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Computer Conference on Lignocellulose Conversion

Staff Summary Report

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Staff Summary Report

Board on Science and Technology for International Development
Office of International Affairs
National Research Council

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This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

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PREFACE

Computer conferences have been made possible by recent developments in telecommunications. They allow geographically scattered individuals to confer by using local computers linked to a remote central computer. In a configuration like spokes radiating from a hub, telephone or satellite connections are created between many isolated participants and a central computer. Participants can forward data to the hub where it can be stored and/or retrieved by others.

Such conferences provide an opportunity for both enhanced and focused communication. Conferees throughout the world can simultaneously address a single topic, providing their own perspectives and insights and building on the contributions of others. Problems of time and travel disappear, since no one leaves home and computer use is at one's own convenience.

The computer conference on lignocellulose conversion was established to exchange information on various aspects of this topic between developed and developing country scientists. The Board on Science and Technology for International Development (BOSTID) of the National Research Council convened a panel of experts in lignocellulose conversion, who also were familiar with the special needs and resources of developing countries. These panelists were:

Janice A. Phillips, Department of Chemical Engineering, Lehigh University, Bethlehem, Pennsylvania, USA (Chairperson)

Albert Binger, Scientific Research Council, Kingston, Jamaica

Robert W. Detroy, USDA Northern Regional Research Laboratory, Peoria, Illinois, USA

Michael R. Ladisch, Food and Agricultural Engineering Department, Purdue University, West Lafayette, Indiana, USA

Carlos Rolz, Central American Research Institute for Industry, Guatemala City, Guatemala

For this activity, these panelists served a dual role; they participated directly in the conference based on their expertise in lignocellulose conversion and, through this experience, evaluated the potential of computer conferences for scientific communication between developed and developing countries.

This staff summary report, which has been prepared by E. Griffin Shay, BOSTID professional associate, covers the organization of the conference, observations of the BOSTID panelists, and their final conclusions and recommendations for future applications of this conference technique. Michael G.C. McDonald Dow, associate director of BOSTID, and Wendy White, information services manager, also participated in the conference. The report was edited by F.R. Ruskin, and Hertha Hanu served as administrative secretary to the project.

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INTRODUCTION

A computer conference on bioconversion of lignocellulosics to fuel, fodder, and food was held from May through December 1983. The purpose of this conference was to focus on processes and products suitable for and valuable to developing countries. It also was designed to assess the potential of computer conferences for communicating data among technical experts on topics such as bioconversion of lignocellulose.

To participate in the conference, individuals submit information to the conference through a computer terminal at their workplace. Each submission, termed a conference comment, is transmitted via phone lines to a central computer, where it is entered into a common database and made available to all. In this fashion, each person can pose questions, supply answers, or offer findings for review by the others. In addition, participants may send private messages to other conferees. The main computer containing all the conference information is accessible around the clock so that conferees may tie into the system at their convenience.

A computer conference differs from a conventional meeting in several ways. This kind of conference allows an extended discussion among large groups of scientists with parallel interests without the problems and costs of travel. Participants have a great deal of flexibility in the timing and extent of their participation. This is particularly valuable for scientists not fluent in English, who are then able to review material and compose comments without the pressures of a face-to-face meeting.

Computer conferences have other advantages. During their course, a continuously updated set of proceedings is always available; latecomers can join the meeting and effectively participate by reviewing this transcript.

In addition, as these proceedings become voluminous, some conference systems allow selective searches for specific items or topics: for example, all the discussions on an individual process, product, or organism can be brought together, or all the submissions of a particular scientist or institute can be retrieved.

ORGANIZATION OF THE CONFERENCE

This conference was organized by Canada's International Development Research Centre (IDRC) in cooperation with the Microbial Research Center in Stockholm, the World Academy of Art and Science, and the International Federation of Institutes for Advanced Study. The conference proceeded with two large groups operating in tandem—a Western Hemisphere group and a European group that included participants from the USSR. The Western Hemisphere group included scientists from Canada, United States, Mexico, Guatemala, Costa Rica, Jamaica, and Brazil. The Western Hemisphere conference moderator was Murray Moo-Young, director of the Institute for Biotechnology at the University of Waterloo. Carl-Göran Hedén of the Karolinska Institutet served as moderator for the European group. Although the conference was planned to emphasize developing country applications, there were relatively few participants from developing countries in either group.

Five subgroups, each covering one aspect of cellulose conversion, were established. The co-moderators for these groups appear in parentheses.

1. Upstream process considerations--including availability, types, and compositions of various lignocellulosics, as well as physical, chemical, and biological pretreatment methods to facilitate substrate accessibility (J. Saddler, Forintek Canada Corporation).
2. Processes for food and fodder--including liquid and solid-phase fermentations, mushroom cultivation, quality and recovery of products and by-products (J.D. Cunningham, University of Guelph).

3. Processes for liquid fuels--including the production of ethanol and butanol/acetone, reactor design, and product recovery (G. Stewart, University of Western Ontario, and D.G. MacDonald, University of Saskatchewan).
4. Processes for gaseous fuels--including systems for biogas production and for fatty acid intermediates, reactor design, and product recovery (J.M. Scharer, University of Waterloo).
5. General considerations--including process integration, implementation, and economics, as well as materials of construction, plant maintenance, and nonbiological process options (S.M. Martin, IDRC).

In addition to the 5 BOSTID panelists, there were 88 other Western Hemisphere participants and 38 European participants. There were also 22 off-line participants who received transcripts of the proceedings by mail on a regular basis and entered comments or questions through IDRC either by mail or telex. In all, about 570 conference comments were entered by these participants.

The Western Hemisphere sector of the lignocellulose conversion computer conference (LCCC) was run on the Electronic Information Exchange System (EIES). The central computer for this system is located at the New Jersey Institute of Technology in Newark, New Jersey. The European sector of LCCC was run on COM, a Swedish system with its central computer in Stockholm.

EIES, founded in 1976, is designed to serve the needs of specialized study groups in exchanging information, tracking projects, and developing reports. It is the original public computer conference system, and it maintains a strong research posture, catering to participants whose activities may advance computer conferences. EIES supports a number of activities simultaneously in both public and private conferences. LCCC was run as a public conference, in the sense that anyone with access to EIES had access to LCCC. During the time that LCCC was active, there were about 20 other public conferences in progress on EIES. Private conferences on EIES are invisible to those not participating in them. A more complete description of the EIES system appears in Appendix A.

OBSERVATIONS AND FOLLOW-UP

Several observations were made by BOSTID panelists concerning the overall structure of the conference, the conference content, and communication problems.

Conference Structure

The organization of the conference into five subgroups to address various aspects of lignocellulose conversion was well thought out. The next, more difficult step--to enlist scientists to participate actively in each of these subgroups--did not work out as well.

The conference could perhaps have been more effective if a core of the participants had been active in each of the subgroups. As it developed, the subgroups proceeded unevenly--which is not unique to this conference, of course. It is a rare scientific convention in which all sessions are of equal interest or are equally well attended.

What did create difficulties, however, was the almost complete absence of developing country voices. When Carlos Rolz (ICAITI, Guatemala) reviewed the first hundred conference comments, he noted that ". . . it is required that technical people from LDCs participate actively in the conference; otherwise, who is going to identify the local problems and . . . work jointly for technical solutions?"

Another problem that was never truly resolved was related to the nature of the medium. It was not clear to any of the participants whether a research finding (or anything else) that was entered as a conference comment was "published." This was an obvious concern to scientists who may have wished to establish precedence,

arrange for patent coverage, or, at some future time, refer to data presented in the conference. This may have inhibited some scientists from disclosing or discussing current research. Although this may not have been a major factor in the conference, methods to encourage rather than discourage participation are needed.

Conference Content

Probably as a result of only minor participation by developing country scientists, the major emphasis was not on the problems of those countries. In a very broad sense, advances in lignocellulose science will tend to help tropical areas where its production is greatest, but this is a more tenuous benefit than the conference planners envisioned.

There were, however, some themes with obvious benefit for or interest to developing country scientists. For example, there were about 45 conference comments concerning on-farm, small-scale biogas production.

Most of the comments were little more than research notes, but, depending on their relevance to a specific scientist's needs, these comments could be quite valuable. For example, on December 8, a participant in Guatemala asked for names of other researchers working on biogas from poultry manure. On December 12, names and addresses of six scientists concentrating in this area were provided by a Scandinavian participant. In another conference comment, a scientist inquired about incubation conditions for anaerobic bacteria and received a response that included a reference on culture conditions for anaerobes. Other comments described specific biogas experiments with both conventional (i.e., manures) and unusual (sorghum, cattails) substrates.

There were also a number of exchanges on methods for evaluating and standardizing cellulases. Apparently, results from the commonly used filter paper evaluation have little relevance for hydrolysis of unrefined lignocellulose.

A number of scientists discussed the merits of hydrogen fluoride in wood hydrolysis. The exchanges on the potential for hydrogen fluoride are an example of the kind of direction a topic can take in a computer conference—almost like some conversations, in which positions are taken and then amended, misstatements are

made and then corrected, conclusions are drawn irrespective of contrary data, people repeat themselves, and, in the end, although there has been a valuable exchange of information, there is no consensus. All of the comments bearing directly on hydrogen fluoride are shown in Appendix B.

Communication Problems

The greatest single problem with this conference was getting participants from developing countries on-line. It took several months for some of these scientists to tie in. For many, the problems of getting through to the central computer were insurmountable.

The barriers to computer communication are formidable. There can be problems with workplace computer systems (including communications software, modems, and telephones), local telephone systems, transmission networks, and with all of the intricate hardware and software of the central computer. Detecting and correcting problems in such elaborately interrelated complexes can be intimidating.

A more particular problem concerned the restrictions of the EIES central computer. At every scientific conference, it is easy to present tabular or graphic data. Not at this one. Although plotting and tabulating capabilities are available for some personal computers, they were not available on this system.

IDRC has developed a comprehensive questionnaire which it has sent to each participant. In addition, IDRC has sent another set of questions to the scientists who were invited to join the conference but did not. Through these questionnaires, IDRC will try to determine why some scientists participated and others did not, and what the benefits and shortcomings of the conference were. Their results will be published separately. IDRC will also publish a complete transcript of the conference on microfiche.

CONCLUSIONS AND RECOMMENDATIONS

Following are the conclusions and recommendations reached by the BOSTID panel concerning the organization of the conference and future applications of this technique.

Conclusions

1. Scientists will actively participate in computer conferences if they are sufficiently interested in the subject matter. In the absence of a strong interest in the principal topics, the novelty of the system wears thin and the conference becomes a chore rather than a pleasure.

2. Chairpersons are needed who will keep the conference moving along the desired path. This can involve detailed preconference planning, careful selection of topics and participants, and continuous guidance.

3. There is a definite attitudinal aspect to computer use: just as some people are more comfortable with telephones than letters, some are enthusiastic about using computers, whereas others dislike them.

4. Senior people tend to have less time during working hours, and perhaps are also less inclined to have computers at home to allow the fullest informal kind of participation. If the intention is to involve senior scientists, arrangements must be made to involve their assistants or graduate students, and thus assure their input by proxy.

5. It seems likely that more directly focused, narrowly based conference topics would attract greater and more specific interest and thereby result in more successful conferences.

6. Computer conferences are clearly different from, and complementary to, face-to-face meetings. They are less suited to directing the attention of a large number of people of varied background and interest to developing, say, a consensus on a perceived common problem than to the exchange of miscellaneous and frequently specific information. They are not mandatory, they are voluntary.

7. As technical communication problems become less of an impediment, computer conferences will become an increasingly useful medium of communication among scientists from both industrial and developing countries. Database searching is bound to be the major thrust of future technical information systems in developing countries, since books and journals are already prohibitively expensive to acquire and maintain in collections. As such uses become more routine, much of the current prejudice, unfamiliarity with the medium, excessive enthusiasm, and other temporary phenomena will disappear and permit even more efficient management and use of computer conferences. It is also likely that both computers and their programs will be refined to increase user-friendliness. These developments should lead to broader, more efficient, and cost-effective use of the medium.

8. In many ways, computer conferences are to face-to-face meetings as letters are to telephone calls. Letters and computer conferences are both asynchronous, allow time for reflection in their preparation and for review and sharing of their contents, and are well suited for uninterrupted, cohesive presentations. Face-to-face meetings and phone calls both have immediacy, require relatively succinct presentations, and can have greater emotional content and impact.

Although this analogy is far from flawless, it illustrates that computer conferences will not replace face-to-face meetings any more than the invention of the telephone replaced letters. Each medium has its own special attributes and tends to supplement rather than supplant the others.

Recommendations

1. Planning and preparation need as much, if not greater, attention in computer conferences as in conventional meetings. Not only should the technical content of the conference be well defined, but an adequate number of appropriate participants should be enrolled to ensure attention to each aspect of the meeting topic. As in conventional conferences, leaders are needed to shake the somnambulant and suppress the strident.

2. Just as an important face-to-face meeting would not start with half the participants still en route, resources should be allocated to ensure that all developed and developing country scientists are on-line before a computer conference begins. To reduce communications costs, the use of on-line time should be optimized. Questions, responses, comments, and presentations should be prepared off-line, for example. All participants should be capable of up-loading and down-loading during connection.

3. A computer conference is likely to be more productive if there are times scheduled for special emphasis on one aspect of the conference theme. The conference leaders might periodically introduce short papers on particular developments or research needs and attempt to gain consensus on their importance or implications over a period of one or two days. This could provide the immediacy that some participants miss in a computer conference.

4. Computer conferences seem ready-made for tracking and perhaps accelerating cooperative projects among groups of developed and developing country institutions and should be used for this purpose. For example:

- Details on progress can be exchanged
- Errors by one group can be avoided by others
- Consideration of alternative solutions is facilitated
- Shortcuts found by one group can be used by all
- Consultants can be introduced as needed
- Contacts with equipment suppliers on shipping dates, operating procedures, or repairs can be facilitated

- Faster and better responses to emergencies are possible
- Private messages on finance or personnel matters can be exchanged with donors
- As a side benefit, access to worldwide scientific databases and literature resources can be provided to laboratories in developing countries.

Computer conferences can fill special needs in management of development programs and in the exchange of scientific information between developed and developing countries. Although computer links will not replace face-to-face meetings, such links facilitate pre-visit consultation and post-visit collaboration in ways not previously possible.

APPENDIX A

THE EIES SYSTEM

There are about 1,500 individuals and institutions that subscribe to the Electronic Information Exchange System (EIES). The first statement received after connecting with EIES concerns whether or not any private messages have been sent to you from any of the other EIES subscribers.

Access to:		Do you wish to:	
Messages	(1)	Get items	(1)
Conferences	(2)	Display titles	(2)
Notebooks	(3)	Search/Find	(3)
Special Systems	(4)	Send/Compose/Submit	(4)
Directory	(5)	Edit/Delete	(5)
Explanations	(6)	Organize items	(6)
Reviews	(7)	Vote/Form	(7)
Composition	(8)	Set options	(8)
Monitoring	(9)		

INITIAL CHOICE?1 MESSAGE CHOICE?-

FIGURE 1 On EIES, the initial choices are shown on the left. Entering "1" (i.e., Messages) gives a second set of options, shown on the right.

Beyond this point, EIES is "menu-driven"--that is, the user is presented with a series of numbered alternatives (see Figure 1 on previous page). For example, if one wishes to review messages sent or received or to create and send a new message, the number "1" is entered as an initial choice. EIES then offers another set of choices related only to messages.

If one wishes to examine conference activity, entering the number "2" at initial choice results in a display of public conferences (Figure 2). To access the bioconversion of lignocellulosics conference, the code 604 is then entered. In Figure 2, the list of numbers under "Waiting" indicate the number of unread conference comments by the particular individual who logged on to EIES. The ability to keep track of and display such individualized information is characteristic of the sophistication of EIES. It is also possible to determine which EIES subscribers have participated in each public conference and how many conference comments each has examined in each conference.

A number of other paths through EIES can be followed. "Notebooks" (choice 3) gives access to a private notepad where thousands of lines of text may be entered and edited. This data can be made available to one, a few, or all of the other EIES subscribers.

"Directory" (choice 5) leads to listings of information about each of the subscribers, including names, addresses, phone numbers, general interests, and the conferences in which each has participated.

Other computer conference systems range from those even more sophisticated than EIES to bare-bones systems (see Appendix C for a list of vendors for computer conference systems). The Augment system, for example, gives subscribers a high degree of graphics capability, including multicolor page composition. On the simpler end of the scale, there are a number of systems termed computer bulletin boards that can be run on microcomputers like Apple II or IBM PC. Typical of these is Communitree (Communitree Group, Suite 207-3002, 470 Castro Street, San Francisco, CA 94114). In design, it is similar to the EIES message and conference structures. Although the smaller storage and control inherent in microcomputers limits the resources that can be provided to participants, the simplicity of bulletin board systems makes them easy to understand and use.

The special advantage of bulletin board systems is that they can be purchased outright for $5,000-10,000 and run under the complete control of the owner. EIES recently estimated that it would cost $175,000 to duplicate its system.

Access to:

Messages	(1)
Conferences	(2)
Notebooks	(3)
Special Systems	(4)
Directory	(5)
Explanations	(6)
Reviews	(7)
Composition	(8)
Monitoring	(9)

INITIAL CHOICE?2

FIGURE 2 By entering "2" as an initial choice (above), a list of conferences is obtained (below).

CONF	Waiting	Name
47	446	Writing Tools (Whole Earth)
417	107	The Critics Corner
531	6	Carinet
604	-	Bioconversion of Lignocellulosics
685	150	Future of Telecommunications
786	59	Mircenet Newsletter
866	357	Micro Communications (Whole Earth)
1000	200	Practice

APPENDIX B

RETRIEVING SELECTED DATA

As an illustration of the ability to select data from the conference, the proceedings were searched for information on the hydrogen fluoride (HF) hydrolysis of cellulose, a technical theme in the conference. In this search, the EIES computer was directed to examine every line of every comment for HF. The edited results appear on the following pages.

C604 CC11 Elaine Thompson (502) 5/3/83 12:32 PM
KEYS:/HF/
Has anyone out there besides Forintek and Derek Lamport at MSU applied HF, especially in the gaseous form, to wood chips or to sawdust? If so, what was the physical appearance of the surface of the wood like?

C604 CC16 Arlene Radcliff (277) 5/11/83 11:17 AM
KEYS:/UPSTREAM 1.2/
With reference to possible use of gaseous HF or HCl, various previous workers had looked at this as a pretreatment method for lignocellulosics. It should be noted that this approach had been abandoned primarily because of the corrosive nature of the reagents leading to the need for very expensive types container materials of construction. Has anyone done any economic analyses of this strategy that could be shared with us? Murray Moo-Young

C604 CC19 Ingemar Falkehag (509) 5/16/83 4:09 PM L:6
KEYS:/UPSTREAM 1.2/
Regarding the use of HF you might want to check with

Hoechst in Germany who must have done an economic assessment of their HF process. They had a paper at the Bioenergy Conference in Berlin which is published in the proceedings. You might also want to contact Grenoble where they have been doing some HF work.

C604 CC22 Murray Moo-Young (604) 5/20/83 10:22 AM L:10
KEYS:/UPSTREAM/FOOD/
This is further to my comments (CC 16), perhaps our "resource people" should remember our special interest in possible Third World applications. CC13 by Ian Reid is a good example whereby mushrooms for human consumption could be prepared via village technology. Ingemar, can you tell us more on the Hoechst HF results?

C604 CC27 Ingemar Falkehag (509) 5/25/83 4:06 PM L:9
KEYS:/UPSTREAM/
Murray, I will send you the Hoechst HF paper from the Berlin bioenergy conference when I get back to Sweden. If anyone is interested in exhibiting or participating in BIOENERGY 84 in Sweden next year, please let me know. It will include field trips and maybe we should coordinate some computer conferencing in relation to that. Does anyone have some examples of villages around the world who have been able to adopt the kind of biotechnology we are talking about in this conference in an integrated manner?

C604 CC31 S.R. Vaughan (Ruakura, 557) 5/29/83 8:04 PM L:48
KEYS:/INTRO/UPSTREAM/FOOD/LIQUID FUELS/GENERAL/
Hello everybody out there. Greeting from New Zealand. This message is to make ourselves known to other conference participants. We are a small group involved in looking at the processing of lucerne [alfalfa to you North Americans!]. The overall process envisaged is protein extraction of fresh lucerne followed by hydrolysis of the residual fibre to give fermentable sugars.

With regard to HF, we had some work done by Hoechst on our protein extracted fibre. The residual solid was a hard black-brown material resembling steam explosion "lignin." Hoechst say that water content of the starting material must be less than 10% for satisfactory operation. Contact is Prof. Jensen or Dr. Deger Hoechst AG, 6230 Frankfurt [M]80, Bundesrepublik Deutschland. NOTE: At the moment we will only be signing on approximately

once a week as line charges to the US are quite high for us. Steve Vaughan.

C604 CC32 D. Larry J. Douglas (L.J., 473) 5/31/83 6:46 PM L:14
This is a note to Elaine (502)
There are two other US researchers working on HF hydrolysis of cellulosic materials. They are Dr. N. L. Hecht at the University of Dayton, and Dr. Andrew J. Mort at the Charles F. Kettering Research Institute Foundation Laboratory. If you have trouble finding further information, I can furnish more specific information. This is a note to Inge (509); Dr. Chum says let's proceed with the proposed conference on lignin. Can I hear something from you on this subject? Have a nice day. L. J.

C604 CC33 Murray Moo-Young (604) 6/2/83 10:28 AM L:23
KEYS:/GENERAL/
Re CC32, more definitive information on HF pretreatment from Dr. Douglas would be welcomed. A general comment . . . As your moderator, I am very pleased with the informative discussions taking place so far. However, may I remind participants of our special mandate in trying to help Third-World countries. For example, can any field experiences be shared with us at present? Please note that I will be attending the IUPAC Congress, Cologne, Germany, June 12-17. It would be a pleasure to meet any of you who may also be there. Auf Wiedersehen. Murray Moo-Young.

C604 CC69 Keith Mackie (251) 7/13/83 8:06 PM L:57
KEYS:/UPSTREAM PROCESSING/ACID/HYDROLYSIS/LIQUID FUELS/METHANE/PENTOSE/FERMENTATION/
Greetings from the biotechnology group of the forest research institute, Rotorua, New Zealand. Our main interests are in the dilute acid hydrolysis of softwoods and hardwoods using a Madison style process. HF hydrolysis currently seems to be a high interest area. Has anyone data on the energy economics of the liquid phase hydrolysis process? The major energy inputs would seem to be in drying the raw material and evaporation of the HF.

C604 CC105 "From COM in Stockholm" 8/2/83 8:31 AM L:155
(Text 19475) 83-08-02 11.16 Carl-Göran Hedén
Receiver: Bioconversion technical (46)

Method probably requires complete drying to reduce HF-dilution. Besides corrosion problems mentioned by A. Radcliff, CC16 (COM/14094), HF-production is difficult to visualize in an LDC-environment, or are there simple approaches?

C604 CC352 "From COM in Stockholm" 12/13/83 3:22 PM
L:28
KEYS:/HF/
(Text 33640) 83-12-13 20.53 Alistair Paterson UK
Subject: HF
Chemical routes for the hydrolysis of lignocelluloses will be successfully developed in the near future. Banks and Brown at UMIST have special facilities and interests in the use of anhydrous HF to hydrolyse all types of lignocellulosic materials. Early work dating back to 1869 and more recent developments have been reviewed by Brown (1983) Phil. Trans. R. Soc. Lond B300 305-322. The most recent report appears in Canertech Inc newsletter number 6, 6/5/83 and states that this company has embarked on an intensive programme aimed at the development of an HF hydrolysis process using a test reactor with a capacity of 12 kg aspen chips. This reactor is located at the University of Manitoba and the work involves collaboration between Canertech, the Industrial Technology Centre of the Manitoba Research Council and Forintek. The work at UMIST is based on processing separated municipal waste and soft-wood sawdust, hard-wood chips, shredded telephone directory and barley straw. All the non-lignin material appears to be removed rapidly at room temperature and can be recovered as the fluoride free (0.1% F by weight) sugars.

Preliminary design studies based on the integration of a two thousand tonne/per week hydrolysis plant with conventional HF production facilities suggests a viable future technology.

C604 CC367 "From COM in Stockholm" 12/14/83 8:41 AM
L:22
KEYS:/HF/
(Text 33674) 83-12-14 04.12 Carl-Göran Hedén
Comment on: (Text 33640) by Alistair Paterson UK
Subject: HF
This interesting approach does not seem to be very viable in a rural development context, but I would be interested to hear what our Kuwait node convenor, El-Nawawy, who is

concerned with solid waste disposal, thinks about it. Since he has not yet appeared on-line (!!), I will send your comments on to him by telex. Are you in Manchester aware of the work on HF in Grenoble, Michigan, Canada and BASF in Germany?

C604 CC374 "From COM in Stockholm" 12/14/83 10:04 AM
L:29
KEYS:/COMMENT ON TEXT 33640/HF
What is conventional HF production facilities? The biggest scale I know about is the 500 ml HF lab scale they use in Kolding, Denmark. This work was done in collaboration with Grenoble and Dr. Pedersen the Technical High School Lyngby, Denmark.
In this process there are two big problems:
1. The toxicity of HF
2. The sugars which are dissolved in HF are so reactive that when the HF is removed, the monomeric sugars form oligomers so it is necessary to use enzymes (AMG) for conversion to monomer again.
Comment on: (Text 33744) by Martin Schuelein
Subject: Comment on text 33640/HF
I made a mistake in my input. It is not BASF but Hoechst who did work on HF. Agree with Martin on the limits of HF. It produces a lousy lignin which does not make me happy.

C604 CC385 Murray Moo-Young (604) 12/14/83 12:41 PM
L:34
KEYS:/GENERAL/
Hello again from the Canadian node, Murray Moo-Young, University of Waterloo.
Re CC367 (Ingemar), CC374 (Schulein),
although HF pretreatment techniques for lignocellulosics are attractive to researchers for preparing fermentable substrates, it appears that they are very unattractive economically at present. I believe Hoechst and other commercial enterprises have not pursued these options because of this problem. Murray Moo-Young

C604 CC392 "From COM in Stockholm" 12/14/83 2:40 PM
L:11
KEYS:/HF/
(Text 33847) 83-12-14 17.27 Alistair Paterson UK
Receiver: Bioconversion technical (372)
Comment on: (Text 33701) by Ingemar Falkehag (1)
Subject: HF
YES!

This work is quoted in the Phil. Soc. Trans. mentioned in our notice. Thanks for the interest!

C604 CC397 "From COM in Stockholm" 12/14/83 2:50 PM
L:33
KEYS:/CELLULASE ACTIVITY DETERMINATIONS/
(Text 33874) 83-12-14 19.00 Reiner Eckermann
Receiver: Bioconversion technical (379)
Subject: Pretreatment with HF
Following text 33760, the pretreatment with HF is a process which includes some considerable disadvantages. I will try to get some information on Hoechst HF-process (Hoechst AG as well as our node is located in Frankfurt). It should be easy to get information. Especially the advantages of this process by which a maintenance is justified seems to be interesting.
PETER KRAEMER/FRANKFURT-NODE

C604 CC452 "From COM in Stockholm" 12/15/83 10:41 PM
L:29
KEYS:CELLULASE ASSAYS/
(Text 34141) 83-12-15 15.11 Frances Van Sant
Receiver: Bioconversion technical (442)
Subject: Ethanol
The Swedish node has received information from Canertech in Winnipeg on their ethanol from cellulose program, employing HF hydrolysis. Those interested in HF can contact L.D.R. Dyke, Canertech, 1003-213 Notre Dame, Winnipeg MB R3B 1N3, Canada (Tel. 204-949-1160)

C604 CC463 "From COM in Stockholm" 12/15/83 11:29 PM
L:27
KEYS:/COMMENT ON TEXT 33640/
(ext 34207) 83-12-15 18.27 Reiner Eckermann
Receiver: Bioconversion technical (455)
Comment on: (Text 33760) by Ingemar Falkehag (1)
Subject: Comment on text 33640
In text 33874 I announced to ask the Hoechst AG about the advantages of their HF pretreatment method. Here is a statement of Dr. Deger from Hoechst AG: It is well known that the use of the HF-method produces only a low-quality lignin. But the aim of this process is the production of high quality sugars and therefore the HF-method is excellent. The by-product in this technique is high concentrated lignin and because the refinement of lignin to high quality products makes some problems, the lignin is used to cover the energy supply of the

process. The process is running in at the Hoechst AG in a 25 kg scale as batch process. The main difference of the Hoechst process to other HF-processes is that in this technique gaseous HF is used. Thus it is problematical to compare it with other HF-processes. Dr. Deger and P. Kraemer.

C604 CC481 "From COM in Stockholm" 12/16/83 4:17 AM
L:18
KEYS:/HF/
Text 34269 83-12-15 20.52 Alistair Paterson UK
Receiver: Bioconversion technical (471)
Subject: HF
Replies to comments on my notice 33640.
To comment 33674 by Heden. - We agree that HF process is not suitable in a rural context, regardless of country. However, developing countries will have technical ability to cope with such a plant within areas of industrialisation. To comment 33744 by Schulein. - The 1976 Figures for UK production of HF by ICI: 40,000 tonnes per year and by Imperial Smelting: 20,000 tonnes/year. HF is a dangerous material but methods have existed for many years for safe manufacture and use of this chemical. Yes, the glucosyl fluorides are reactive during fluorine removal but it is confidently believed that repolymerisation might be controlled and even manipulated.

C604 CC506 "From COM in Stockholm" 12/16/83 1:13 PM
L:20
KEYS:/PRETREATMENT WITH HF/
(Text 34425) 83-12-16 16.15 Reiner Eckermann
Receiver: Bioconversion technical (509)
Subject: Pretreatment with HF
Question of Axel Borchert, Dechema-Institut, Frankfurt:
Which is the best raw material for pretreatment with HF . . .? What product concentrations (monosaccharides) are possible? What product concentrations can be obtained when other pretreatment methods are used? Peter Kraemer.

C604 CC518 Murray Moo-Young (604) 12/19/83 12:29 PM
L:42
KEYS:/GENERAL/from Murray Moo-Young
Re CC481 etc., my intelligence network has indicated that even for developed countries the HF techniques for lignocellulosic pretreatment are uneconomical; (despite

the fact that our Canadian government, Canertech, is trying to rejuvenate this!!), so why are we discussing these for possible LDC application?

If I do not get a chance to "talk" to you again, many thanks for helping me with this conference and on behalf of my Waterloo colleagues, may we wish you a "Merry Christmas and a Happy New Year."

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(This is supposed to be a Christmas tree.)

Murray Moo-Young et al.

APPENDIX C

VENDORS FOR COMPUTER CONFERENCE SYSTEMS

System	Availability	Connect Cost	Processor
MATRIX Transaction Exchange International Tele/Conferencing Co. Suite 405, 1877 Broadway Boulder, CO 80302	Telenet may be licensed	Set-up fee plus $6.75-19.75/hr 5-year license: $10,000	DEC System
PARTICIPATE Participation Systems Inc. 50 Cross Street Winchester, MA 01890	The Source	Initial fee-$100 plus $7.75-25.75/hr $10/month minimum	Prime computers
	or		
	Dialcom	Initial fee - none $18.50-22.50/hr $100/month minimum	
CONFER II Advertelv Communications Systems, 2067 Ascot Ann Arbor, MI 48103	Telenet Autonet direct dial may be licensed	$19-20/hr license cost depends on implementation	Amdahl

EIES Electronic Information Exchange System New Jersey Institute of Technology 323 High Street Newark, NJ 07102	Telenet Uninet direct dial	$75/month group accounts $200/month plus $10/month per user plus $8/hr	Perkin-Elmer 3230
COM Stockholm University Computer Center Box 27322 102 54 Stockholm Sweden	May be licensed	$4-40/hr	DEC 10 DEC 20
AUGMENT Tymshare 20705 Valley Green Drive Cupertino, CA 95014	Tymnet may be licensed	$14-18/hr licensing cost depends on implementation	DEC 20 with TOPS 20 operating system

NAS NAE IOM NRC National Academy Press

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