

PD-ADW-643
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AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20523

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DATE: 9/11/87

MEMORANDUM

TO: AID/PPC/CDIE/DI, room 209 SA-18
FROM: AID/SCI, Victoria Ose
SUBJECT: Transmittal of AID/SCI Progress Report(s)

Attached for permanent retention/proper disposition is the following:

AID/SCI Progress Report No.	4. 555
Rec'd	7/28/87 - Intern.
2d half of 1986	rec'd 3/9/87
1st half of 1986	rec'd 10/20/86
2d half of 1985	rec'd 3/14/86
1st half of 1985	rec'd 8/13/85
2d half of 1984	rec'd 3/25/85

~~Attachment~~

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3 cys each

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PROGRESS REPORT

1. Report for the 2nd half of 1986.
2. Grantees: Dr S. G. Dlangantilleke
Mr S. Seniviratne
Mr J. B. Rajeswaran
3. Grant No: RG/ATD/05
4. Title: Promoting Jatropha Curcas (Rata Endaru) as a fuel substitute for diesel engine fuel in Sri Lanka.
5. Date of award: 2nd October, 1984
6. Progress to date
 - 6.1 Preparations for engine testing.
 - 6.2 Modification of mechanical extractor
 - 6.3 Alternate extraction methods
 - 6.4 Moisture control studies

6.1 Preparations for Engine Testing

A detailed search was carried out both locally and, through local agents to manufactures from other countries, to contact suppliers for a diesel engine test bed. The requirement was for a test bed to accommodate a small diesel engine of the order 400 cc, 2500 rpm - such as those used on 2 wheel tractors. However all responses and quotations received were for much larger engines.

It was hence decided to adopt a different approach, viz; to purchase a Lister generator with diesel engine, and to carry out engine tests. In such a situation, the load may be controlled and monitored simply by connecting the generator to a series of electric light bulbs - hence eliminating the need to purchase a dynamometer. Air flow measurements and fuel consumption may be measured by simple flow meters to the diesel engine. Equipment to analyze exhaust gases too were identified, and quotations received.

However it was suggested by Dr Sabadell, Energy advisor USAID, during his brief visit to Sri Lanka, that efforts should also be made to locate U.S. manufacturers who may be able to supply appropriate test beds. and failing that to consider the option of using a Lister generator with diesel engine thereafter. A comprehensive report on the visit of Dr Sabadell has already been

submitted.

6.2 Modification of Mechanical Extractor

The Hydraulic Press apparatus was further modified, since the earlier modification of using a 6" diameter cylinder did not appreciably increase the rate of extraction.

The modification carried out subsequently was to decrease the height of the cylinder to 6", and also to reduce the overall height of the structure to 2 feet. Also, the screw-rod arrangement was replaced with a simple piston and shaft. A third modification was to incorporate a mesh made of small gauge sheeting inside the extraction cylinder.

These modifications have proved to be very effective. There is now an appreciable increase in the rate of extraction. Also, oil obtained is clear with hardly any fine particles. A detailed drawing to scale of this version of the mechanical extractor, with any more modifications if any, will be forwarded with the next report.

6.3 Alternate Extraction Methods

In order to extend extraction methods to indigenous levels, methods other than mechanical extraction and chemical solvent extraction were explored. Experiments were conducted by crushing Jatropha Seed, mixing with water, and boiling. The objective was to blend the seed thoroughly with water, and to evaporate water by boiling. It was hoped that during the heating process, oil extracted from the blend would separate in to a top layer, and by separating and filtering 100% Jatropha Oil may be extracted. However, all such efforts of various methods of blending, heating and separating, proved to be futile. Notes were made on the different approaches tried and a more detailed report may be submitted if required.

6.4 Moisture Content Studies

In tests carried out by the Ceylon Petroleum Corporation on Jatropha Oil to determine distillation temperatures, there was a thermal break down after 30% recovery. It was suggested by scientists at CPC that the inclusion of moisture particles in the oil may be a possible reason for the thermal breakdown. Hence it was decided to carry out moisture content analyses on Jatropha seed. Such analysis would also be beneficial in determining the nature of the oil extracted.

Moisture tests are therefore being conducted with Jatropha Seed.

The experiment is carried out with a combination of 3 variables, namely;

- a) The weight of the samples
- b) Duration of heating in an oven
- c) Drying temperatures

It is envisaged that a co-relation will be established between moisture content and the extracted oil quantities and properties.

7. PLAN OF WORK FOR THE FIRST HALF OF 1987

7.1 Engine testing

7.2 Extraction

7.3 Study of Jatropha Oil properties and processes

7.1 Engine Testing

If efforts that are being made to contact US manufacturers proves to be fruitful, then immediate steps will be taken for a test bed to be supplied. In this event, it will not be necessary to design and fabricate accessory test equipment such as fuel and air flow measuring apparatus, engine load, temperature and pressure measuring devices, etc. Research on testing Jatropha Oil may be then carried out as soon as the test bed is supplied.

However, in the event of a suitable test bed being unavailable, steps will be taken to test the oil using a Jister diesel engine generator, as mentioned earlier.

Meanwhile, oil extracted will be processed and transesterified, in preparation to being tested as a diesel fuel substitute. Chemicals necessary for esterification have now been supplied. Efforts will also be taken to produce a quantity of purified oil.

7.2 Extraction of Oil

Chemical solvent methods will be used in addition to mechanical extraction. Solvents required have also been supplied now. Two methods of solvent extraction will be used, namely;

- a) Mixing n-Hexane with crushed Jatropha, boiling, stirring and evaporating.
- b) Using GPS Methanol and Chloroform in proportion and vigorously mixing and separating by distillation. Oil thus extracted will also be subjected to chemical analyses, and compared with the properties of mechanically extracted oil.

In mechanical extraction, finer modifications will be made to the hydraulic press arrangement, for more efficient extraction. It is envisaged that the final version of the extractor will be

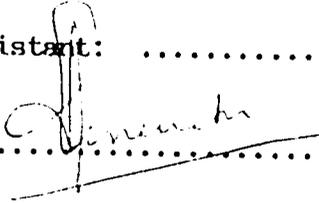
extended to a series of cylinders to be pressed in one action, so that larger batches of seed may be subjected to mechanical load.

Also a strain gauge measuring device will be incorporated into the Hydraulic Press, so that actual pressures exerted may be recorded, and related to quantities and rated of oil extracted.

7.3 Study of Oil Properties

Tests will be continued on the chemical and physical properties of mechanically and chemically extracted Jatropha oil. Since the necessary chemicals have now been supplied to the researchers, the processes of esterification and the making of micro emulsions will be carried out. Prior to testing as an alternate engine fuel, the esterefied forms of Jatropha oil too will be subjected to chemical and physical analyses.

8. Signature of Research Assistant:

9. Signature of Grantee:


10. Signature of Head/Department:


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