ISSCT CO-PRODUCTS WORKSHOP

PIRACICABA, SãO PAULO, BRAZIL
14 - 18 July 2003

ETHANOL PRODUCTION AND USE

- INTRODUCTION
- PROGRAMME
- **REPORT**
- ABSTRACTS

Organized by
COPERSUCAR TECHNOLOGY CENTER,
Piracicaba, São Paulo, BRAZIL

The Co-Products Workshop was hosted and organized by Copersucar Technology Center in Piracicaba, São Paulo, Brazil from July 14 to 18, 2003.

The central theme “Ethanol Production and Use” was selected due to the growing interest worldwide in the use of renewable liquid fuels and the commitment of several important sugar cane producting countries such as India, Colombia, Thailand, Australia, China, besides Brazil, to start ethanol programs to displace fossil fuels and to diversify the sugar industry.

The main objective of the workshop was to facilitate the exchange of experiences and information about the central theme and other co-products.

The first day, July 14, was dedicated to registration and the welcome cocktail, aimed to start to create an informal atmosphere that prevailed throughout the workshop.

The workshop had two days dedicated to plenary sessions, totaling 31 papers spread in nine sessions, and two days of site visits 58 delegates from 12 countries participated in nearly all events.

Plenary Sessions

The two days of plenary sessions consisted of one opening session, which had the welcome speech of Copersucar Technology Center General Manager.

The eight technical sessions were taken by the 31 oral presentations with a broad discussion at the end of each section.

Ethanol programs in Brazil and other countries

This session started with the presentation of history of Brazil ethanol program, detailing the main problems and solutions and how the institutional, legal and technical frameworks were created to consolidate the program.

The Iran alcohol and yeast complex was presented showing the country’s very well conceived sugar cane co-products project anchored in seven raw sugar factories and including sugar refineries, fodder, yeast, alcohol, paper particle board factories and energy generation and other related industrial units. The Guyana perspectives to introduce the ethanol production in its sugar industry were presented along with the motivation behind this drive, such as the creation of an important new source of revenues and improving the cane processing efficiency and reducing costs. The potential of India’s ethanol market and current production were presented; several alternatives of increasing alcohol production were analyzed as well as the technology being used in this production expansion. The session was closed with the presentation of Colombia’s ethanol program where a multi ministry effort is taking place to create the necessary framework for the program development; environmental issues such as cane burning and vinasse disposal were discussed.

Automotive Use of ethanol

A representative of a Brazilian automaker, Volkswagen, reported its experience in producing vehicles to use ethanol, either as a neat fuel or blended in the gasoline; the modifications of the fuel systems to handle ethanol in various concentrations were discussed, culminating with the presentation of the new flex fuel models that can handle automatically pure ethanol (E100), gasoline (E25) or any mixture of these two fuels. The environmental impacts from the ethanol fuel use in Brazil were discussed covering both the local and global effects; among the benefits, the use of ethanol blend in the gasoline permitted Brazil to be one of the first countries in the world to eliminate lead from all gasoline due to the octane enhancement effect of ethanol. This facilitated the use of catalytic converters in the exhaust pipes allowing a significant reduction in vehicular emissions.

The Brazilian specification for the two types of fuel ethanol, hydrated and anhydrous, were presented showing how the quality control is done at the mill and the results achieved.

The results of a fleet test of ethanol/Diesel blend with 7% anhydrous ethanol, without any additive, were presented indicating performance data and minor operational problems and the correction for a fleet of 9 cane transportation trucks (Mercedes Benz and Scania); the conclusion is that it is feasible to use such a blend for this type of vehicles that use in line fuel injection pumps.

Alternative raw materials for ethanol production

Dedini Rapid Hydrolysis (DHR) process was presented as an innovative method to produce ethanol from sugar cane bagasse allowing an increase of the overall energy efficiency of sugar cane; a 5000 l of ethanol per day demonstration plant is being commissioned at the São Luiz AA Mill (Dedini Agroindustrial).

Sugar Research Institute (SRI) presented several alternatives to boost ethanol production in Australia up to a level to be able to add 10% ethanol to the gasoline pool; the various feedstocks available in a sugar factory were evaluated and the corresponding ethanol productions were estimated.

Energy balance in ethanol production

Energy economy schemes were suggested by IPRO that would allow a considerable reduction in steam consumption in the distillation process. The integration of ethanol production with a sugar factory with maximization of the cogeneration capacity was suggested by IPRO, in other presentation, indicating the optimum use of low pressure steam and multiple vapour usage. The life cycle analysis of energy use in the production of sugar cane and its processing to sugar and ethanol was presented by Copersucar, indicating an output of renewable energy more than nine times larger than the fossil energy input; this results qualifies ethanol to be an important alternative to reduce CO_2 emission in transportation.

Ethanol production technologies

A technology to reduce steam consumption in azeotropic dehydration of ethanol, called PDE process, was introduced by Dedini. The Bio Nanotec Research Institute BNRI, from Japan, presented the zeolite membrane based dehydration process that allows the production of very low moisture content ethanol with low energy consumption in a continuous process.

The Rocky Point Sugar Mill and Distillery, from Australia, discussed how the mill manage to survive in such a competitive environment through cogeneration and ethanol production. The India's plans with respect to fuel ethanol use, today and future, were presented indicating the huge amounts needed; the alternatives for ethanol production using energy efficient processes, such as Biostil and molecular sieves, were discussed.

The point of view of a Brazilian mill owner was presented with respect to the decision to produce more sugar or ethanol, based on market conditions. CTC presented the evolution of ethanol production process and the gains in efficiency and productivity achieved in Brazil; this presentation was enriched by the Santa Adélia Mill discussion on fermentation control and its successful struggle to bring bacterial infection in continuous fermentation under control. The diversification of Guabira Sugar Factory, in Bolivia, was presented in the form of a time schedule and associated mill modifications required to produce ethanol in increasing amounts.

By-products of the ethanol production

Alternatives to add value to the yeast co-produced with ethanol by processing it and obtaining different fractions for various uses were presented by CTC. A very interesting presentation by Andhra Sugar Ltd, from India, showed how a broad range of by-products could be produced in the plant, such as ethanol, CO_2, electricity, acetic acid, acetic anhydride, ethyl acetate, butyl acetate and even Aspirin. The use of vinasse in fertirrigation was shown by CTC demonstrating how this activity is well handled by the Brazilian ethanol industry and the many advantages that comes from the application of this liquid effluent in the cane fields; vinasse started as a problem and now is one of the solutions to increase cane productivity and to reduce the use of industrial chemical fertilizers.

Other Co-products from sugar cane

A presentation was made by CTC covering chemical and biochemical routes combined to produce several valuable chemicals such as organic acids, amino acids, polymers, solvents, flavoring agents, manitol, sorbitol, furfural, xilitol, ethanol derivatives, waxes, sterols and others. Another presentation covered specifically the production of bioplastic polyhydroxy butirate (PHB) by sugar fermentaion.

Shakarganj Mill, from Pakistan, presented biocomposting technique for filter cake together with vinasse, producing a product that increased the efficiency of nitrogen, phosphorous and potassium resulting in an economy of fertilizers.

Integration of Co-products production with the sugar factory and energy cogeneration

Mauritius Sugar Authority discussed the economic aspects of cogeneration in sugar mills and its history, pointing out the important milestones; the creation of the Bagasse Transfer Price Fund seems to be an interesting solution for the power revenue sharing among small growers and miller-planters. Another presentation from Mauritius, this time by the Mauritius Sugar Industry Research Institute (MSIRI), covered the differences in electricity production between sugar only and sugar/ethanol productions.

This same topic was covered by Procknor Engenharia exploring other aspects of the energy balance when sugar and ethanol are produced in the same plant. In the last presentation, CTC discussed the energy balances of the integration of the DHR process with a sugar/ethanol mill focusing in the optimized use of bagasse as raw material for energy and alcohol productions.

Workshop Conclusions

In the closing session a quick review of the whole workshop was presented and the final discussion conducted aiming to summarize the conclusions and to indicate directions for the next workshop.

One important observation is that in those countries that ethanol production is being planned or considered the tendency is to increase the sugar cane areas in order to maintain the present sugar production; final molasses seems to be the preferred raw material, a different option from what has been adopted in Brazil.

No firm suggestions were made concerning the topics and location for the next co-products workshop. Therefore, these items remain open for suggestion and recommendation by ISSCT members.

Site Visits

During the visit to São Luiz Mill (Dedini Agroindustrial) the delegates were informed about the main aspects and achievements events of the Dedini Group, specially of Agroindustrial Branch.

The delegates visited the DHR 5000 liters of ethanol/day production plant and could understand better how this interesting process converts the bagasse cellulose in a sugar solution that will be send to the conventional distillery.

The delegates also visited the mill distillery where the new PDE distillation devices for increasing anhydrous ethanol production with low energy use was recently installed; the fed-batch fermentation process with total cell recycle was also visited.

The visitors had also the chance to see the Copersucar's pilot plant, where juice is being extracted from prepared sugar cane by using a new extractor technology (Rivière).

On the next day, Friday, 18th of July, the delegates visited 2 mills in Ribeirão Preto region which is considered as sugar cane production center of Brazil. In the morning, the Santa Adélia mill near Jaboticabal was presented to the delegation. This medium sized mill crushes about 2 million tons of sugar cane per year. Special attention during the visit was given to the cane milling section, the Central Control Room, of the sugar factory and the distillery. Concerning the milling section extraction efficiencies as high as 97,7% on an average have been achieved during the 2002 crop due to proper maintenance practices and high level of automation. In the sugar factory the visitors could view the continuous centrifuge for massecuite, the continuous vacuum pans and the new glass enclosure of the sugar transportation system. The distillery is characterized by a 4 stage continuous fermentation system with recovery of the surplus-yeast. The high level of process automation in the distillation section, as in all other sections too, has been the key factor for low energy consumption and stable product quality. Finally, the new 42MW cogeneration plant (34 + 8 MW) was presented to the delegates. In the afternoon, the delegation visited the Pedra Mill in Serrana, a mill which crushes 3,4 million tons of sugar cane per year.

The trip started with a close look to the distillery which is characterized by a conventional fet-batch process with cell recycle and a molecular sieve unit for alcohol dehydrating, the first industrial unit of this kind in Brazil.

The Pedra Mill is doing also some pioneer work by developing, together with Copersucar and IPT (Technological Research Institute in São Paulo), an innovative process for producing a biodegradable plastic (Polyhydroxybutirate) from sugar. The pilot plant converted to a commercial unit was viewed from outside.

Finally, the delegation visited the site of the new 65 bar boilers and the new turbo-generator ennabling the sale of 20 MW of electric power.



