,937	10,870
PRC	30,712	8,243
BRAZIL	26,840	7,195
MEXICO	18,646	6,329
INDIA	17,176	4,872
NETHERLANDS	11,983	4,093
ARGENTINA	15,495	3,811
BELGIUM	14,295	3,393
INDONESIA	8,476	3,314
MOROCCO	7,785	2,999
S. KOREA	6,840	2,705
MONACO	4,349	2,542
AUSTRALIA	4,503	1,793
PERU	3,508	1,734
HONG KONG	21,140	1,631
ISRAEL	4,690	1,483
IRELAND	5,086	1,451
THAILAND	3,108	1,086
AUSTRIA	2,082	981
BULGARIA	3,044	923
MALAYSIA	2,643	776
COLOMBIA	1,246	702
JAMAICA	1,694	422
DOMINICAN REP	976	363
VENEZUELA	1,257	303
GUATEMALA	902	299
BERMUDA	404	176
BAHAMAS	182	126
DOMINIA	215	116

SOURCE: NATIONAL TRADE DATA BANK

TABLE 3: U.S. IMPORTS FROM SMALL COUNTRIES

	1992 $1,000	JAN.-APRIL 1993 $1,000
AUSTRIA	2,082	981
BULGARIA	3,044	923
MALAYSIA	2,643	776
COLOMBIA	1,246	702
JAMAICA	1,694	422
DOMINICAN REP.	976	363
VENEZUELA	1,257	303
GUATEMALA	902	299
BERMUDA	404	176
BAHAMAS	182	126
DOMINIA	215	116

SOURCE: NATIONAL TRADE DATA BANK

essential oils.

C. Major Product Categories

1. Essential Oils

The American Spice Trade Association reports that essential oils are most often used to standardize and strengthen oleoresins and other extracted products. Sometimes essential oils are used as substitutes for dried herbs because they are more convenient for the manufacturer, since the oil is more consistent in concentration and quality and does not deteriorate as much as raw spice during storage.

However, several factors have impacted the essential oils market in recent years, which have increased competition and reduced the growth of demand.

There has been a trend of increasing costs in essential oils production, due to the scarcity of fuel wood in many producing countries and an increase in the cost of maintaining traditional distillation equipment. At the same time, very low wage producers such as China have been capturing larger shares of world markets, putting downward pressure on prices (See Table 4: Chemical Prices and Table 5: IPP Index for Essential Oil Prices).

The steam distillation process most often used to extract essential oils does not capture nonvolatile compounds, leading to an incomplete flavor profile lacking "top notes". This is due primarily to the heat required for steam distillation. For example, ginger and pepper oils produced by steam distillation have only low levels of gingerol and piperine, the compounds which give these spices their sharpness. Oleoresins, which are more often extracted using solvents at low heat, capture more nonvolatile flavor elements.

In addition, essential oils oxidize more easily because of their higher percentages of terpenes, and they contain fewer of the antitoxins that give the spices their preservative properties.

The highest growth areas are in high quality essential oils that most closely match the olfactory qualities of raw spice.

2. Oleoresins

Until the early 1970's, spice oleoresins and essential oils were produced predominantly by the industrialized countries using raw imported spice. More recently there has been a shift of production to some spice producing countries to reduce production costs. Consumption grew enormously over the next few years as lower priced oleoresins replaced raw spices in major markets. The largest share of oleoresin substitution took place in high-volume processed foods. However, in higher quality processed products, raw spices are still preferred. By the early 1980s, the substitute market was saturated and growth has since been tied to growth of finished product sales and stricter food purity regulations in the U.S., which have forced food processors to reduce bacterial content. Oleoresins have an advantage over raw

TABLE 4: CHEMICAL PRICES

Chemical Prices: Week ending 10/4/93

ESSENTIAL OIL	STANDARD UNIT OF MEASUREMENT	UNIT PRICES LOW	HIGH
Basil oil	lb.	$41.00	$50.00
Basil oil, Egyptian			
Principle constituent of Rosemary			
Camphor	Monobromated drums, kgs., lb.	$3.63	$3.70
Camphor, synthetic	Technical 165 lb drums, 5,000 lbs or more, lb.	$1.80	
Camphor, USP, powdered	50 kg drums, 10,000 lbs or more, lb.	$5.50	
Camphor, synthetic, refined 1 oz. tablets	Cartons, 1,000 lb lots or more, lb.	$3.50	
Camphor white	Formosan drums, lb.	$4.50	
Camphor oil, specific gravity 1.070	Drums, lb.	$4.65	
Camphor	Yellow taiwan drums, lb.	$2.00	
Principle constituent of Geranium			
Citronellol	Drums, f.o.b., lb.	$3.45	
Principle constituent of Marjoram, Allspice			
Eugenol, USP	55 gal, lb.	$2.75	$3.95
Principle constituent of Geranium, Ginger			
Geraniol, synthetic		$8.65	
Geraniol natural 90-92%		$9.40	
NG	gal	$8.00	
Ginger Oil	lb.	$15.50	
Ginger oil, Chinese	lb.	$15.00	$20.00
Ginger oil, Indian			
Principle constituent of Geranium, Basil			
Linalool	Ex bois de rose oils drums, lb.	$56.85	
Linalool, synthetic	FCC drums, f.o.b. works, lb.	$5.50	
Linalool oxide, synthetic	55 gal drums, lb.	$16.35	
Principle constituent of Geranium			
Menthol, natural Chinese	Drums, lb.	$4.80	$5.20
Menthol, Indian	Drums lb.	$4.60	$4.80
Menthol, synthetic, USP	100-450 lbs., lb.	$11.00	
Allspice oil	80% drums, lb.	$21.00	$22.00
Pimento leaf oil			
Principle constituent synthetic substitute of Geranium			
Rhodinol	25 lb., cartons, lb	$155.55	
Rhodinol	98% a+b citronellol synthetic drums, lb.	$14.00	
Rosemary oil			
Rosemary oil, National Formulary	Spanish drums, lb.	$7.50	
Rosemary oil	Tunisian drums, lb.	$9.00	$9.50
Clary Sage Oil			
Clary Sage oil	French bottles, lb.	$50.00	$58.00
Principle constituent of Marjoram			
Terpineol	B.P. per kilo, lb.	$1.75	
Terpineol	Perf. Grade per kilo, lb.	$3.95	
Principle constituent of Vetiver			
Vetiveryl acetate	Drums, kg	$160.50	
Vetiver oil	Bourbon drums, lb.	$62.00	
Vetiver oil, Chinese origin	lb.	$17.00	
Vetiver oil, Java origin	lb.	$25.00	$26.00

Source: Chemical Marketing Reporter Oct. 4, 1993, p. 34-42

TABLE 5: IPP INDEX FOR ESSENTIAL OIL PRICES

	JAN.-MARCH	APRIL-JUNE	JULY-SEPT.	OCT.-DEC.
1984	1.8%	3.0%	-1.2%	0.0%
1985	-2.2%	5.5%	0.9%	-3.1%
1986	2.7%	4.1%	0.0%	0.6%
1987	10.0%	0.2%	1.2%	3.2%
1988	2.2%	0.4%	1.0%	2.4%
1989	-0.2%	-0.1%	-2.3%	6.4%
1990	-3.0%	1.2%	0.6%	2.7%
1991	-1.4%	-0.1%	2.9%	-0.8%
1992	2.4%	1.1%	0.4%	

SOURCE: NATIONAL TRADE DATA BANK

*The product universe of the International price index (export-import price index) consists of all commodities exchanged between U.S. residents and foreign residents. The export universe consists of products sold by U.S. residents to foreign buyers. The import universe covers products purchased from abroad by U.S. residents. The U.S. export and import price indexes are general-purpose indexes that measure changes in price levels within the foreign trade sector.

ground spices because they have lower bacterial levels. There was an overestimation of long-term demand by oleoresin producers during the 1970s which has resulted in excess production capacity.

More than half of all oleoresin production is sold to the U.S., primarily because the U.S. produces most of the world's processed, packaged foods. The U.S. consumed 850-900 tons of oleoresins per year during the mid-1980s, compared to 350-450 tons for the second largest consuming nation, the United Kingdom.

Estimated annual consumption in the mid-1980's

US 850-900 tons
UK 350-450 tons
Japan 75 tons
Canada 50-60 tons
Germany 40-45 tons
France 10-15 tons

Source: International Trade Forum, 1986

Successful marketing of oleoresins requires adherence to stringent quality control standards of buyers. The supplier's main goals should be achieving and maintaining high product quality and open communication with the buyer. Early consultations with prospective buyers to determine quality specifications is particularly important for a new producer entering the market.

3. Synthetic Substitutes

There are many synthetic substitutes for essential oils, but very few for oleoresins, so oleoresins rarely compete directly with synthetics. Synthetic organic substitutes for essential oils are capturing a growing share of the market in food flavoring, aromas, beverages, cosmetics and soaps. This is because synthetics are lower cost and are not subject to the price and supply fluctuations characteristic of natural oils and oleoresins. Many compounding houses for perfumers and flavors have increased their use of synthetics in recent years as a way to reduce formulation costs. Also, turpentine, the major feedstock for synthetics, is made from readily available, renewable resources and is not likely to increase in price beyond inflation. Quality is rarely as high as that of the best natural products, but it is more consistent (See Table 6: U.S. Synthetic Flavor and Perfume Materials).

The success of synthetic essential oil substitutes has contributed to the downward pressure on natural oil prices in recent years.

The largest producers of these synthetic substances are in the U.S. Total U.S. production of synthetics reached 38.7 million kg in 1991, up 14.9% from 1990, but sales dropped 6.7%, from $991.6 million in 1991 to $925.5 million in 1992, indicating that the substitution market for synthetics in the U.S. may be saturated.

TABLE 6: U.S. SYNTHETIC FLAVOR AND PERFUME MATERIALS

Natural Essential Oil	Synthetic	Synthetic Material Producers
Eugenol	4-Allyl-2-methoxyphenol	Fragrance Resources, Inc. Firmenich Elan Chemical Co. Givaudan Corp.
Eucalyptol	Cineole	SCM Corp., Glidco Organics
Menthol	dl-Menthol	Haarmann & Reimer Corp SCM Corp, Glidco Organics Union Camp Corp. BBA div.
	l-Menthol	SCM Corp, Glidco Organics
Terpineol	Terpinene-ol a-Terpineol	SCM Corp., Glidco Organics Hercules, Inc. Union Camp Corp. BBA Div. SCM Corp., Glidco Organics
Geraniol	3,7-Dimethyl-trans 2,6-octadien-1-ol	Elan Chemical Co. Givaudan Corp. Union Camp Corp. BBA Div. SCM Corp. Glidco Organics
Linalool	3,7 Dimethyl-1,6-octadien-3-ol	Elan Chemical Co. Internatational Flavors and Fragrances, Inc SCM Corp., Glidco Organics
Citronellol	3,7-Dimethyl-6-octen-1-ol	Elan Chemical Co. Givaudan Corp. International Flavors & Fragrances, Inc. Union Camp Corp. BBA Div. SCM Corp., Glidco Organics

Source: U.S. International Trade Commission
Synthetic Organic Chemicals, Feb. 1993
Section 7.

4. Aromatherapy Market

One sector in which the natural extracts are likely to remain strong is aromatherapy products. Although this segment represents only about 2% of the total U.S. market for botanical extracts, it has been experiencing growth rates of 20-50% per year, with new, small producers growing most rapidly. Total volume of retail sales for aromatherapy products is $300-500 million per year worldwide. The fastest growing product lines in this market which use essential oils include bath and massage oils, and body lotions and gels. The industry purchases $15-25 million worth of essential oils per year, with a strong upward trend. Aroma Vera, a major U.S. aromatherapy products producer, reports that it will purchase $500,000 worth of essential oils in 1993 and projects that this figure will reach $1 million in 1994.

The growth trend in aromatherapy is driven largely by the expanding "new age" movement in the U.S., which has brought many mainstream fragrance manufacturers, including Estee Lauder (the world's largest fragrance manufacturer), into the aromatherapy market.

Unlike the food sector, which is highly concentrated and dominated by McCormick and Durkee-French, the aromatherapy market is diffused. The number of producers is growing significantly, but the average firm is buying only small amounts. Because this segment is one of the newest niches in the essential oils market, distribution links through agents and brokers are still weak. Supplying this industry therefore requires extensive marketing and customer outreach efforts in order to establish stable relationships with many buyers (See Table 7: Aromatherapy).

D. Competitiveness Factors

For the most part, the essential oils and oleoresin markets are price-driven and many producers compete for a share of a tightening market. Some large producers have attempted in recent years to withhold supplies to drive up prices, but this has tended to lead to a permanent loss of market share because buyers could easily shift to other suppliers. Competitiveness is based more on price than quality, with the exception of a few niche markets for extremely pure, high quality, rare products. U.S. buyers commonly redistill essential oils they purchase to achieve a consistent product, so many processors produce only 'generic' quality product.

Competitiveness of Natural vs. Synthetic Essential Oils

In the most price-sensitive sectors of the market, such as low-priced processed foods and perfumes produced in large volumes, inexpensive synthetics have an advantage for many applications. Research to date indicates that there is no significant difference in health benefits between natural and synthetic oils, but there continues to be a market advantage in lucrative niches for "natural" products, and these consumers are accustomed to paying premium prices. Many buyers producing products to meet "natural" or "healthy" labeling requirements must use natural oils. Olfactory and organoleptic traits of essential oils are still considered superior to synthetics, but advances in chemical processing have gradually narrowed the quality gap.

TABLE 7: AROMATHERAPY

NAME	AROMATHERAPY USE
ALLSPICE	FLATULENCE
	INDIGESTIONS
	CRAMPS
	INTESTINAL PROBLEMS
	COLDS
	RHEUMATISM
	MUSCULAR STRAINS
	DEPRESSION
	TONIC AND TRANQUILIZER
BASIL	BRONCHITIS
	FATIGUE
	COLDS
	CONCENTRATION LOSS
	MIGRAINE
	GOUT
	ACHES/PAINS
BLACK PEPPER	COLDS
	ACHES/PAINS
	INFLUENZA
	FLATULENCE
	RHEUMATISM
CLARY SAGE	DEPRESSION
	NERVES
	SORE THROAT
	ACHES/PAINS
	DEBILITY
	AS A SEDATIVE

NAME	AROMATHERAPY USE
GERANIUM	DEPRESSION
	MENSTRUAL PROBLEMS
	DIARRHEA
	DIABETES
	SORES
	NEURALGIA
	BLEEDING
	CIRCULATORY CONDITIONS
	ECZEMA
	SORE THROATS
	NERVOUS TENSION
	KIDNEY STONES
GINGER	RHUEMATISM
	MUSCULAR ACHES/PAINS
	SPRAINS
	BROKEN BONES
	COLDS
	NAUSEA
	DIARRHEA
	ALCOHOLISM
	DIGESTIVE DISORDERS
MARJORAM	SPRAINS
	BRUISES
	COLDS
	THEUMATISM
	INTESTINAL CRAMPS
	MENSTRUAL PROBLEMS
	ANXIETY
	ASTHMA
	BRONCHITIS
	INSOMNIA
	CIRCULATORY DISORDERS
	MUSCULAR PROBLEMS

NAME	AROMATHERAPY USE
ROSEMARY	GOUT
	HEADACHES
	FATIGUE
	THEUMATISM
	SKIN INFECTIONS
	MUSCULAR ACHES/PAINS
	SPRAINS
	DANDRUFF
	ALOPECIA
	OBESITY
	SPINAL INJURIES
	NERVE STIMULANT
	HEART TONIC
	LIVER DESCONGESTANT
	ANALGESIC
VETIVER	NERVOUSNESS
	INSOMNIA
	THEUMATISM
	MUSCULAR RELAXANT
	ANTISEPTIC
	TONIC

Responding to improvements in synthetic products, which now more closely mimic natural compounds, the U.S. Food and Drug Administration is developing stricter definitions of what constitutes a natural product. This move promises to protect any market advantage to be gained from using natural extracts. Some observers suggest that this advantage will decline over the long term, enhancing the competitiveness of the synthetics; however, other experts suggest that the market for natural products will continue to grow.

E. Distribution Systems and Shipping

U.S. distribution channels for essential oils vary according to the size of the buyer. Larger finished product manufacturers tend to deal directly with overseas producers to avoid middlemen and obtain the lowest price. These buyers have supplier certification programs and offer technical assistance to suppliers to help improve product quality and facilitate U.S. importation. In addition, they usually have in-house distillation facilities to reprocess oils to meet their specific needs. For high volume buyers, the costs of these activities are offset by the lower unit costs of supplies. Smaller finished product producers are more likely to source their essential oils through domestic brokers, agents and dealers that guarantee quantity and quality by contract. A spot market exists among these merchants to meet short-term buyer needs at marked up prices (See Table 8: Essential Oil and Oleoresin Distribution Channels).

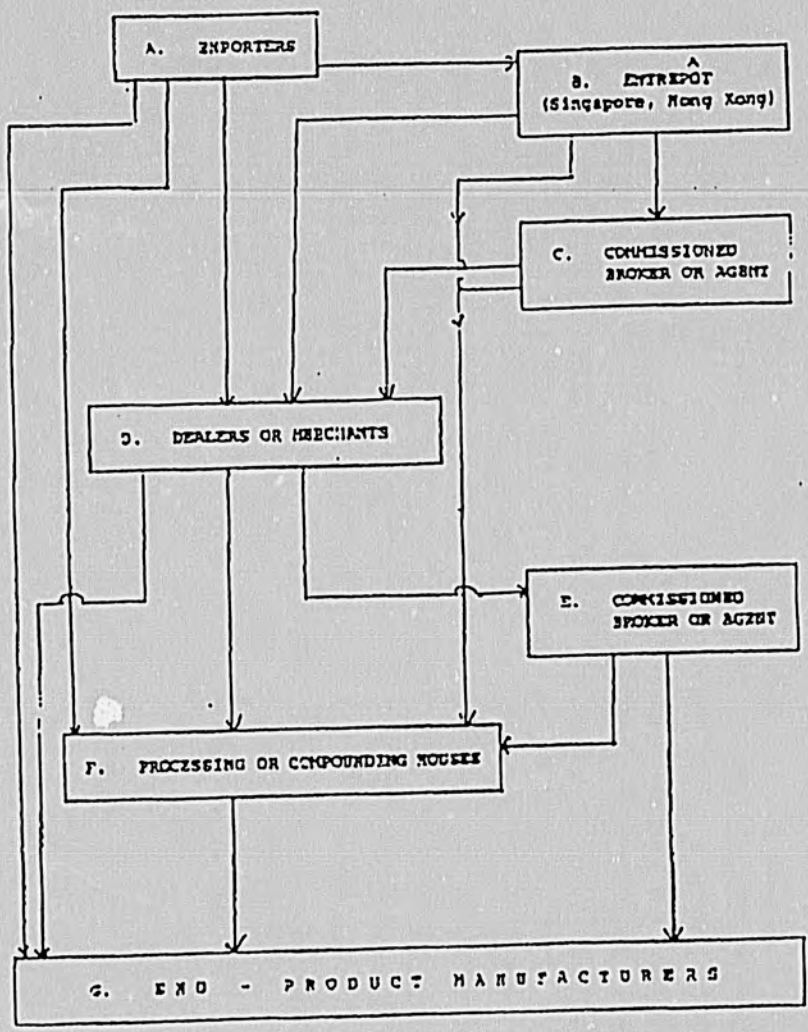
The oleoresin market, which is restricted almost entirely to food processors, has similar distribution channels, but there is less of a spot market because there are fewer parties involved. In the food processing sector, many of the oleoresin buyers also purchase essential oils, so the agents and distributors are often the same.

Essential oils sold to large manufacturers or middlemen are typically shipped in 200 L iron drums containing 180 kg of product. Low volume shipments are sent in 25 to 100 L drums. Epoxy lining must be used in drums containing essential oils that react with iron. U.S. dealers break bulk and re-ship to individual buyers. Although shipping requirements are not particularly complicated, buyers report that problems do frequently arise with low value oils which processors ship in used drums. Low value oils tend to leave residues which contaminate the product. When drums are re-used, they should be thoroughly cleaned with appropriate solvents and tested to ensure that they are free of residue.

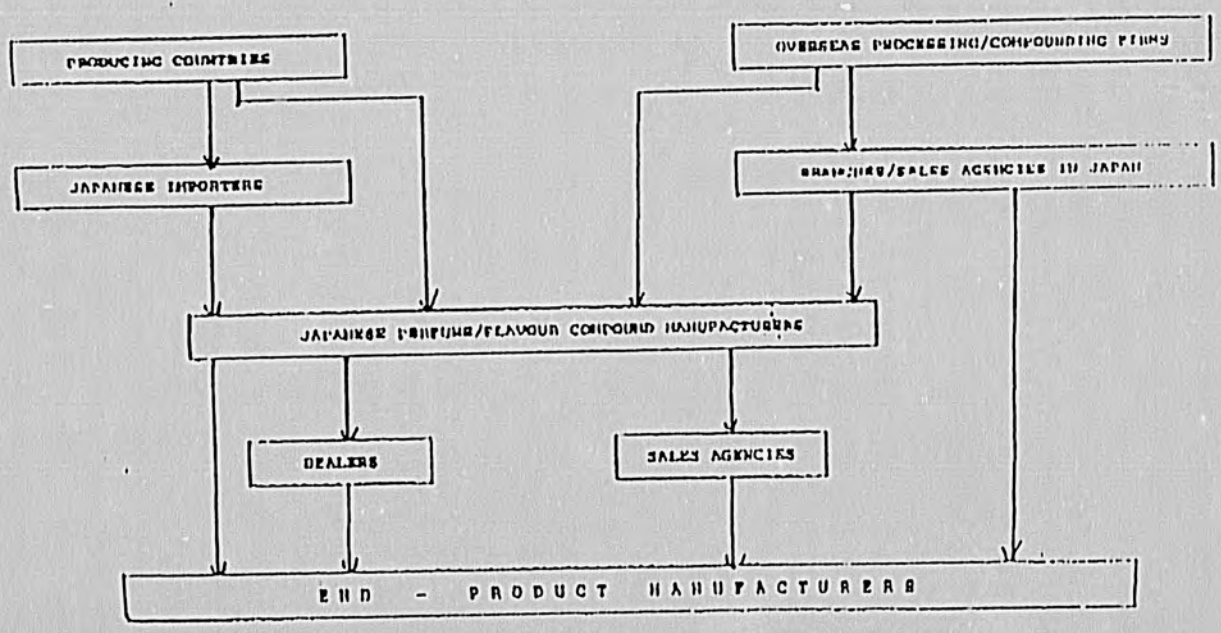
Oleoresins are shipped by processors in 1, 10, and 15 kg glass lined metal containers for small shipments, and 100-200 kg plastic lined metal containers for larger shipments. The producer is responsible for using the proper shipping seal, providing adequate air space, and meeting all U.S. labeling requirements.

TABLE 8: ESSENTIAL OIL AND OLEORESIN DISTRIBUTION CHANNELS

STRUCTURE OF THE WESTERN TRADE IN ESSENTIAL OILS AND SPICE OLEORESINS



STRUCTURE OF THE JAPANESE TRADE IN ESSENTIAL OILS AND SPICE OLEORESINS



Source: Japanese National Trade Organisation, Tokyo.

67

II. Assessment of Market Potential of Selected Botanical Extracts

Reliable marketing data in the essential oil and oleoresin industry is difficult to find and therefore any information gathered by individual companies is guarded very closely. Even the U.S. government has many problems in obtaining adequate data. However, a preliminary assessment of the selected extracts provides a basis for roughly prioritizing these products according to overall market potential.

Low Potential Extracts

Industry sources say that there is not a big demand for basil oil and that there is already an abundance of rosemary oil on the market (See Table 9: U.S. Rosemary Essential Oil Imports). The essential oil industry did look into commercially producing canella essential oil, but decided not to. Lemon Verbena is supplied commercially in very limited quantities from Tunisia and Algeria, but buyers are increasingly purchasing lemongrass instead (Cymbopogon citratus or C. flexuosus).

Quassia is imported by a limited number of U.S. companies as a bitter agent in beverages, but there has been concerns about toxicity levels. The use of sarsaparilla has actually been banned in the U.S. by the Food and Drug Administration for the past 20 years because it contains sapharol, a carcinogen.

The market for clary sage is currently glutted by supplies from both Russia, the U.S. and France. The price for the oil has dropped dramatically and U.S. buyers are switching to substitute products. Also, the climate for Jamaica is not suited for growing clary sage as it needs altitude and cold weather. Therefore, we do not recommend any investment in distilling clary sage in Jamaica.

An increase in the use of black pepper (See Table 10: U.S. Black Pepper Oleoresin Imports) is expected in the U.S. because of the increase in immigration from countries in Latin America and Asia that use more spices, and the cultural influence these groups are having on mainstream American cuisine. In addition, with a growing emphasis on healthier foods, many consumers are reducing their consumption of salt and fat and are substituting spices to increase flavor. Industry experts report that there is currently an overabundance of black pepper oil on the global market. In general higher volume essential oils and spices fetch lower market prices than the rare, high quality products that can be produced in Jamaica.

Medium to High Potential Extracts

Paprika (See Table 11: U.S. Paprika Oleoresin Imports)

Paprika is grown by many countries around the world, putting it in the same high volume category as black pepper. The oleoresin is predominantly used for coloring, almost exclusively in the food industry. An internal survey of large volume paprika oleoresin buyers conducted by IBD indicates that there is interest in acquiring new sources of high quality product.

TABLE 9: U.S. ROSEMARY ESSENTIAL OIL IMPORTS

	1990 KG	1990 $1,000	1991 KG	1991 $1,000	1992 KG	1992 $1,000	JAN.-APRIL 1993 KG	JAN.-APRIL 1993 $1,000
WORLD	-	-	-	-	57,740	$713	13,854	$262
SWEDEN	300	$11	680	$26	300	$12	-	-
UK	-	-	918	$18	300	$4	-	-
FRANCE	29,027	$306	22,014	$266	39,675	$450	8,634	$112
GERMANY	-	-	65	$6	-	-	-	-
SWITZERLAND	-	-	200	$8	-	-	-	-
SPAIN	19,235	$294	28,405	$424	13,185	$214	3,920	$51
ITALY	30	$3	-	-	-	-	100	$82
MOROCCO	200	$2	1,000	$11	80	$2	-	-
TUNISIA	-	-	1,600	$23	2,200	$31	1,200	$17

SOURCE: NATIONAL TRADE DATA BASE

TABLE 10: U.S. BLACK PEPPER OLEORESIN.. IMPORTS

	JAN.-APRIL 1993 KG	JAN.-APRIL 1993 $1,000
WORLD	103,798	1,074
CANADA	40	1
UK	250	15
SWITZERLAND	33	14
INDIA	60,280	917
SRI LANKA	42,995	121
INDONESIA	200	5

SOURCE: NATIONAL TRADE DATA BASE

TABLE 11: U.S. PAPRIKA OLEORESIN IMPORTS

	JAN.-APRIL 1993 KG	JAN.-APRIL 1993 $1,000 VALUE
WORLD	138,236	4,226
CANADA	3,483	6
UK	2,350	29
SPAIN	17,839	782
ISRAEL	4,000	197
INDIA	11,538	367
INDONESIA	4,750	9
MOROCCO	94,276	2,836

SOURCE: NATIONAL TRADE DATA BANK

TABLE 12: U.S. GERANIUM ESSENTIAL OIL IMPORTS

	1990 KG	1990 $1,000	1991 KG	1991 $1,000	1992 KG	1992 $1,000	JAN.-APRIL 1993 KG	JAN.-APRIL 1993 $1,000
WORLD	-	-	-	-	53,074.0	1,970.0	21,677.0	881.0
UK	2,980.0	200.1	1,601.0	112.8	1,900.0	123.0	483.0	30.0
FRANCE	26,655.0	921.1	20,135.0	903.9	22,509.0	768.0	13,762.0	509.0
GERMANY	2,939.0	98.5	588.0	29.0	848.0	30.0	417.0	12.0
SWITZERLAND	1,620.0	148.1	555.0	35.6	675.0	36.0	1,760.0	97.0
SPAIN	-	-	465.0	58.9	2,109.0	148.0	220.0	8.0
ITALY	30.0	7.8	-	-	-	-	-	-
HONG KONG	6,850.0	133.0	-	-	500.0	16.0	500.0	-
MOROCCO	18.0	1.5	25.0	2.4	549.0	30.0	549.0	-
EGYPT	6,950.0	290.1	14,924.0	548.7	1,180.0	432.0	1,180.0	92.0
REUNION	-	-	-	-	540.0	52.0	540.0	-
S. AFRICA	-	-	50.0	2.8	-	-	-	-
FRENCH INDIAN OCEAN TERR.	1,350.0	147.0	1,280.0	124.0	540.0	52.3	-	-

SOURCE: NATIONAL TRADE DATA BASE

Allspice

Jamaica has a decided market advantage in producing allspice because of its worldwide reputation for high quality product with the highest concentration of essential oils. Jamaica is the largest producer of raw allspice, exporting about 4.5 million pounds per year, about two thirds of total world production.

Only Jamaica has a cultivated allspice crop, elsewhere the leaves are harvested from wild trees. These wild sources are dwindling due to deforestation, and harvesting these sources is not cost effective, so the Jamaican share of the allspice market is expected to grow.

The largest market for allspice products is the U.S., where it is used as a raw spice and a medicinal herb. IBD has identified U.S. interest in high quality allspice essential oil. Jamaica already has firmly established channels to the U.S. market where the raw spice imported from Jamaica is considered very high quality.

Geranium (See Table 12: U.S. Geranium Essential Oil Imports)

Europe's demand for geranium oil has been dropping due to economic recession. Demand in general for geranium oil has been decreasing over time. Though it is important for perfumes, it is not one of the oils that is traded most frequently. China, Egypt, and France are all major suppliers to the U.S. market.

Chinese geranium oil is very low priced, due to their low labor costs. Because of its ability to produce great quantities, China has a major influence on market prices. France's geranium oil is considered the best quality and is mainly bought by fine fragrance manufacturers. There are also cheaper blends of American, Chinese and French oils.

Currently, prices for Chinese geranium oil have been going up because of a decrease in supply. China produces 80 tons per year on average, but in 1992 it only produced 20 tons, leading to a global price increase in the short term. Egyptian and French geranium oil prices have also risen, keeping pace with the Chinese market price. Other geranium oil sources have remained stable, though it is likely that their price will also rise in the short and medium term, creating a potential market opportunity for high quality Jamaican suppliers.

Ginger

India and Nigeria produce for a large internal market as well as for export while Jamaica and Sierra Leone produce primarily for an export market. The leading importers of ginger are the United Kingdom, Arab countries and the U.S. The market for ginger root is tight and competition is strong from India and Nigeria. However, IBD has found interest in high quality ginger oleoresin.

Ginger produces 1-3% essential oil composed of zingiberols, zingiberene, zingerone and gingerol. It is used in food flavorings and perfumery, with an

increasing use in men's toilet lotions. But, there is more demand for ginger oleoresin than the essential oil. Ginger oleoresin made from ground ginger is used in soft drinks such as ginger ale and ginger beer. However, it requires considerable amounts of the raw material.

Ginger is no longer found growing in the wild. It is a soil exhausting crop, which requires heavy fertilization or crop rotation to rest the soil.

Vetiver (See Table 13: U.S. Vetiver Essential Oil Imports)

Haiti is the leading producer of vetiver, though Reunion, Indonesia, and Brazil are also respected suppliers. Other producing countries include Seychelles, Angola, Zaire, India, New Guinea and France. However, vetiver from different regions are often considered separate, non-interchangeable products. Indonesian vetiver, for example, has different qualities and does not compete with Caribbean vetiver.

Reunion Island produces 35 tons annually of an essential oil known as Bourbon vetiver which only a selective group buys because of its unique 'note'. Brazil produces good vetiver products, but the industry is not structured and supply is erratic.

In general, the supply of vetiver oil has been unstable. Recent disruptions in the supply from Haiti, due to continuing political difficulties, reduced the world supply significantly, leading to shortages and price increases. The recent United Nations embargo against Haiti has cut off this supply completely. Haitian production of vetiver essential oil has been hurt because the product is denied access to the US, Haitian vetiver's largest market. Other difficulties include the unavailability of spare parts for their machinery, a rise in fuel prices and the lack of reliable electricity. In 1992, some Haitian producers began retrofitting their plants for syrup and fruit extract manufacturing. Others are moving to corn and sweet potato crops which are more profitable.

In spite of vetiver oil's long-standing reputation as a key perfume ingredient, there has been a gradual decline in vetiver consumption in the perfume industry as manufacturers substitute other natural and synthetic compounds that are more stable in price and supply. There may, however, be promising opportunities for a Jamaican processor able to produce a reliable, high quality supply of this sought-after oil.

TABLE 13: U.S. VETIVER ESSENTIAL OIL IMPORTS

	1990 KG	1990 $1,000	1991 KG	1991 $1,000	1992 KG	1992 $1,000	JAN.-APRIL, 1993 KG	JAN.-APRIL 1993 $1,000
WORLD	-	-	-	-	29,777.0	1,172.0	7,172.0	357.0
HAITI	71,818.0	2,813.4	30,004.0	1,061.4	-	-	-	-
BRAZIL	-	-	2,110.0	61.2	849.0	37.0	-	-
UK	-	-	-	-	204.0	27.0	50.0	3.0
FRANCE	3,233.0	216.9	2,113.0	191.8	13,061.0	557.0	1,772.0	127.0
GERMANY	-	-	-	-	50.0	9.0	-	-
SWITZERLAND	190.0	11.3	132.0	6.6	265.0	24.0	150.0	14.0
SPAIN	-	-	-	-	50.0	8.0	-	-
ITALY	932.0	37.1	-	-	-	-	-	-
INDIA	-	-	-	-	-	-	1,000.0	40.0
SINGAPORE	800.0	23.8	-	-	-	-	-	-
INDONESIA	7,725.0	210.5	3,480.0	75.0	15,223.0	501.0	1,600.0	62.0
HONG KONG	-	-	-	-	-	-	2,600.0	110.0
JAPAN	-	-	3,067.0	89.5	-	-	-	-
REUNION	-	-	-	-	75.0	10.0	-	-
FRENCH INDIAN OCEAN TERR.	650.0	60.4	200.0	26.6	75.0	9.6	-	-

SOURCE: NATIONAL TRADE DATA BASE

III. Potential Customers

IBD conducted a survey of potential extract buyers to assess their interest in new Jamaican suppliers of the selected products. Based on theses discussions, IBD has identified an immediate opportunity to cultivate a relationship with McCormick.

McCormick Profile

McCormick is the leading spice producer in the US, with more than 40% market share domestically amounting to $1.2 billion in sales. One third of sales comes from the retail market, the rest from the industrial and food service market. Approximately 53% of their final sales price represents raw materials costs.

The company is planning a major expansion of European operations and is seeking new suppliers to meet the anticipated growth of demand for McCormick products in these markets.

The company has a technical assistance program in India for its essential oil and oleoresin suppliers there, and representatives of the company say that it would consider providing similar services to a qualified supplier in Jamaica.

McCormick has an interest in expanding its Jamaican sourcing of high quality pimento oil, raw basil, paprika oleoresin for coloring, and high quality ginger oleoresin. The company also uses large amounts of black pepper and rosemary oil, but is not seeking new sources at the present time.

APPENDICES

1. Essential Oil Production Flow Chart
2. Food Chemicals Codex Regulations for Essential Oils
3. International Regulations for Essential Oils
4. Analysis of Selected Botanical Extracts
5. Potential Buyers
6. Sources
7. Bibliography

BUSINESS OPPORTUNITIES IN THE BOTANICAL EXTRACTS MARKET

APPENDIX 1

ESSENTIAL OIL PRODUCTION FLOW CHART

ESSENTIAL OIL PRODUCTION FLOW CHART

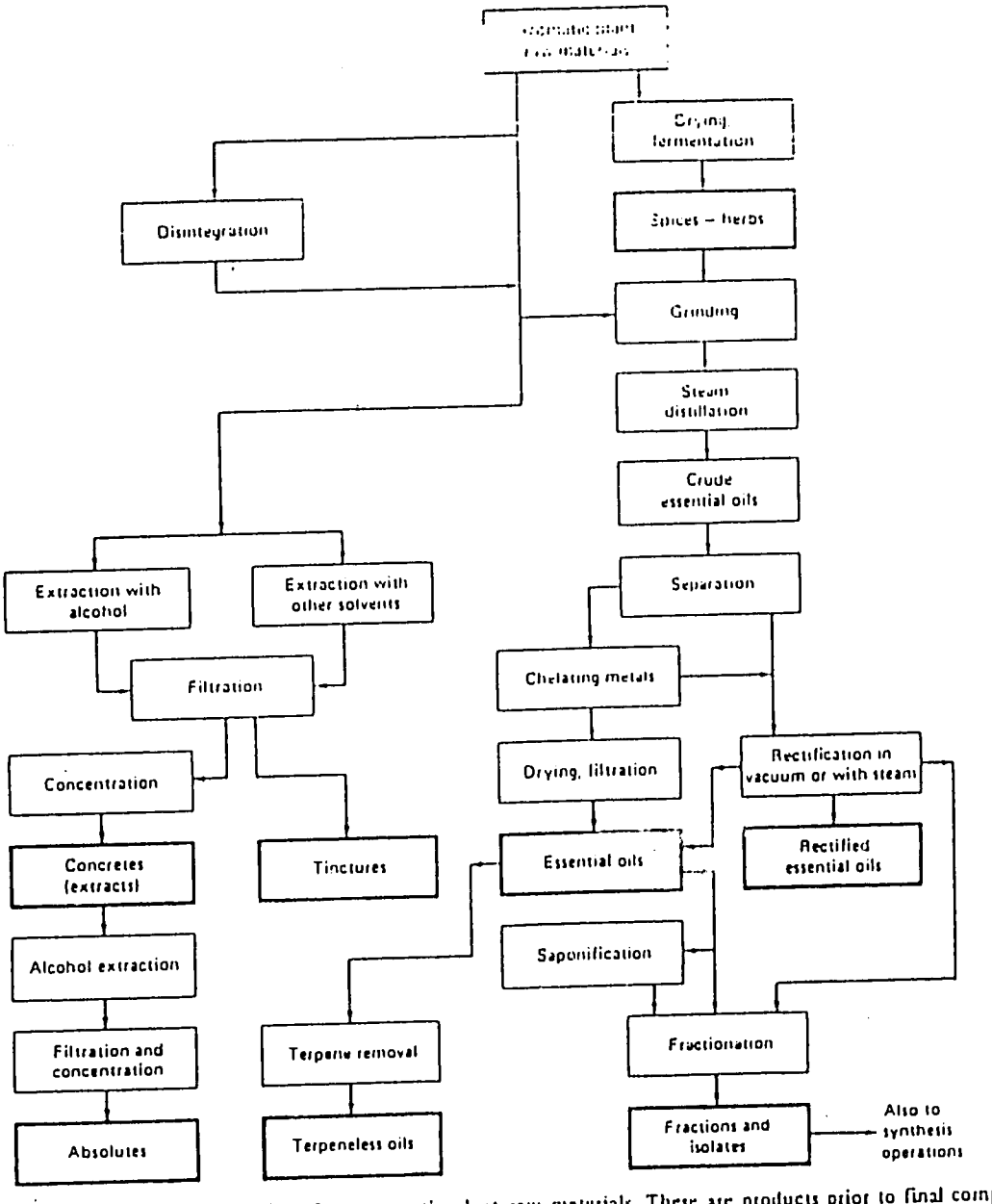


Fig. 8. Production of 7 categories of flavorings from aromatic plant raw materials. These are products prior to final compounding and approval by the manufacturer's flavor quality control center. It will be noted that spices and herbs also serve as a raw material for the production of certain essential oils, rectified essential oils, terpeneless oils, and fractions and isolates. Also, that concretes serve as raw materials for absolutes; and that essential oils serve as raw materials for terpeneless oils, recetified essential oils, and fractions and isolates. All final products are shown in boxes with bold borders. It will be noted that fractions and isolates also are used in synthesis operations as raw materials for synthetic flavorings.

Source: Foods and Food Production Encyclopedia, p. 722.

BUSINESS OPPORTUNITIES IN THE BOTANICAL EXTRACTS MARKET

APPENDIX 2

FOOD CHEMICALS CODEX REGULATIONS FOR ESSENTIAL OILS

Amyris Oil, West Indian Type

Sandalwood Oil, West Indian Type

DESCRIPTION

The volatile oil obtained by steam distillation from the wood of *Amyris balsamifera* L. (Fam. *Rutaceae*). It is a clear, pale yellow, viscous liquid having a distinct odor suggestive of sandalwood. It is soluble in most fixed oils and usually in mineral oil. It is soluble in an equal volume of propylene glycol, the solution often becoming opalescent on further dilution. It is practically insoluble in glycerin.

REQUIREMENTS

Identification

The infrared absorption spectrum of the sample exhibits relative maxima (that may vary in intensity) at the same wavelengths (or frequencies) as those shown in the respective spectrum under *Infrared Spectra of Essential Oils*, page 585, using the same test conditions as specified therein.

Acid Value Not more than 3.0.
Angular Rotation Between +10° and +53°.
Ester Value Not more than 7.
Ester Value after Acetylation Between 115 and 165.
Heavy Metals (as Pb) Passes test.
Refractive Index Between 1.503 and 1.512 at 20°.
Solubility in Alcohol Passes test.
Specific Gravity Between 0.943 and 0.976.

TESTS

Acid Value Determine as directed in the general method, page 499.

Angular Rotation Determine in a 100-mm tube as directed under *Optical Rotation*, page 530.

Ester Value Determine as directed in the general method, page 501, using about 5 g, accurately weighed.

Ester Value after Acetylation Proceed as directed under *Total Alcohols*, page 499, using about 2 g of the dried acetylated oil, accurately weighed. Reflux for a period of 2 h. Calculate the *Ester Value after Acetylation* by the formula $A \times 28.05/B$, in which A is the number of ml of 0.5 N alcoholic potassium hydroxide consumed in the saponification, and B is the weight, in g, of the acetylated oil used in the test.

Heavy Metals Shake 10 ml of the oil with an equal volume of water to which 1 drop of hydrochloric acid has been added, and pass hydrogen sulfide through the mixture until it is saturated. No darkening in color is produced in either the oil or the water.

Refractive Index, page 533 Determine with an Abbé or other refractometer of equal or greater accuracy.

Solubility in Alcohol Proceed as directed in the general method, page 502. One ml dissolves in 3 ml of 80% alcohol, often with opalescence.

Specific Gravity Determine by any reliable method (see page 3).

Packaging and Storage Store in full, tight, preferably aluminum, glass, or tin lined containers in a cool place protected from light.

Functional Use in Foods Flavoring agent.

BEST AVAILABLE COPY

Basil Oil, Comoros Type

Basil Oil Exotic; Basil Oil, Réunion Type

DESCRIPTION

Basil oil, Comoros type, is obtained by steam distillation of the flowering tops or the entire plant of *Ocimum basilicum* L. It may be distinguished from other types, such as European basil oil, by its camphoraceous odor and physicochemical constants. It is a light yellow liquid with a spicy odor. It is soluble in most fixed oils and, with turbidity, in mineral oil. One ml is soluble in 20 ml of propylene glycol with slight haziness, but it is insoluble in glycerin.

REQUIREMENTS

Identification

The infrared absorption spectrum of the sample exhibits relative maxima (that may vary in intensity) at the same wavelengths (or frequencies) as those shown in the respective spectrum under *Infrared Spectra of Essential Oils*, page 586, using the same test conditions as specified therein.

Acid Value Not more than 1.0.
Angular Rotation Between −2° and +2°.
Ester Value after Acetylation Between 25 and 45.
Heavy Metals (as Pb) Passes test.
Refractive Index Between 1.512 and 1.520 at 20°C.
Saponification Value Between 4 and 10.
Solubility in Alcohol Passes test.
Specific Gravity Between 0.952 and 0.973.

TESTS

Acid Value Determine as directed in the general method, page 499.

Angular Rotation Determine in a 100-mm tube as directed under *Optical Rotation*, page 530.

Ester Value after Acetylation Proceed as directed under *Linalool Determination*, page 501, using 2.5 g of the dry acetylated oil, accurately weighed, for the saponification. Calculate the *Ester Value after Acetylation* by the formula $a \times 28.05/b$, in which a is the number of ml of 0.5 *N* alcoholic potassium hydroxide consumed in the saponification, and b is the weight of the acetylated oil, in g, used in the test.

Heavy Metals Shake 10 ml of the oil with an equal volume of water to which 1 drop of hydrochloric acid has been added, and pass hydrogen sulfide through the mixture until it is saturated. No darkening in color is produced in either the oil or the water.

Refractive Index, page 533 Determine with an Abbé or other refractometer of equal or greater accuracy.

Saponification Value Determine as directed in the general method, page 501, using about 5 g of sample, accurately weighed.

Solubility in Alcohol Proceed as directed in the general method, page 502. One ml dissolves in 4 ml of 80% alcohol.

Specific Gravity Determine by any reliable method (see page 3).

Packaging and Storage Store in full, tight, preferably glass or aluminum containers in a cool place protected from light.

Functional Use in Foods Flavoring agent.

BEST AVAILABLE COPY

Basil Oil, European Type

Basil Oil, Italian Type; Sweet Basil Oil

DESCRIPTION

Basil oil, European type, is obtained by steam distillation of the flowering tops or the entire plant of *Ocimum basilicum* L. It may be distinguished from other types, such as basil oil, Comoros type, or basil oil, Réunion type, by its more floral odor and its physicochemical constants. It is a pale yellow to yellow liquid with a floral spicy odor. It is soluble in most fixed oils and, with turbidity, in mineral oil. One ml is soluble in 20 ml of propylene glycol with slight haziness, but it is insoluble in glycerin and in mineral oil.

REQUIREMENTS

Identification

The infrared absorption spectrum of the sample exhibits relative maxima (that may vary in intensity) at the same wavelengths (or frequencies) as those shown in the respective spectrum under *Infrared Spectra of Essential Oils*, page 609, using the same test conditions as specified therein.

Acid Value: Not more than 2.5.
Angular Rotation: Between −5° and −15°.
Ester Value after Acetylation: Between 140 and 180.
Heavy Metals (as Pb): Passes test.
Refractive Index: Between 1.483 and 1.493 at 20°C.
Solubility in Alcohol: Passes test.
Specific Gravity: Between 0.900 and 0.920.

ASSAY

Acid Value: Determine as directed in the general method, page 199.

Angular Rotation: Determine in a 100-mm tube as directed under *Optical Rotation*, page 530.

Ester Value after Acetylation: Proceed as directed under *Linalool Determination*, page 501, using 2.5 g of the dry acetylated oil, accurately weighed, for the saponification. Calculate the *Ester Value after Acetylation* by the formula $a \times 28.05/b$, in which a is the number of ml of 0.5 *N* alcoholic potassium hydroxide consumed in the saponification, and b is the weight of the acetylated oil, in g, used in the test.

Heavy Metals: Shake 10 ml of the oil with an equal volume of water to which 1 drop of hydrochloric acid has been added, and pass hydrogen sulfide through the mixture until it is saturated. No darkening in color is produced in either the oil or the water.

Refractive Index, page 533: Determine with an Abbe or other refractometer of equal or greater accuracy.

Solubility in Alcohol: Proceed as directed in the general method, page 502. One ml dissolves in 4 ml of 80% alcohol.

Specific Gravity: Determine by any reliable method (see page 1).

Packaging and Storage: Store in full, tight, preferably glass or aluminum containers in a cool place protected from light.

Functional Use in Foods: Flavoring agent.

BEST AVAILABLE COPY

Black Pepper Oil

DESCRIPTION

The volatile oil obtained by steam distillation from the dried, unripened fruit of the plant *Piper nigrum* L. (Fam. *Piperaceae*). It is an almost colorless to slightly greenish liquid having the characteristic odor of pepper and a relatively mild taste. It is soluble in most fixed oils, in mineral oil, and in propylene glycol. It is sparingly soluble in glycerin.

REQUIREMENTS

Identification

The infrared absorption spectrum of the sample exhibits relative maxima (that may vary in intensity) at the same wavelengths (or frequencies) as those shown in the respective spectrum under *Infrared Spectra of Essential Oils*, page 587, using the same test conditions as specified therein.

Heavy Metals (as Pb) Passes test.
Refractive Index Between 1.479 and 1.488 at 20°.
Solubility in Alcohol Passes test.
Specific Gravity Between 0.864 and 0.884.

TESTS

Heavy Metals Shake 10 ml of the oil with an equal volume of water to which 1 drop of hydrochloric acid has been added, and pass hydrogen sulfide through the mixture until it is saturated. No darkening in color is produced in either the oil or the water.

Refractive Index, page 533 Determine with an Abbé or other refractometer of equal or greater accuracy.

Solubility in Alcohol Proceed as directed in the general method, page 502. One ml dissolves in 3 ml of 95% alcohol.

Specific Gravity Determine by any reliable method (see page 1)

Packaging and Storage Store in full, tight, glass containers in a cool place protected from light

Functional Use in Foods Flavoring agent.

BEST AVAILABLE COPY

Clary Oil

Clary Sage Oil; Oil of Muscatel

DESCRIPTION

The oil obtained by steam distillation from the flowering tops and leaves of the clary sage plant, *Salvia sclarea* L. (Fam *Labiatae*). It is a pale yellow to yellow liquid having a herbaceous odor and a winy bouquet. It is soluble in most fixed oils, and in mineral oil up to 3 volumes, but becomes opalescent on further dilution. It is insoluble in glycerin and in propylene glycol.

REQUIREMENTS

Identification

The infrared absorption spectrum of the sample exhibits relative maxima (that may vary in intensity) at the same wavelengths (or frequencies) as those shown in the respective spectrum under *Infrared Spectra of Essential Oils*, page 591, using the same test conditions as specified therein.

Assay: Not less than 48.0% and not more than 75.0% of esters, calculated as linalyl acetate ($C_{12}H_{20}O_2$).
Acid Value: Not more than 2.5.
Angular Rotation: Between −6° and −20°.
Heavy Metals (as Pb): Passes test.
Refractive Index: Between 1.458 and 1.473 at 20°.
Solubility in Alcohol: Passes test.
Specific Gravity: Between 0.886 and 0.929.

TESTS

Assay: Weigh accurately about 2 g, and proceed as directed under *Ester Determination*, page 500, using 98.15 as the equivalence factor (*e*) in the calculation.

Acid Value: Determine as directed in the general method, page 499.

Angular Rotation: Determine in a 100-mm tube as directed under *Optical Rotation*, page 530.

Heavy Metals: Shake 10 ml of the oil with an equal volume of water to which 1 drop of hydrochloric acid has been added, and pass hydrogen sulfide through the mixture until it is saturated. No darkening in color is produced in either the oil or the water.

Refractive Index, page 533: Determine with an Abbé or other refractometer of equal or greater accuracy.

Solubility in Alcohol: Proceed as directed in the general method, page 502. One ml dissolves in 3 ml of 90% alcohol, becoming opalescent upon further dilution.

Specific Gravity: Determine by any reliable method (see page 3).

Packaging and Storage: Store in full, tight, preferably glass, aluminum, tin-lined, or galvanized iron containers in a cool place protected from light.

Functional Use in Foods: Flavoring agent.

Geranium Oil, Algerian Type

Rose Geranium Oil, Algerian Type

DESCRIPTION

The oil obtained by steam distillation from the leaves of *Pelargonium graveolens* L'Her. (Fam. *Geraniaceae*). It is a light yellow to deep yellow liquid having a characteristic odor resembling rose and geraniol. It is soluble in most fixed oils, and it is soluble, usually with opalescence, in mineral oil and in propylene glycol. It is practically insoluble in glycerin.

REQUIREMENTS

Identification

The infrared absorption spectrum of the sample exhibits relative maxima (that may vary in intensity) at the same wavelengths (or frequencies) as those shown in the respective spectrum under *Infrared Spectra of Essential Oils*, page 595, using the same test conditions as specified therein.

Assay Not less than 13.0% and not more than 29.5% of esters, calculated as geranyl tiglate ($C_{16}H_{24}O_2$).
Acid Value Between 1.5 and 9.5.
Angular Rotation Between −7° and −13°.
Ester Value after Acetylation Between 203 and 234.
Heavy Metals (as Pb) Passes test.
Refractive Index Between 1.464 and 1.472 at 20°.
Solubility in Alcohol Passes test.
Specific Gravity Between 0.886 and 0.898.

TESTS

Assay Proceed as directed under *Ester Value*, page 501, using about 6 g, accurately weighed. The ester value multiplied by 0.422 equals the percentage of geranyl tiglate ($C_{16}H_{24}O_2$).
Acid Value Determine as directed in the general method, page 499, using about 5 g, accurately weighed, and modifying the procedure by using 15 ml of water, instead of alcohol, as diluent and by agitating the mixture thoroughly during the titration to keep the oil in suspension.
Angular Rotation Determine in a 100-mm tube as directed under *Optical Rotation*, page 530.
Ester Value after Acetylation Proceed as directed under *Total Alcohols*, page 499, using about 1.9 g of the acetylated oil, accurately weighed, for saponification. Calculate the ester value after acetylation by the formula $A \times 28.05/B$, in which A is the number of ml of 0.5 N alcoholic potassium hydroxide consumed in the saponification, and B is the weight of acetylated oil, in g.
Heavy Metals Shake 10 ml of the oil with an equal volume of water to which 1 drop of hydrochloric acid has been added, and pass hydrogen sulfide through the mixture until it is saturated. No darkening in color is produced in either the oil or the water.
Refractive Index, page 533 Determine with an Abbé or other refractometer of equal or greater accuracy.
Solubility in Alcohol Proceed as directed in the general method, page 502. One ml dissolves in 3 ml of 70% alcohol, but on further dilution with the alcohol opalescence may occur, sometimes followed by separation of paraffin particles.
Specific Gravity Determine by any reliable method (see page 3).

Packaging and Storage Store in full, tight, preferably glass, aluminum, or tin-lined containers in a cool place protected from light.
Functional Use in Foods Flavoring agent.

Ginger Oil

DESCRIPTION

The volatile oil obtained by steam distillation of the dried ground rhizome of *Zingiber officianale*, Roscoe (Fam. *Zingiberaceae*). It is a light yellow to yellow liquid having the aromatic, characteristic odor of ginger. It is soluble in most fixed oils and in mineral oil. It is soluble, usually with turbidity, in alcohol, but it is insoluble in glycerin and in propylene glycol.

REQUIREMENTS

Identification

The infrared absorption spectrum of the sample exhibits relative maxima (that may vary in intensity) at the same wavelengths (or frequencies) as those shown in the respective spectrum under *Infrared Spectra of Essential Oils*, page 595, using the same test conditions as specified therein.

Angular Rotation Between −28° and −47°.
Heavy Metals (as Pb) Passes test.
Refractive Index Between 1.488 and 1.494 at 20°.
Saponification Value Not more than 20.
Specific Gravity Between 0.870 and 0.882.

TESTS

Angular Rotation Determine in a 100-mm tube as directed under *Optical Rotation*, page 530.

Heavy Metals Shake 10 ml of the oil with an equal volume of water to which 1 drop of hydrochloric acid has been added, and pass hydrogen sulfide through the mixture until it is saturated. No darkening in color is produced in either the oil or the water.

Refractive Index, page 533 Determine with an Abbé or other refractometer of equal or greater accuracy.

Saponification Value Determine as directed in the general method, page 501, using about 5 g, accurately weighed.

Specific Gravity Determine by any reliable method (see page 3).

Packaging and Storage Store in full, tight, glass, aluminum, or tin-lined containers in a cool place protected from light.

Functional Use in Foods Flavoring agent.

Marjoram Oil, Spanish Type

DESCRIPTION

A volatile oil obtained by steam distillation from the flowering plant *Thymus mastichina* L. (Fam. *Labiatae*). It is a slightly yellow liquid having a camphoraceous note. It is soluble in most fixed oils, but it is insoluble in glycerin, in propylene glycol, and in mineral oil.

REQUIREMENTS

Identification

The infrared absorption spectrum of the sample exhibits relative maxima (that may vary in intensity) at the same wavelengths (or frequencies) as those shown in the respective spectrum under *Infrared Spectra of Essential Oils*, page 600, using the same test conditions as specified therein.

Assay Not less than 49% and not more than 65% of cineole.
Acid Value Not more than 2.0.
Angular Rotation Between −5° and +10°.
Heavy Metals (as Pb) Passes test.
Refractive Index Between 1.463 and 1.468 at 20°.
Saponification Value Between 5 and 20.
Solubility in Alcohol Passes test.
Specific Gravity Between 0.904 and 0.920.

TESTS

Assay Dry a sample over anhydrous sodium sulfate, and transfer 3 g of the dried oil, accurately weighed, into a test tube as directed for *Solidification Point*, page 538. Add 2.1 g of melted *o*-cresol. The *o*-cresol must be pure and dry and have a solidification point not below 30°. Insert the thermometer, stir, and warm the tube gently until the mixture is completely melted. Proceed as directed under *Solidification Point*, page 539. Repeat the procedure until two successive readings agree within 0.1°. Compute the percentage of cineole from the *Percentage of Cineole* table, page 501.

Acid Value Determine as directed in the general method, page 499.

Angular Rotation Determine in a 100-mm tube as directed under *Optical Rotation*, page 530.

Heavy Metals Shake 10 ml of the oil with an equal volume of water to which 1 drop of hydrochloric acid has been added, and pass hydrogen sulfide through the mixture until it is saturated. No darkening in color is produced in either the oil or the water.

Refractive Index, page 533 Determine with an Abbé or other refractometer of equal or greater accuracy.

Saponification Value Determine as directed in the general method, page 501, using about 10 g, accurately weighed.

Solubility in Alcohol Proceed as directed in the general method, page 502. One ml dissolves in 1 ml of 80% alcohol and remains in solution on further addition of the alcohol to a total volume of 10 ml.

Specific Gravity Determine by any reliable method (see page

Packaging and Storage Store in full, tight, preferably glass, aluminum, tin-lined, or other suitably lined containers in a cool place protected from light.

Functional Use in Foods Flavoring agent.

Marjoram Oil, Sweet

DESCRIPTION

The volatile oil obtained by steam distillation of the dried herb of the marjoram shrub, *Marjoram hortensis* L. (Fam. *Labiatae*). It is a yellow or greenish yellow oil having a spicy or cardamom note. It is soluble in most fixed oils and in mineral oil (with turbidity). It is only partly soluble in propylene glycol, and is insoluble in glycerin.

REQUIREMENTS

Identification

The infrared absorption spectrum of the sample exhibits relative ...xima (that may vary in intensity) at the same wavelengths ... frequencies) as those shown in the respective spectrum under *Infrared Spectra of Essential Oils*, page 600, using the same test conditions as specified therein.

Acid Value Not more than 2.5.
Angular Rotation Between +14° and +24°.
Heavy Metals (as Pb) Passes test.
Refractive Index Between 1.470 and 1.475 at 20°.
Saponification Value Between 23 and 40.
Saponification Value after Acetylation Between 68 and 86.
Solubility in Alcohol Passes test.
Specific Gravity Between 0.890 and 0.906.

TESTS

Acid Value Determine as directed in the general method, page 499.

Angular Rotation Determine in a 100-mm tube as directed under *Optical Rotation*, page 530.

Heavy Metals Shake 10 ml of the oil with an equal volume of water to which 1 drop of hydrochloric acid has been added, and pass hydrogen sulfide through the mixture until it is saturated. No darkening in color is produced in either the oil or the water.

Refractive Index, page 533 Determine with an Abbé or other refractometer of equal or greater accuracy.

Saponification Value Determine as directed in the general method, page 501, using about 5 g, accurately weighed.

Saponification Value after Acetylation Proceed as directed under *Total Alcohols*, page 499, using about 2.5 g of acetylated oil, accurately weighed. Calculate the saponification value by the formula $28.05 \times A/B$, in which A is the number of ml of 0.5 N alcoholic potassium hydroxide consumed in the titration, and B is the weight of the acetylated oil, in g.

Solubility in Alcohol Proceed as directed in the general method, page 502. One ml dissolves in 2 ml of 80% alcohol.

Specific Gravity Determine by any reliable method (see page 3).

Packaging and Storage Store in full, tight containers in a cool place protected from light.

Functional Use in Foods Flavoring agent.

Pimenta Leaf Oil

Pimento Leaf Oil

DESCRIPTION

The volatile oil obtained by steam distillation from the leaves of the evergreen shrub *Pimenta officinalis* Lindl. (Fam. *Myrtaceae*). It is a pale yellow to light brownish yellow liquid when freshly distilled, becoming darker with age. In contact with iron, it acquires a blue shade, turning to dark brown on extended contact. It has a spicy odor. It is soluble in propylene glycol, and it is soluble, with slight opalescence, in most fixed oils. It is relatively insoluble in glycerin and in mineral oil.

REQUIREMENTS

Identification

The infrared absorption spectrum of the sample exhibits relative maxima (that may vary in intensity) at the same wavelengths (or frequencies) as those shown in the respective spectrum under *Infrared Spectra of Essential Oils*, page 604, using the same test conditions as specified therein.

Assay Not less than 80% and not more than 91%, by volume, of phenols.
Angular Rotation Between −2° and +0.5°.
Heavy Metals (as Pb) Passes test.
Refractive Index Between 1.531 and 1.536 at 20°.
Solubility in Alcohol Passes test.
Specific Gravity Between 1.037 and 1.050.

TESTS

Assay Shake a suitable quantity of the oil with about 2% of powdered tartaric acid for about 2 min, then filter. Using a sample of the filtered oil, proceed as directed under *Phenols*, page 502, modified by heating the flask on a boiling water bath for 10 min and cooling, after shaking the mixture of oil and 1 *N* potassium hydroxide.

Angular Rotation Determine in a 100-mm tube as directed under *Optical Rotation*, page 530.

Heavy Metals Shake 10 ml of the oil with an equal volume of water to which 1 drop of hydrochloric acid has been added, and pass hydrogen sulfide through the mixture until it is saturated. No darkening in color is produced in either the oil or the water.

Refractive Index, page 533 Determine with an Abbé or other refractometer of equal or greater accuracy.

Solubility in Alcohol Proceed as directed in the general method, page 502. One ml dissolves in 2 ml of 70% alcohol; a slight opalescence may occur when additional solvent is added.

Specific Gravity Determine by any reliable method (see page 3).

Packaging and Storage Store in full, tight, preferably glass, aluminum, stainless steel, or tin-lined containers in a cool place protected from light.

Functional Use in Foods Flavoring agent.

Pimenta Oil

Pimenta Berries Oil; Pimento Oil; Allspice Oil

DESCRIPTION

The volatile oil distilled from the fruit of *Pimenta officinalis*, Lindley (Fam. *Myrtaceae*). It is a colorless, yellow, or reddish yellow liquid, which becomes darker with age. It has the characteristic odor and taste of allspice. It is affected by light.

REQUIREMENTS

Identification

The infrared absorption spectrum of the sample exhibits relative maxima (that may vary in intensity) at the same wavelengths (or frequencies) as those shown in the respective spectrum under *Infrared Spectra of Essential Oils*, page 604, using the same test conditions as specified therein.

Assay Not less than 65%, by volume, of phenols.
Angular Rotation Between −4° and 0°.
Heavy Metals (as Pb) Passes test.
Refractive Index Between 1.527 and 1.540 at 20°.
Solubility in Alcohol Passes test.
Specific Gravity Between 1.018 and 1.048.

TESTS

Assay Proceed as directed under *Phenols*, page 502, modified by heating on a steam bath for 10 min, after shaking for 5 min. Then cool and let stand overnight, or until the liquids are clear.

Angular Rotation Determine in a 100-mm tube as directed under *Optical Rotation*, page 530.

Heavy Metals Shake 10 ml of the oil with an equal volume of water to which 1 drop of hydrochloric acid has been added, and pass hydrogen sulfide through the mixture until it is saturated. No darkening in color is produced in either the oil or the water.

Refractive Index, page 533 Determine with an Abbé or other refractometer of equal or greater accuracy.

Solubility in Alcohol Proceed as directed in the general method, page 502. One ml dissolves in 2 ml of 70% alcohol.

Specific Gravity Determine by any reliable method (see page 3).

Packaging and Storage Store in full, tight, preferably glass, aluminum, or tin-lined containers in a cool place protected from light.

Functional Use in Foods Flavoring agent.

Rosemary Oil

DESCRIPTION

The volatile oil obtained by steam distillation from the fresh flowering tops of *Rosemarinus officinalis* L. (Fam. *Labiatae*). It is a colorless or pale yellow liquid having the characteristic odor of rosemary and a warm camphoraceous taste.

REQUIREMENTS

Identification

The infrared absorption spectrum of the sample exhibits relative maxima (that may vary in intensity) at the same wavelengths (or frequencies) as those shown in the respective spectrum under *Infrared Spectra of Essential Oils*, page 605, using the same test conditions as specified therein.

Assay for Esters Not less than 1.5% of esters, calculated as bornyl acetate ($C_{12}H_{20}O_2$).
Assay for Total Borneol Not less than 8.0% of borneol ($C_{10}H_{18}O$).
Angular Rotation Between −5° and +10°.
Heavy Metals (as Pb) Passes test.
Refractive Index Between 1.464 and 1.476 at 20°.
Solubility in Alcohol Passes test.
Specific Gravity Between 0.894 and 0.912.

TESTS

Assay for Esters Weigh accurately about 10 ml, and proceed as directed under *Ester Determination*, page 500, using 98.15 as the equivalence factor (*e*) in the calculation.

Assay for Total Borneol Proceed as directed under *Total Alcohols*, page 499, using 5 ml of the dried, acetylized oil, accurately weighed, for the saponification. Calculate the percentage of total borneol by the formula

$$7.712A(1 - 0.0021E)/(B - 0.021A),$$

in which A is the difference between the number of ml of 0.5 N hydrochloric acid required for the sample and the number of ml of 0.5 N hydrochloric acid required for the residual blank titration, B is the weight of the acetylized oil taken, and E is the percentage of esters calculated as bornyl acetate ($C_{12}H_{20}O_2$).

Angular Rotation Determine in a 100-mm tube as directed under *Optical Rotation*, page 530.

Heavy Metals Shake 10 ml of the oil with an equal volume of water to which 1 drop of hydrochloric acid has been added, and pass hydrogen sulfide through the mixture until it is saturated. No darkening in color is produced in either the oil or the water.

Refractive Index, page 533 Determine with an Abbé or other refractometer of equal or greater accuracy.

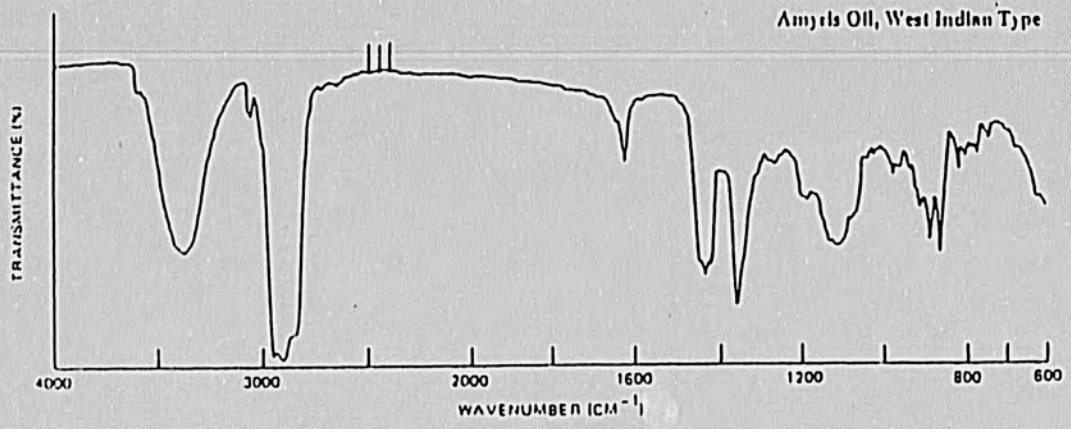
Solubility in Alcohol Proceed as directed in the general method, page 502. One ml dissolves in 1 ml of 90% alcohol. Upon further dilution, the solution may become turbid.

Specific Gravity Determine by any reliable method (see page 3).

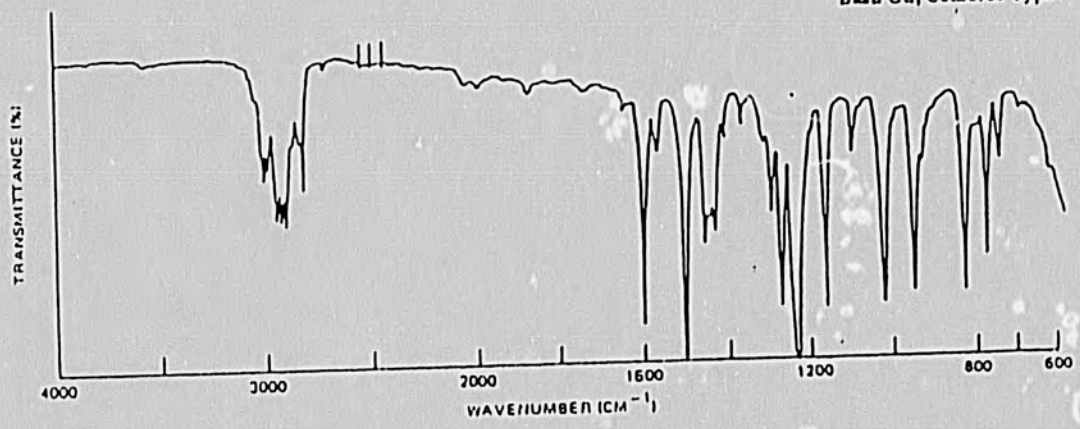
Packaging and Storage Store in full, tight containers. Avoid exposure to excessive heat.

Functional Use in Foods Flavoring agent.

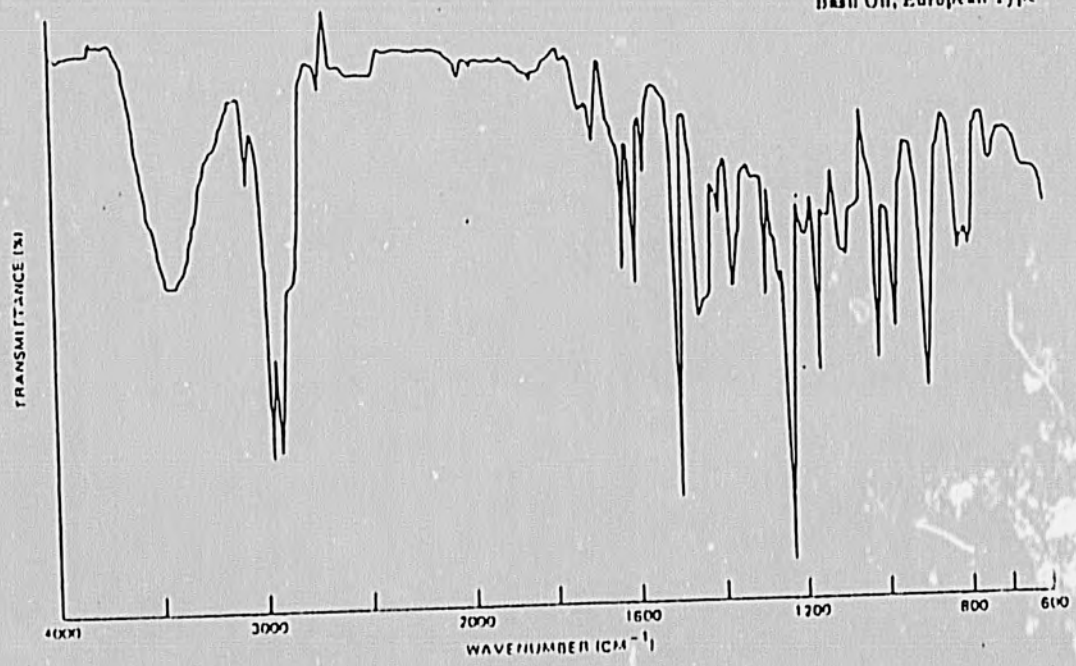
Amyris Oil, West Indian Type



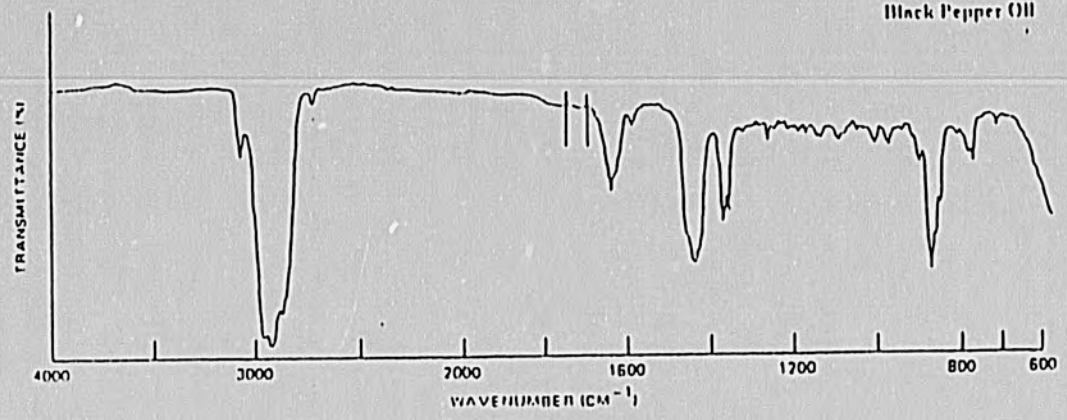
Basil Oil, Comoros Type



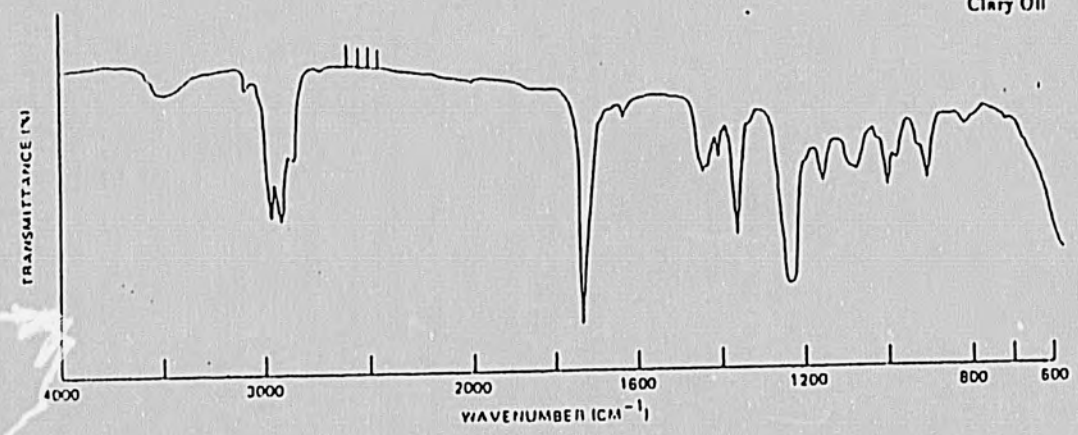
Basil Oil, European Type



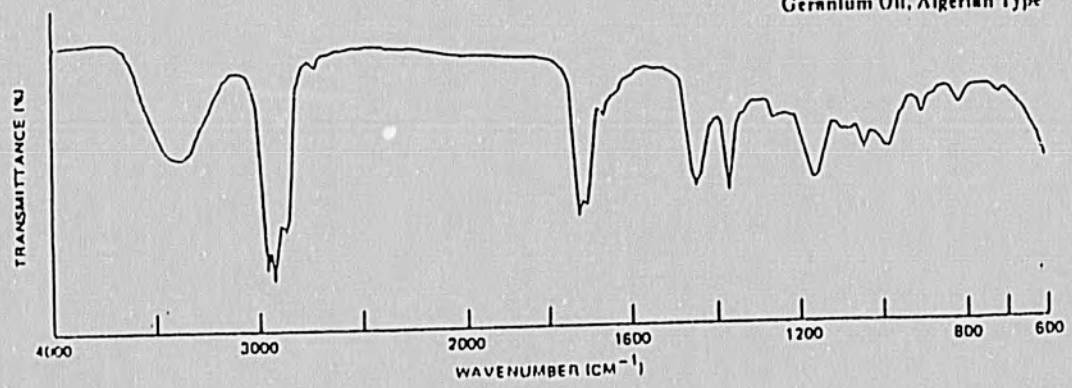
Black Pepper Oil



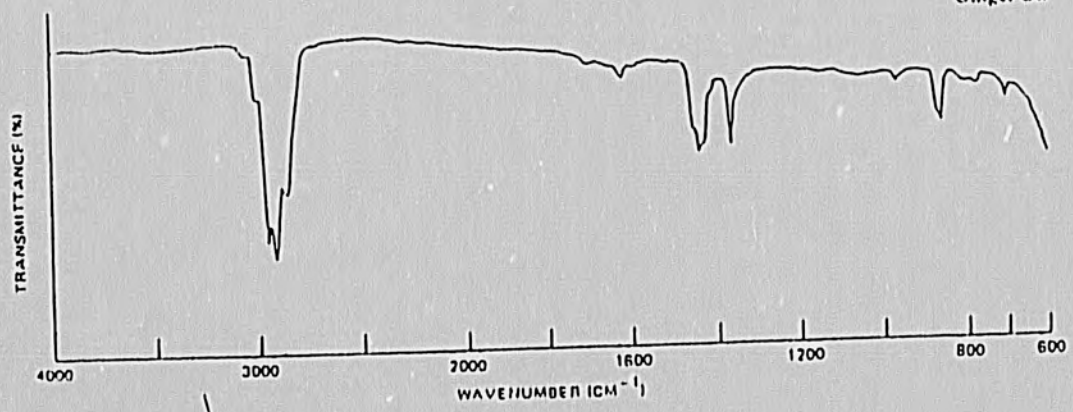
Clary Oil



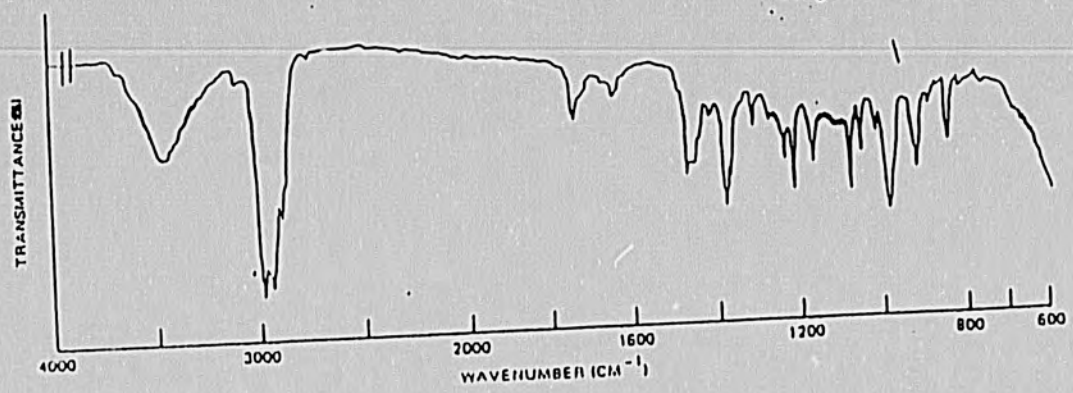
Geranium Oil, Algerian Type



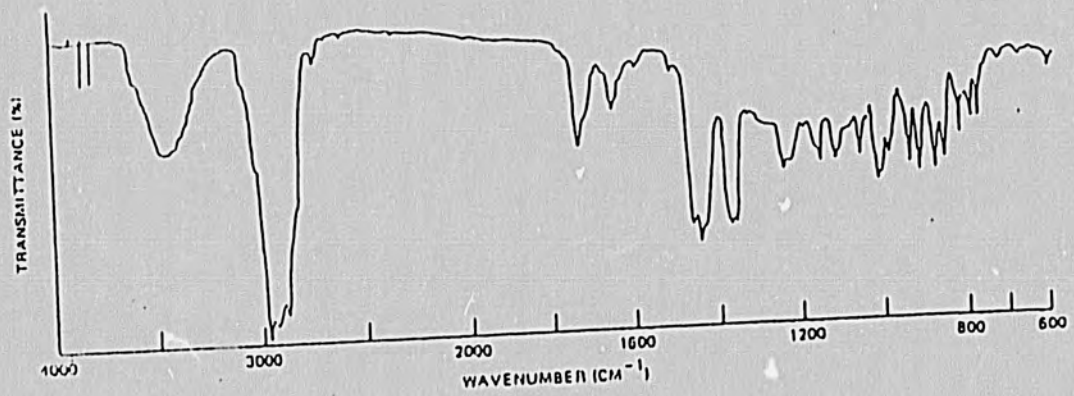
Ginger Oil



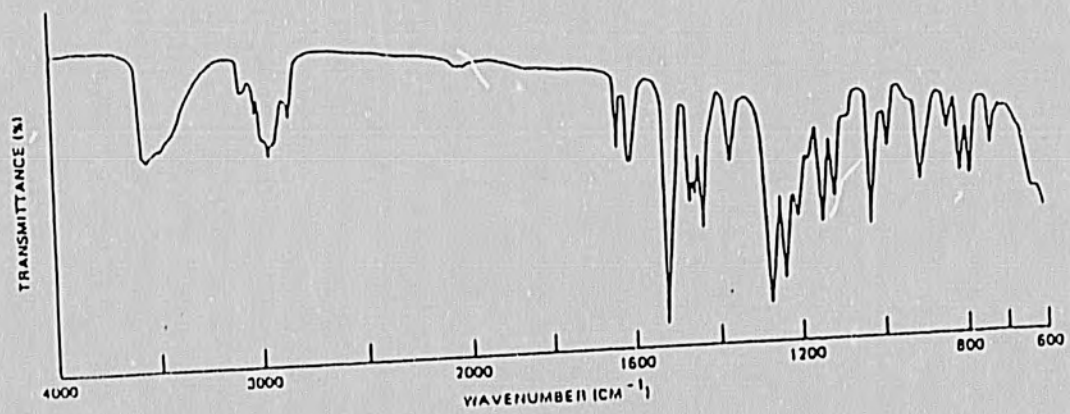
Marjoram Oil, Spanish Type



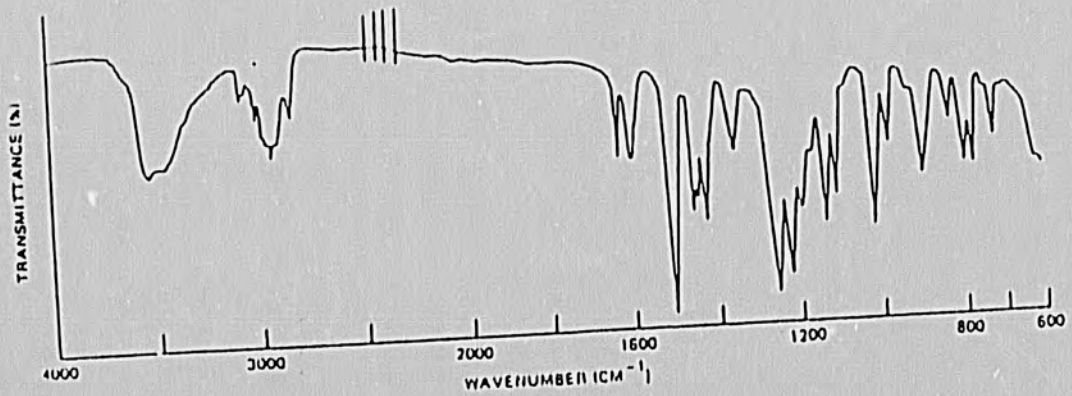
Marjoram Oil, Sweet



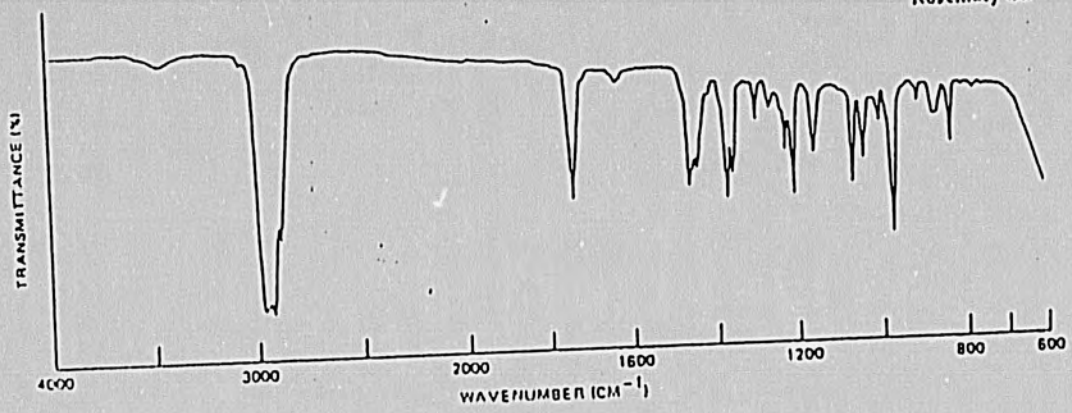
Pimenta Leaf Oil



Pimenta Oil



Rosemary Oil



BUSINESS OPPORTUNITIES IN THE BOTANICAL EXTRACTS MARKET

APPENDIX 3

INTERNATIONAL STANDARD ORGANIZATION REGULATIONS FOR ESSENTIAL OILS

INTERNATIONAL STANDARD ORGANIZATION REGULATIONS FOR ESSENTIAL OILS

REFERENCE	TITLE
ISO/R 210-1961	Essential oils-Packing
ISO/R 213-1961	Essential oils-Labelling and Marketing
ISO 212-1973	Essential oils-Sampling
ISO/R 1342-1971	Oil of rosemary
ISO 3043-1975	Oil of pimento berry
ISO 3061-1979	Oil of black pepper
ISO 3525-1979	Oil of amyris
ISO 4729-1984	Oil of pimento leaf
ISO 4731-1878	Oil of geranium

The International Standard Organization may be contacted at
1-3, rue de Varambe
1211 Geneve 20
Switzerland

eproduced from Information Handling Services.
orldwide Standards Index on CD-ROM. 93-08 Issue.
Wed Oct 13 15:50:13 1993

```
*****************************************************************************
 ****                    DOCUMENT TITLES REPORT                            *****
 ****                    -----------------------                           *****
 ****                                                                      *****
*****  Based on the following search criteria:                            *****
*****  Non-U.S. Database                                                  *****
*****  Keyword in Title/Subject: ESSENTIAL, OIL*                          *****
*****  Organization: ISO                                                  *****
*****************************************************************************
```

Organization	Document Number	Title
*ISO	R210	Essential Oils- Packing First Edition
*ISO	R211	Essential Oils- Labelling and Marking Containers First Edition
*ISO	212	Essential Oils - Sampling First Edition
*ISO	279	Essential Oils - Determination of Relative Density at 20 Degree C (Reference Method) First Edition
*ISO	280	Essential Oils - Determination of Refractive Index First Edition
*ISO	356	Essential Oils - Preparation of Test Sample First Edition
ISO	592	Essential Oils - Determination of Optical Rotation First Edition
*ISO	709	Essential Oils - Determination of Ester Value First Edition
*ISO	875	Essential Oils - Evaluation of Miscibility in Ethanol First Edition
*ISO	1041	Essential Oils - Determination of Freezing Point First Edition
*ISO	1202	Essential Oils - Determination of 1,8-Cineole Content First Edition
*ISO	1241	Essential Oils - Determination of Ester Value After Acetylation and Evaluation of Free Alcohols and Total Alcohols Content First Edition
*ISO	1242	Essential Oils - Determination of the Acid Value First Edition
*ISO	1271	Essential Oils - Determination of Carbonyl Value - Free Hydroxylamine Method Second Edition; (Corrected and Reprinted -1985)
*ISO	1272	Essential Oils - Determination of Phenols Content First Edition
*ISO	1279	Essential Oils - Determination of Carbonyl Value - Hydroxylammonium Chloride Method Second Edition
*ISO	1955	Citrus Fruits and Derived Products - Determination of Essential Oils

		Content (Reference Method) First Edition
*ISO	3218	Essential Oils - Principles of Nomenclature First Edition
*ISO	3793	Essential Oils - Estimation of Primary and Secondary Free Alcohols Content by Acetylation in Pyridine First Edition
*ISO	3794	Essential Oils (Containing Tertiary Alcohols) - Estimation of Free Alcohols Content by Determination of Ester Value After Acetylation First Edition
*ISO	4096	Essential Oils (Containing Tertiary Alcohols) - Evaluation of Free Alcohols Content by Determination of Ester Value After Cold Formylation First Edition
*ISO	4715	Essential Oils - Quantitative Evaluation of Residue on Evaporation First Edition
*ISO	4720	Essential Oils - Nomenclature First Edition
*ISO	5991	Essential Oils - Determination of Residue from Distillation Under Reduced Pressure First Edition
*ISO	7355	Oils of Sassafras and Nutmeg - Determination of Safrole and cis- and trans-isosafrole Content - Gas Chromatographic Method on Packed Columns First Edition
*ISO	7356	Oil of Thujone-Containing Artemisia and Oil of Sage (Salvia Officinalis Linnaeus) - Determination of Alpha Particle and Beta Ray- Thujone Conten - Gas Chromatographic Method on Packe Columns First Edition
*ISO	7357	Oil of Calamus - Determination of cis Beta Ray-Asarone Content - Gas Chromatographic Method on Packed Columns First Edition
*ISO	7359	Essential Oils - Analysis by Gas Chromatography on Packed Columns - General Method First Edition
*ISO	7609	Essential Oils - Analysis by Gas Chromatography on Capillary Columns - General Method First Edition
*ISO	7660	Essential Oils - Determination of Ester Value of Oils Containing Difficult-to-Saponify Esters First Edition
*ISO	8432	Essential Oils - Analysis by High

Reproduced from Information Handling Services.
Worldwide Standards Index on CD-ROM. 93-08 Issue.
Wed Oct 13 15:50:24 1993

Performance Liquid Chromatography
General Method First Edition

BUSINESS OPPORTUNITIES IN THE BOTANICAL EXTRACTS MARKET

APPENDIX 4

ANALYSIS OF SELECTED BOTANICAL EXTRACTS

ANALYSIS OF SELECTED BOTANICALS

Allspice (Pimento)

(Pimento dioica or Eugenia pimenta (formerly Pimento officinalis) family Myrtaceae)

Alternative names: Carolina allspice, Japan allspice, Bayberry, Jamaica pepper, pimento.

Allspice is native to the New World. It is rarely grown outside of the Caribbean and Central American region, with the exception of Reunion Island off the coast of Madagascar and India. Other producers include Honduras, south east Mexico, Guatemala, Brazil, Leeward Islands rainforests, India, Reunion, Grenada, Costa Rica, Cuba, and Haiti.

The essential oil is used as a food additive and as a scent. It is also popular in Sweden, Finland and France, and Poland where it is called kubaba and used in soups, gravy and pickling.

Jamaican Pimento is a medium sized evergreen tree, 25-40 feet tall grown principally in limestone hills in the southwestern part of the island at elevations of less than 1,500 feet. The trees are also native to southeast Mexico, Guatemala, and the Honduran rainforest where they grow to 100 feet or more. Jamaican statistics state that the average yield of trees of all ages is 2 1/2 pounds of dried berries per tree. A large tree under extremely good conditions can produce 100 pounds in one year. Pimento leaves typically contain approximately 2% essential oil (eugenol).

Pimento is usually grown from the seed extracted from the fresh ripe fruit and planted immediately to ensure a high rate of germination, which starts in about two weeks and continues for several months. However, grafting has been introduced to speed up the growing process. The seedlings may be transplanted to pots and grown in humid, shady locations.

After a year of growth, the trees should be 10 to 18 inches high and ready to be planted in the field. Fruit bearing starts in the sixth to the eighth year and increases through the fifteenth year. From then on, it may bear for 100 years or more. Seedlings are initially planted in stands of three plants each with 20 feet between the stands. In the sixth year the field is pruned so that there is one nonbearing "male" tree to every ten "female" trees to ensure pollination. To maximize berry production, the final spacing should be one tree for every 20 feet. To maximize leaf production for essential oils the trees are planted much closer together and cut back to form small bushes, which facilitates harvest of the leaves.

Copper fungicidal sprays are used in Jamaica to combat pimento

rust (puccinia psidii Wint) but are discontinued two months before harvesting.

Raw allspice is sold in several forms: whole for seasoning meat broths, gravies, pickling liquids, Benedictine and chartreuse liqueurs; and ground for seasoning fruit cakes, pies, relishes, preserves, sweet yellow vegetables and tomatoes.

Amyris

Amyris Balsamifera or Amyris Elemifera

The only commercial source for Amyris essential oil is Haiti which began in 1945. Previously, the supply fluctuated greatly from 135 tons in the 1960s to 40 metric tons in 1984. But since the late 1970s there has been a trend of decreasing production which was caused by a marketing decision to cut production rather than a raw material deficit. It is also used as a substitute for sandalwood. The reasons for the substitution is that the sandalwood tree takes 30 year to grow 25 feet and it takes 220 pounds of wood to create 12 pounds of essential oil. Sandalwood extract is used mostly for making soaps because of its fixative power and lasting fragrance.

The Amyris tree is also grown for fuel, torches and wood for small cabinet work.

Basil

Ocimum Basilicum, Alternative names sweet basil, bush basil, mountain mint

Basil essential oil is used in perfumes, soaps, toothpastes, food flavorings and mouthwashes. The oil is produced through steam distillation from the fresh herbs yielding about .15% for every 24-30 pounds. It is also the basic ingredient for Chartreuse liqueurs.

Basil can be grown anywhere in all warm and temperate areas of the world, but is mostly grown in France, Hungary, ex-Yugoslavia, Indonesia, Morocco and within the U.S. Hawaii and California. Basil is grown by seed at a rate of five pounds per acre in well drained, sunny soil, with little wind and diligent weeding as basil is prone to cryptogamic diseases. The rows are sown initially 30 inches apart with the seedling thinned afterwards to six inches apart.

Black Pepper

Piper negrum

Pepper is the most prolific and commercially important source of peppercorn which produces the raw spice black and white pepper. The difference between the two products is that with white

pepper, the husk from the peppercorn is removed while with black pepper the husk remains. White pepper, while less pungent than black, is preferred by Europeans. Indonesia is the leading producer of pepper followed by India and Malaysia. These three countries grow 80% of the world's output of 156 million pounds a year. This amount is about 25% of the total volume of world exports of all spices.

There are several grades of black pepper, named for their place of origin. Indonesia produces 'Lampong', the Malabar coast from southwest India produces the 'Malabar' and the Tellicherry grade, Brazil produces the 'Brazilian' grade. The most important and expensive grade is from Malaysia called the 'Sarawak'. There are also grade of white pepper. These include the 'Muntok' from Banka, 'Brazilian', and 'Sarawak'.

Black pepper is distilled for its pepperine. The peppercorn itself contains 5-9% pepperine. Black pepper yields about 1-2.4% essential oil while white pepper contains more pepperine but with less aromatic elements than the black. Black pepper essential oils are poorly soluble in water and need oil-based solutions or emulsification in order to be used in food. Black pepper oleoresins contain chavicine and crystalline alkaloid piperine. Both black pepper essential oil and oleoresins are used in the food industry to season sausages, table sauces, canned meats and salad dressings. The market price for pepper and its products is a factor of its hotness which is measured in Scoville units.

Pepper vines grow best 10-15 degrees from the equator, with high temperatures, long rainy seasons and partial shade from sea level to 1,500 feet in elevation. The soil should have good drainage and rich in humus and be flat or gently sloping. The vines are grown by cuttings from the upper parts of high-yielding young vines. They are first grown in well controlled nurseries. Then they are transferred to young trees or posts. The vines are not harvested until their seventh year, but will continue to bear fruit for the next fifteen or twenty years.

Canella

Canella alba, Canella winterana Alternative names white cinnamon, wild cinnamon or bastard cinnamon

Canella is grown in the West Indies and South Florida where its bark is used a condiment or medicine.

Clary Sage

Salvia sclarea

The raw herb is used to flavor pastries and beer and ale instead of hops and also Italian vermouth. The U.S., the former Soviet Union and France produce the oil commercially, though the oil made in France is considered superior to that of Russia's. The

oil is used not used so much in the food industry, but it is used by US tobacco companies in their cigarette production. Clary sage contains sclariol which is converted into another chemical used by the tobacco industry.

Geranium

Essential oils are extracted form Pelargonium graveolens, P. odoratissimum, P. fragrans, P. captiatum, P. roseum, and P. radens Geranium oil is used in the cosmetics industry, sometimes to substitute for rose essence.

Geraniums are grown either from seed or from cuttings in warm climates and rocky areas. Farmers who replant geranium crops must wait two to three years to export again to regain quality oils.

Ginger

Zingiber officinale Alternative names, black ginger, canton ginger, jamaican ginger, limed ginger, white ginger

India is the world's largest producer of ginger followed by Nigeria, Jamaica, Sierra Leone, Haiti, Taiwan and Siau Island. Ginger is sold in many forms, ground, cracked and whole. Whole ginger is sold as black or white ginger the difference being that black ginger still has its outer coating, while the white is peeled, decorticated or calcinated. On average, the U.S. imports 1,800 tons of dried ginger annually.

Sierra Leone's ginger contains the most essential oil along with oleoresins and ginger oil. Ginger oil, which is not the same as the essential oil, is obtained from distilling fresh ginger which is used by the liquor and cosmetic industry.

It is grown commercially by dividing the root and planting it in a warm, moist climate, bright sunshine and heavy rainfall. It grows best at elevations lower than 2,500 feet in the tropics in rich, well-tilled loam.

Marjoram

Majorana hortensis Moench. Alternative names Sweet marjoram or knotted marjoram.

Marjoram is produced in the U.S. France, Romania, Lebanon, Mexico, Chile, and Portugal. It is native to the Mediterranean region and is extremely sensitive to cold. The essential oil is used to season sauces, vinegars, salads, cooked dishes, and herbal liqueurs. In perfumery marjoram oil scents soaps, lotions, and cremes. Essential oils are distilled from the dried leaves and flowering tops of marjoram yielding .2-.8%. It is rich in terpenes and tannins.

Marjoram may be grown from seeds or plantling in a warm sheltered environment with full sunlight, good drainage, and light right soil. The first harvest occurs in July the second, conditions permitting, in October. The plant is usually planted annually though it is naturally a perennial in its native Mediterranean origin.

Paprika

Capsicum tetragonum

Paprika is grown in Spain, the Balkans, Hungary, the former Yugoslavia, Morocco, Bulgaria and California. The ground powder is made out of the dried, ripe pods of the plants. Sweet paprika is sold to grocers, spicier varieties are sent to food manufacturers.

There is no essential oil product extracted from paprika, only oleoresins. Paprika contains carotenoids that contains the red and yellow pigments carotene and capasanthin. The oleoresin is used in the manufacture of meat and sausage products, salad dressings and cheeses, and other processed foods where a bright red color is desired. Oleoresins can be extracted from paprika using alcohol or ethyl ether.

Paprika plants are grown from seed either in a field or hothouse. The best growing conditions are warm, well-drained sandy loam or clay followed by diligent weeding and cultivation. Flowering begins three months after sowing and continues three months afterwards as the pods ripen during the summer and fall. Five or six pickings may be needed during the harvesting season as only the fully mature pods are selected.

Quassia

family Simaroubaceae Alternative names, Jamaican quassia, bitterwood, Surinam quassia, Quassia amara

The extract is formed from the heartwood of a tropical tree grown in Mexico, the West Indies and Northern South America. It is used as a flavoring agent in aperitifs and a drug. The most common derivative of quassia is quassin the bitter crystalline principle.

Rosemary

Rosmarius officinalis L.

Rosemary is grown in southern France, Spain, Portugal, former Yugoslavia, North Africa and California. The essential oil is employed in the preparation of cosmetics, soaps, perfumes, deodorants, hair tonics, and insect repellents. .5-1.5% essential oil can be extracted from the fresh leaves and tops of the plant.

Rosemary is grown through seed or cuttings, the second method being more common. The best soil, is a light, chalky soil in sheltered full sun with good drainage. The plants are ideally in rows four feet apart with eighteen inches between the plants in the row.

Sarsaparilla

family Smilax

There are several commercial species, a different variety for each country it's grown in. Honduras grows Smilax officinalis and S. Regelii, Brazil S. papyracea, Mexico S. medica and S. aristolochiaefolia, Jamaica S. ornata and Ecuador S. febrifuga. Sarsaparilla yields sterols and crystalline glycoside and sarsaponin. Sarsaponin is used to synthesize steroids like progesterone. It is also used as a flavoring in drinks and mask the taste in medicines.

Lemon Verbena

Lippia citriodora Kunth or Aloysia triplylla Britt.

Lemon Verbena is produced in Grasse, France, China and Algeria. The essential oil harvested from the leaves is an ingredient of colognes and perfumery in perfumed soap. In the food industry it is used in infusions and food flavorings. It is also a source of aldehyde citral.

The lemon verbena plant is very delicate and unable to withstand frosts. It need sun and well drained soil.

Vetiver

(Vetiveria Zizanioides Stapf. Alternative names: Vetiveria)

Vetiver is used as a scent in non-food products. Its major uses include scenting soaps, perfumes and handkerchiefs. Soap manufacturers use the whole oil for scenting, while some producers of expensive perfumes will further process the oil to extract individual active compounds such as vetiveral, vetiver acetate and vetiveryl acetate.

Vetiver oil is extracted from the roots of vetiver grass, a hearty plant which grows for centuries, is invulnerable to most pests and can survive drastic temperature changes.

BUSINESS OPPORTUNITIES IN THE BOTANICAL EXTRACTS MARKET

APPENDIX 5

POTENTIAL BUYERS

POTENTIAL ESSENTIAL OIL BUYERS

AFF Inc.
Marietta GA
404-926-5530
Comments: Amyris
Creators and manufacturers of aromatic flavors and fragrances Est. Annual Sales $3,00,000-$5,000,000 Employees 20, Manufacturer
Contact: Pres. Lonnie Pope, Chief Perfumer Bertrand Dor

Berje, Inc.
Bloomfield, NJ
201-748-8980
Comments: Barry Dowles referred by Claudia Blom of Chart, Very old Essential Oil firm, Supplier of raw materials, primarily essential oils and aromatic chemicals, Estimated Annual Sales $20,000,000-50,000,000, 40 employees, Sq. Footage of Facility 90,000, Interested in Clary Sage, Vetiver, Black Pepper, Allspice, Rosemary, Amyris, Basil, Geranium, Ginger
Imports from Central/South America, Europe, Asia, Australasia, 60% of business imports. Manufacturer, Importer, Exporter
Contact: Barry Dowles, Executive Vice President

Bio-Botanica Inc.
Hauppauge NY
516-231-5522
Comments: Quassin
Processor of herbs and spices (extracts, powdered, crude) No. Employees 50, Sq Footage of Facility 33,700, Manufacturer, Exporter, Importer,
Contact: Frank D'Amelio Sr. CEO, Pres/Natue Answer Frank D'Amelio Jr.

Botanicals International Div. Parent: Zuellig Botanical Inc.
Long Beach CA
213-637-9566
Comments: Ginger, Paprika, Manufacturer, Importer

Brown & Sons
Bremen, IN
219-546-3565
Comments: Basil, Geranium, Ginger, Marjoram, B. Pepper, Allspice, Rosemary, Clary Sage, Verbena, Vetiver
Distributor of essential oils and flavors, Est Annual Sales $3,000,000-$5,000,000, No Employees 20 Parent Company Lebermuth S. Bend IN, Imports from Europe, Asia, Middle East, 35% of Business from imports, Manufacturer, Importer, Exporter, Distributor
Contact: President Irvin Brown

102

Centflor Manufacturing Co.
New York, NY
212-246-8307
Comments: Amyris, Basil, Geranium, Ginger, Marjoram, B. Pepper, Allspice, Rosemary, Clary Sage, Vetiver
Manufacturer of essential oils and aromatic chemicals,
Contact: President Robert Beller, General Manager, Gloria Rose

Chart Corp.
Paterson NJ
201-345-5554
Comments: Amyris, Basil, Geranium, Ginger, Marjoram, Paprika, B. Pepper, Rosemary, Clary Sage, Verbena
Manufacturer of botanical extracts, botanical oils, water soluble gums, flavoring ingredients, No. Employees 40, Sq. Footage Facility 40,000, Manufacturer, Exporter, Importer
Contact: Pres Charles Blum

Classic Flavors & Fragrances
New York, NY
212-777-0004
Comments: Basil, Geranium
Manufacturer, exporter & importer of flavors, essential oils, aromatics, specialties, No. Employees 7, Sq Footage 1,800
Contact: Pres. George Ivolin

Commodity Services International Inc.
Easton MD
410-820-8880
Comments: Basil
Exclusive marketing agents for producers of gums, essential oils, extracts aroma chemicals and psyllium, exporter of gum arabic and US Northwestern Peppermint oil, importer of agar, guar gum, essential oils, extracts, aroma chemicals, psyllium, Broker
Contact: VP Marketing George Clark

Freeman Industries
Tuckahoe NY,
914-961-2100
Comments: Basil, Paprika, Quassin
Manufacturer of dried fruits and Vegetable pectin, dairy vitamin concentrates, zein, herbal extracts, natural flavors, natural colors, Est. Annual Sales $1,000,000-$3,000,000, No. Employees 12, Manufacturer, Exporter, Importer
Contact: Pres. Joel Freeman

109

Givaudan-Roure
Clinton NJ
201-365-8104
Teaneck NJ HQ
212-628-7200
Comments: Vanilla Flavoring division in Vanilla
Contact: Sales Manager Tom Malone

Glidco Organics
Jacksonville, FL
904-768-5800
Comments: Geranium
Manufacturer of nature identical essential oils, flavors-synthetic, No. Employees 200 Branch locations in NJ, Brussels, Japan Parent company Hanson Industries Inc. Iselin NJ, Manufacturer, Exporter
Contact: VP Sales Marketing M.B. Wimberly

International Flavors and Fragrances
Hazlet NJ
908-329-4600
New York, NY
212-765-5500
Comments: Subsidiaries Kerr Fruit Concentrates, Manufacturer, Exporter
Contact: VP Sales Tony Willard

Kato Worldwide, Ltd.
Mt. Vernon, NY
914-664-6200
Comments: Basil, Geranium, Marjoram, Rosemary, Clary Sage, Verbena
Have offices in Egypt, France, Ukraine
Contact: Mr. Anas Jouejati

Lebermuth Co.
Mishawaka IN
219-259-7000
Comments: Geranium, Ginger, Marjoram, Paprika, Allspice, Rosemary, Clary Sage
Complete line of botanicals, herbs, spices, essential oils, fragrances, and flavors, Imports botanicals, herbs, spices, Essential Oils, fragrances, flavors, Manufacturer, Imports
Contact: VP Alan Brown

Mane USA
Wayne NJ
201-633-5533
Comments: Amyris, Basil, Geranium, Marjoram, Allspice, Rosemary, Clary Sage, Verbena, Vetiver
Manufacturer of Flavors, No. Employees 65, Parent Company Fils, V Mane, SA 93-42-51-00, Manufacturer, Exporter, Importer
Contact: Pres. Gerald Goldverg

110

Manheimer Inc. J.
Long Island City, NY
718-392-7800
Comments: Amyris, Basil, Geranium, Ginger, Paprika, B. Pepper, Allspice, Rosemary, Clary Sage, Verbena, Vetiver
Basic raw materials for flavors and fragrances

Medallion International Inc.
N. Haledon NJ
201-427-7781
Comments: Ginger
Extracts, flavorings, essential oils and fragrances, Manufacturer, Exporter, Importer
Contact: Pres. Michael Boudjouk

Meer Corp
N. Bergen, NJ
201-861-9500
Comments: Basil, Ginger, Paprika, Quassin, Verbena
Manufacturer of gums, botanics, extracts, oleoresin, oils, flavors, stabilizers, Branches in CA, IL, Manufacturer, Exporter, Importer, (Bought by Frutarom VP John Nobile in 1993, $14.7 in sales leading supplier of flavor and fragrance chemicals to Israeli market, esp. orange, grapefruit, mandarin, lemon) Meer has $23.5 million in annual sales
Contact: Director of Sales and Marketing R.J. Nikola

Natural Products Co.
Brooklyn NY
718-782-8800
Comments: Basil, Rosemary, Clary Sage
Parent Company FH Von Damm Inc., Manufacturer
Contact: Sales Head Joan Marshall

Noville Essential Oils
N. Bergen NJ
201-867-9080
Comments: Manufacturer, Exporter, Fragrances, oils, flavors

Penta Manufacturing Co. Specialty Chemical Division
W. Fairfield, NJ
201-575-7475
Comments: Amyris, Basil, Geranium, Ginger, Marjoram, Paprika, B. Pepper, Allspice, Rosemary, Clary Sage, Verbena, Vetiver
Manufacturer of flavor extracts, oils, chemicals and pharmaceutical, Manufacturer, Exporter
Contact: Sr. VP George Volpe

Polarome Manufacturing Co.
201-309-4500
Comments: Amyris, Basil, Geranium, Ginger, Marjoram, B. Pepper, Allspice, Rosemary, Clary Sage, Verbena, Vetiver

Robertet Inc.
S. Plainfield, NJ
908-561-2181
Comments: Basil, Clary Sage
Manufacturer of instant tea mixes, dairy bases, extracts, citrus oils and flavors, No. employees 62, Parent company Robertet Grasse France Manufacturer, Exporter Branch in Washington, WI
Contact: VP Marketing and Sales Neil Callahan, VP R&D John Scire

Sanofi Bio-Industries Inc.
Trevose PA
215-638-7801
Comments: Basil, Geranium, Rosemary, Clary Sage, Verbena, Vetiver
Provides cultures, enzymes, edible and industrial gelatin, hydrocolloids, flavors, fruit systems, fragrance raw materials primarily to the food industry. Parent Company Elf-Sanofi Inc. New York, New York, Manufacturer, Exporter
Contact: SR VP F&F Div. Paul Murphy

Technology Flavors and Fragrances Inc.
Amityville NY
516-842-7600
Comments: Amyris, Basil, Geranium, Ginger, Marjoram, Rosemary, Clary Sage, Verbena, Vetiver
Manufacturers of flavors, essential oils and aromatics for the food and pharmaceutical industry, Est. Annual Sales $10,000,000-$20,000,000 No. employees 30 Branches in CA, NJ, Santiago, Chile, bought Meer Corp. 1993, Manufacturer, Exporter, Acquired F&C International fragrance division July, 1993 for $4.7 million in bankruptcy auction
Contact: Pres. Philip Rosner

Ungerer and Company Fragrance Division
Lincoln Park, NJ
201-628-0600
Comments: Amyris, Basil, Geranium, Ginger, Paprika, B. Pepper, Rosemary, Clary Sage, Verbena, Vetiver, Importer of lemon, orange, peppermint, spearmint, ginger, lime, dill from Central/South America, Asia, Middle East, Manufacturer, Exporter, Importer, Essential oils, fragrances, flavors, Subsidiary Ungerer Ltd. Ungerer de Mexico, Essential Oils and Ingredients
Contact: K.G. Voorhees III

Warner Jenkinson Cosmetic Colors
St. Louis MO
314-889-1900
Comments: Paprika
Manufacturer of FD&C and natural colorants for the food, pharmaceutical and cosmetic industries, Parent Universal Foods Corp. Est. Annual Sales $100,000,000 No. employees 350, Manufacturer, Exporter
Contact: VP Manufacturing Lance Solter

112

BUSINESS OPPORTUNITIES IN THE BOTANICAL EXTRACT MARKET

APPENDIX 6

SOURCES

ESSENTIAL OIL AND OLEORESIN SOURCE LIST

ASSOCIATIONS

American Chemical Society
One Cyanamid Plaza
Wayne, NJ 07470
Telephone: 201-831-2000
Comments: Specialty chemicals and other products

American Spice Trade Association
Box 1267
Englewood Cliffs, NJ 07632
Telephone: 201-568-2163
Contact: Thomas Burns, Executive VP

Chemical Sources Association/Flavor and Extract Manufacturers Association (FEMA)
1620 I St. NW, Suite 925
Washington, D.C. 20006
Telephone: 202-293-5800
Contact: John Halogen
Comments: Fragrance and flavor manufacturers helps find suppliers of unusual or rare oils

European Federation of the Trade in Dried Fruit, Edible Nuts, Preserves Food, Spice, Honey and Similar Foodstuffs
FRUCOM
Plan 5,
D-2000 Hamburg 1, Germany
Telephone: 49-40-32-64-14
Fax 49-40-32-26-39
Contact: Sec. Dr. Hanebuth

European Spice Association
6 Catherine St.
London WC2B 5JJ, UK
Telephone: 44 71-836-2460
Contact: R.P. Pearson

Herb Growing and Marketing Network
P.O. Box 245
Silver Springs, PA 17575
Telephone: 717-393-3295
Contact: Maureen Rogers, Director

Herb Research Foundation
1007 Pearl St. Suite 200
Boulder, Colorado 80302
Telephone: 303-449-2265
Contact: Robert McCaleb, President

International Spice Group
c/o ComSec
Marlborough House
Pall Mall
London SW1Y 5HX UK
Telephone: 44 71-839-3411

Original Swiss Aromatics
Pacific Institute of Aromatherapy
P.O. Box 606
San Rafael, CA 94915
Comments: Aromatherapy

INDUSTRY

Aroma Vera Inc.
P.O. Box
Culver City CA 90231
Comments: Aromatherapy

KATO Worldwide, Ltd.
One Bradford Rd.
Mt. Vernon, NY 10553
Telephone: 914-664-6200
Contact: Mr. Anas Jouejati
Comments: Owns Nickstadt-Moeller, Firms deals with Essential Oils and Spices

Chart
787 East 27th St.
Paterson, NJ 07504
Telephone: 201-345-5554
Contact: Claudia Blom
Comments: Essential Oil Firm

Kalsec, Inc.
3713 W. Main St.
Kalamazoo, MI 49005
Telephone: 616-349-9711
Contact: Ted Lupina
Comments: Essential Oil Firm

McCormick Ingredients
10901 Gilroy Rd.
Hunt Valley, MD 21031
Telephone: 410-771-5061
Contact: Harry Vogt, Sales Representative
Mike Parker, Quality Standards
Bill Galetto
Comments: Processes and sells spices, herbs, tomato production, oleoresins, oils.

Meer Group
9500 Railroad Ave.
N. Bergen, NJ 07047
Telephone: 201-861-9500
Contact: Morris Glazer
Comments: Essential Oils Firm

RESOLVE
National Office
5 Water St
Arlington, MA 02174
Comments: Aromatherapy

UNIVERSITY

Dr. Robert Cassens
University of Wisconsin
Telephone: 608-262-1792
Comments: International Food Technologist Additive Expert

Dr. C.T. Ho
Rutgers University
Telephone: 908-932-9671
Comments: International Food Technologist Flavor Expert

Dr. Robert Linsay
University of Wisconsin
Telephone: 608-263-2568
Comments: International Food Technologist Flavor Expert

Dr. Gary Reineccius
University of Minnesota
Telephone: 612-624-3201
Comments: International Food Technologist Flavor Expert

TRADE JOURNALS

Allured Publishing
2100 Manchester Rd., Bldg. C, Suite 1500
Wheaton, IL 60187
Telephone: 708-653-2155
Fax: 708-653-2192
Contact: Stanley Allured, Editor
Comments: Publishes Journal of Essential Oil Research, Perfumist and Flavorist

Chemical and Engineering News
American Chemical Society
1155 16th St. NW
Washington, D.C. 20036
Telephone: 202-872-4600

116

Chemical Marketing Report
New York City, NY
Telephone: 212-248-4177
Contact: Matt Galleger
Comments: Has column on Essential Oil Flavor/Fragrance Industry

Food Chemical News Guide
Food Chemical News, Inc.
1101 Pennsylvania Ave. SE
Washington, D.C. 20003
Telephone: 202-544-1980
Contact: Mr. Louis Rothschild, Editor
Comments: Food additives, Government approval

International Trade Forum
International Trade Centre
UNCTAD/GATT
Palais des Nations
1211 Geneva 10, Switzerland
Telephone: 730-0111
Fax: 917-0123

Journal of Herbs, Spices and Medicinal Plants
Haworth Press, Inc.
10 Alice St.
Binghamton, NY 13904
Telephone: 800-342-9678
Contact: Lyle Craker, Editor

Brian M. Lawrence
R.J.R. Tobacco Company
Bowman Gray Technical Center
P.O. Box 1487
Winston-Salem, N.C. 27102
Telephone: 919-741-2031
Comments: Writes article "Progress on Essential Oils" for Perfumer and Flavorist, Has worked with U.S. AID on spice development projects abroad.

GOVERNMENT

National Institute of Standards and Technology
National Center for Standards and Certification Information
Gaithersburg, Maryland 20899
Telephone: 301-975-4038
Direct number: 301-975-2000
Contact: Alison Seymor
Comments: Database search for ISO standards for Essential Oils

117

U.S. Customs Service
Dept. of Treasury
U.S. Customshouse
6 World Trade Center
New York City, NY 10048
Telephone: 212-466-5550

U.S. International Trade Administration
Department of Commerce
14th St. and Constitution Ave. NW
Washington, D.C. 20230
Telephone: 202-377-2000

U.S. International Trade Commission
500 E Street, SW
Washington, D.C. 20436
Telephone: 202-205-3296
Contact: Eric Land
Comments: Wrote Section on Flavor and Perfume Materials in U.S. Synthetic Organic Materials Report

USDA, Foreign Agricultural Service
Horticultural Tropical Products
Washington, D.C.
Telephone: 202-720-6590
Contact: Rex Dull
Comments: U.S. exports and imports in Essential Oils

STUDIES AVAILABLE FOR PURCHASE

C A Selects Flavors and Fragrances
Chemical Abstracts Service
2540 Olentany River Rd.
Columbus, OH 43210
Telephone: 614-447-3600
Comments: On line computer information

The Condiments Market
FIND/SVP
625 Avenue of the Americas
New York City, NY 10011
Telephone: 212-645-4500
Comments: Market data related to sauces, dry condiments, spices, extracts

Leading Edge Reports
12417 Cedar Rd., Suite 29
Cleavland Heights, OH 44106
Telephone: 216-791-5500
Contact: Tim Gellis
Comments: Did report on Essential Oils, but didn't include natural essential oil information.

118

Salad Dressings, Sauces, and Condiments
Off-the-Shelf Publications
2171 Jericho Turnpike
Commack, NY 11725
Telephone: 516-462-2410
Comments: Market data forecasts to the year 2000

Supercritical Fluid Extraction Experts

INDUSTRY

Chemac
Box 266
Leonia NJ 07605
Telephone: 201-592-0970
Fax: 201-947-6154
Contact: Richard Birgler, VP

Fluitron, Inc.
30 Industrial Dr.
Ivyland PA 18974
Telephone: 215-355-9970
Fax: 215-355-9074
Contact: Jim McCleery

Krupp Industries
1370 Washington Pike
Bridgeville PA 15017
Telephone: 412-257-5680
Comments: Parent company Krupp Industrietechnik GmbH

Marc Sims
Berkely, CA
Telephone: 510-843-1306
Comments: works for EPS Inc., 30 years experience in the industry

National Forge Company
EPS Inc. Subsidiary of NFC
155 River St.
PO Box 40 Andover, MA 0181
Telephone: 508-470-1620
Fax: 508-475-2951
Contact: Thomas Lanier, Director of Sales/Marketing

Newport Scientific Inc. (formerly AMINCO)
8246-E Sandy Court
Jessup MD 20794
Telephone: 301-498-6700
Fax: 301-490-2313
Contact: Al Bladen

119

Phasex
360 Merrimak St.
Lawrence MA 01843
Telephone: 508-794-8686
Fax: 508-794-9580
Contact: Val Krukonis, President
Comments: SCE machinery expert, Wrote article on application of SCE on natural products

SKW Chemicals Inc.
4651 Olde Towne Parkway, Suite 200
Marietta GA 30068
Telephone: 404-971-1317
Contact: Eugene Carbonell
Comments: Supercritical CO2 extraction of natural products, plants for production of natural products, SCE products, Essential Oils

Universal Flavors
265 Harrison Ave.
Kearny, NJ 07023
Telephone: 317-243-3521
Fax: 201-991-1827
Comments: Produces Templar brand Essential oils made from sub-critical CO2 process

Xytel
801 Business Center Dr.
Mt. Prospect, IL 60056
Contact: Ravi Randhava
Telephone: 708-299-9200
Fax: 708-699-1807

UNIVERSITY

Dr. Bruce Chasey
University of Illinois-Champaign
Dept. of Food Science
Telephone: 217-244-4498
Comments: SCE expert

Dr. Bernard Liska
Purdue University
W. Lafayette, Indiana
Telephone: 317-494-5443
Comments: SCE expert

Dr. Ed Perkins
University of Illinois-Champaign
Dept. of Food Science
Telephone: 217-244-4498
Comments: SCE expert

120

BUSINESS OPPORTUNITIES IN THE BOTANICAL EXTRACTS MARKET

APPENDIX 7

BIBLIOGRAPHY

BIBLIOGRAPY

Abderhalden, Hans "Future of the Flavor Business" Perfumer and Flavorist Nov./Dec. 1991, p. 31-34.

Anonymous, "Chemical Prices", Chemical Marketing Reporter, Oct. 4, 1993, p. 34-42.

Anonymous, "Alert Lifted on Hawaiian Basil after Contamination Scare" Los Angeles Times, Dec. 30, 1990 p. 38.

Anonymous, "Natural Trends Revisited", Chemical Marketing Reporter, July 26, 1993, 5, 27.

Anonymous, "Spices" International Trade Forum, Jan/March 1983.

Bedoukian, Paul Z. "Bedoukian's 49th Annual Review" Perfumer and Flavorist, May/June 1993.

Coyle, Patric, World Encyclopedia of Food, New York: Facts on File, 1982.

Dziezak, Judie "Spices" Food Technology Jan. 1989, p. 102-116.

Encyclopedia of Business Information Sources, 9th ed. Detroit, Gale Research 1993.

Food and Food Production Encyclopedia, Van Nostrand, Reinhold Co. New York, 1982.

Foreign Agricultural Organization: United Nations Utilization of Tropical foods: Sugars, Spices, and Stimulants United Nations: Rome 1989.

Gallagher, Matthew "Haitian Vetiver Restored with Lifting of Embargo" Chemical Marketing Reporter Sept. 13, 1993, p. 17.

Gallagher, Matthew "Fruatrom Expands in US Through Purchase of Meer" Chemical Marketing Reporter, Aug. 23, 1993, p. 15.

Gallagher, Matthew, "The Natural Wave" Chemical Marketing Reporter: Food Additive 1993, July 12, 1993 SR 12-14.

Gallagher, Matthew "Chinese Geranium Pressures Other Markets Up" Chemical Marketing Reporter Sept. 6, 1993, p. 17.

Gallagher, Matthew "Aromatherapy Market Grows Due to Wider U.S. Acceptance" Chemical Marketing Reporter Aug. 16, 1993 p. 17.

Glazer, Morris "A Flavor Odyssey" Food Technology, July 1989, p. 38-43.

Grisanti, Eugene "The Challenges of a United Europe for the Flavor and Fragrance Industry" Perfumer and Flavorist Jan/Feb. 1993. p. 2-7.

Herman, Stephen, "The Art and the Science", Chemtech Aug. 1992, p. 458-462.

Hudson, Selma About Spices Chicago: Melmont Publishers, 1971.

Husain, Fazli, "International Spice Trade" International Trade Forum Jan/March 1983, p. 4-31.

Krukonis, Val "Supercritical Fluid Extraction in Flavor Applications" American Chemical Society Symposium Series, 1985.

Lawrence, Brian "Progress in Essential Oils" Perfumer and Flavorist, Nov/Dec. 1992, p. 57-59.

Lawrence, Brian "A Review of the World Production of Essential Oils (1984)", Perfumer & Flavorer, October/November 1985 p. 2-16.

Lester Jones, editor, A Treasury of Spices American Spice Trade Association, 1956.

Linden, Wechsler Dana, "Hot Stuff" Forbes, Nov. 26, 1990, p. 164-166.

Maftei, Michaela, "Prospects in European Market for Culinary Herbs" International Trade Forum, Jan/March 1992.

Market Share Reporter, 2nd. ed. Detroit: Gale Research 1992.

Millman, Nancy "Making Better Scents Goal of Fragrance Exec" Chicago: Chicago Tribune, Aug. 29, 1993 Section 7.

Mitsui, T. Dr. "Current Issues and Developments in the Fragrance and Cosmetics Industry" Perfumer and Flavorist, Sept/Oct. 1993, p. 2-8.

National Trade Data Bank, Department of Commerce, Washington, D.C.

National Research Council, Food Chemicals Codex, 3rd ed., National Academy Press: Washington, D.C., 1981.

Rinzler, Carol Ann, Complete Book of Herbs, Spices and Condiments New York, Facts on File, 1990.

Rodriguez, D.W. A Short Economic History: Ginger Agricultural Information Service: Kingston, Jamaica 1971.

Rosengarten, Frederic, Book of Spices Wynne Wood: Livingston Publications, 1969.

Santos, William "Chinese Oil Capacity Hikes Flanked by Declining Prices" Chemical Marketing Reporter, Feb. 15, 1993 p. 24, 44.

Santos, William, "Vetiver Embargo Continues to Cripple Haitian Market" Chemical Marketing Reporter Nov. 9, 1992 p. 15.

Schwob, Roger, Essential Oils and Oleoresins: A Study of Selected Producers and Major Markets, Geneva, Switzerland: UNCTAD/GATT, 1986.

Simonetti, Gualtiero, Simon and Schuster's Guide to Herbs and Spices, Englewood Clifs: Simon and Schuster, 1990.

Slessor Peter and Simon Robbins, "Caution is Called for in Marketing Essential Oils and Spice Oleoresins" International Trade Forum July/Sept. 1986, p. 26-32.

Starer, Daniel Who Knows What, New York: Henry Holt Company, Inc., 1992.

Strom, Stephanie "A Waft of Mint and Potpourri as the Scent Trade Grows" New York City: New York Times, Sept. 1, 1991 p. 4.

Thomas Food Industry Register, New York: Thomas Publishing Company, 1993.

Tisserand, Robert Aromatherapy: To Heal and Tend the Body Santa Fe: Lotus Press 1988.

Topfer, Kurt "Geranium Prices Firm as Chinese Cut Production" Chemical Marketing Reporter, Oct. 5, 1992, p. 23.

U.S. International Trade Commission, Synthetic Organic Chemicals: U.S. Production and Sales, 1991, Washington, D.C.: U.S. ITC Publication 2607, Feb. 1993.

United States Department of Agriculture, U.S. Essential Oil Trade, 1991, USDA: FAS Circular Series FTEA 2-93, May 1993.

United States Department of Agriculture, Agricultural Statistics, U.S. G.P.O.: Washington, D.C. 1991.

Worwood, Valerie Ann, Complete Book of Essential Oils and Aromatherapy San Rafael: New World Library 1991.

CISST/IBD

Center for the Interdisciplinary Study of Science and Technology, Northwestern University

USAID/SRI/TAP Project

A Model Approach to Technology-Based Business Development in Developing Countries

Appendix 5:

Technosol Service Plan

125

NORTHWESTERN UNIVERSITY

CENTER FOR THE INTERDISCIPLINARY STUDY OF SCIENCE & TECHNOLOGY
INTERNATIONAL BUSINESS DEVELOPMENT

626 Library Place
Evanston, Illinois, USA

Tel: 708-491-5617
Fax: 708-491-4251

***** FACSIMILE *****

DATE: August 24, 1993

FAX: 809-927-5347

TO: Dr. Lyndon Johnson

NO. OF PAGES: 6
(including cover)

FROM: Tim Lavengood

Dear Dr. Johnson:

In response to your fax of August 11, I have prepared an outline of activities to be conducted by IBD to assist in the marketing and technology acquisition aspects of your botanical extract business development project.

In addition, I have provided an update with further information on the supercritical extraction technology I told you about, including the preliminary financial data you requested and some general description of the market advantages of this system as well as a clarification of its advantages relative to steam distillation and hydrocarbon solvents.

Proposed Service Plan

Market Analysis

In approximately two weeks, IBD will deliver to you a basic overview of the markets for the botanical extracts in which you have expressed an interest (Geranium, Basil, Marjoram, Rosemary, Vetiver, Clary Sage, Amyris, Verbena, Ginger, Allspice, Pepper and Paprika). This general information will be used as a means of identifying two to four of the highest potential raw materials, which we will then investigate in further detail. The selection criteria we propose to use include:

- overall market potential for each botanical extract
- estimated profit margins (with raw materials cost estimates supplied by you)
- availability of raw materials

This information will be provided to you as an input into your decisionmaking. Once

you have selected raw materials, IBD will conduct a more comprehensive analysis to include:

- identification of raw materials production requirements
- basic engineering requirements for producing extracts, including information on machinery
- market data:
    - points of market entry within the distribution chain
    - degree of vertical integration among extract users
    - relevant import restrictions and requirements
    - level of market competition
    - key quality parameters
    - typical order volumes

Sourcing of Supercritical Extraction (SCE) Processes

We are in the process of assembling information on U.S. suppliers of SCE equipment. We are collecting information from approximately seven producers, to include:

- brochures
- price information
- optimal production volumes
- technical assistance requirements

New SCE Technology Identified by IBD

I have assembled some preliminary information on financial requirements using the case of allspice. I believe these figures are generally representative of the costs involved in any of the extractions you are considering.

The development of a commercial SCE plant would take place in three phases (see figure). Each phase has its own financial requirements. Realistic plans for financing all phases should be in place before any significant costs are incurred.

Phase I has two options, either of which is intended to test the process using local raw materials and to **determine the optimal processing parameters**.

Option A: Purchase of a **laboratory scale experimental unit**, which must be complemented with high precision analytical equipment such as HPLC, etc. The cost of this unit, not including the cost of analytical equipment, is about **US$35,000**. This option gives you ownership of the equipment and allows you to personally conduct or oversee testing.

Option B: Go to a **contract laboratory** (we know of two we can recommend) for the initial proprietary testing using Jamaican raw materials which you will supply. This can be done for approximately **US$10,000**. The lab will produce a **pre-feasibility study**, including process parameters and an analysis of the

output.

Phase **II: Demonstration Unit**. This pilot-scale plant will be constructed according to the design specifications determined in Phase I, and will cost **between US$300,000 and US$400,000**. It will be capable of making samples for market testing. These samples will be sent to prospective customers for their analysis. The objective of this phase will be to get **letters of intent** (LOI) from these buyers expressing interest in the product and their willingness to purchase specified volumes if commercial production is undertaken. The LOIs, a detailed study of the processes and its outputs, and a detailed plan for commercial scale-up, are combined to **produce a bankable document** which is used to obtain financing for the commercial plant.

Phase III: Commercial Production. The cost of a full-scale commercial plant could range from **US$3 million to US$7 million**, depending on the specific inputs and production volumes. This plant would be designed as a "campaigning" plant, capable of three or four different production "campaigns" per year using different seasonal raw materials, to ensure profitable year-round operation with at least two shifts per day.

IBD will conduct the study of the market for selected extracted products before Phase I is initiated, in order to determine the specific market advantages of the new technology and to provide a **cost/benefit analysis**. The specific technical advantages of the process are proprietary information. In order for you to begin your own detailed analysis of the process, it will be necessary for you to sign a **secrecy agreement** with the developer. We have already informed the developer of your interest in this project, and they have agreed to move to this step and consider working with you in the commercialization of this technology in Jamaica, provided you are also willing and that it is possible for you to meet the financial requirements. The agreement will give you access to the detailed technical plans and will open the door for direct discussions with the developer. It also prohibits you from discussing any aspect of the process, its components, solvents and operating procedures used, or the nature of its output with anyone not covered by the agreement, without the express consent of the developer.

At this point, I can tell you that the process is most efficient when used to make the very highest quality extracted products, and that it is capable of handling a wide range of raw materials, using a solvent that is readily and cheaply available in Jamaica. The extracted products will command a premium price on major world markets and will probably be of interest primarily to the world's largest manufacturers of spices, flavorings, scents and other products using complex botanical extracts. The investment must therefore be linked to a marketing plan to pursue high end buyers and provide them with extremely high-quality, volume product.

A determination of the specific market advantages for your particular enterprise will be undertaken by IBD if you choose to participate in this project.

Our examination of Jamaican raw materials so far indicates that the required levels of quality and volume are potentially achievable in Jamaica for a wide range of products, and that the technology we have identified can meet the demanding production requirements that are necessary.

Some other process developers have attempted to produce similar systems and failed. Only one other company, in Europe, has successfully produced a similar system. The developer we are dealing with has the longest and most successful track record in the world developing systems of this type which prove to be commercially successful.

Compared to steam distillation and hydrocarbon extraction, the major advantage of this process is quality of output. It requires greater investment, but captures the "top notes" of spices, flavorings and aromas far more effectively, allowing the producer to penetrate the high end of the market with premium priced, high profit product. Hydrocarbon extraction has been used successfully in the production of some essential oils and in coffee decaffeination, but the output quality is not adequate for high-quality products and the use of many of these solvents, such as methylene chloride, are increasingly being questioned due to their toxicity and environmental impact. Finally, compared to alternative processes, the supercritical extraction process we have identified makes it possible to process a wider range of complex molecules from spices, herbs and other botanicals.

It is possible that we will find that the timing is not right for this specific project at the moment. However, once you have had a chance to examine this opportunity in detail, you may find that it has a great deal of potential.

In terms of financing, experience has shown that Phase II, the demonstration unit, is the most difficult to pay for. It requires a significant expenditure, but remains a high-risk investment because the marketability of the product remains unproven and it does not result in a commercial production capability. However, it is critical that this investment be made to ensure that the needed levels of quality can be achieved and to identify specific customers before much larger investment is made in the commercial phase. In many instances, the public sector has proven the most likely source of funding for this stage. Assuming that all goes well in the first phase, it may be possible for you to work through the SRC or UWI to obtain Phase II funding. We have met twice with Dr. Gerald Lalor of UWI, who has described to us his plans to create a science park at UWI. He is interested in acquiring a supercomputer and other advanced equipment to attract academic and industrial research projects to Jamaica. It is possible that UWI, or perhaps the Food Technology Institute at SRC, would have the funds and the interest to purchase and install the demonstration unit. This very flexible unit would represent the state-of-the-art in extraction technology, with a useful life of many years. It could be used for any number of tests and research projects dealing with characterization of local plants as well as food, pharmaceutical and chemical processing, brewing, some aspects of pollution control, assessment of other high pressure liquid technologies, purification and fractionization of silicones, research into halocarbons, extraction of gasifiable compounds from coal, and a host of other basic and applied research

applications. Many of these analytical capabilities are valuable for the continued technical and industrial development of Jamaica. In an environment such as UWI or SRC, where the equipment could be used for several purposes, the investment would perhaps not be particularly large.

In any case, regardless of the financial strategy, our first step must be to identify and develop a marketing strategy for your venture and to clarify the market advantages of this technology as well as others using empirical data from potential buyers. We will help you in establishing contact with these buyers and in determining the quality parameters that will allow you to compete most effectively in these markets. I suggest that the next step should be for you to sign the secrecy agreement so that we can begin to assess the usefulness of this technology relative to your plans.

The preliminary market data we are preparing should arrive in approximately two weeks.

I look forward to hearing from you soon.

Sincerely,

Tim Lavengood