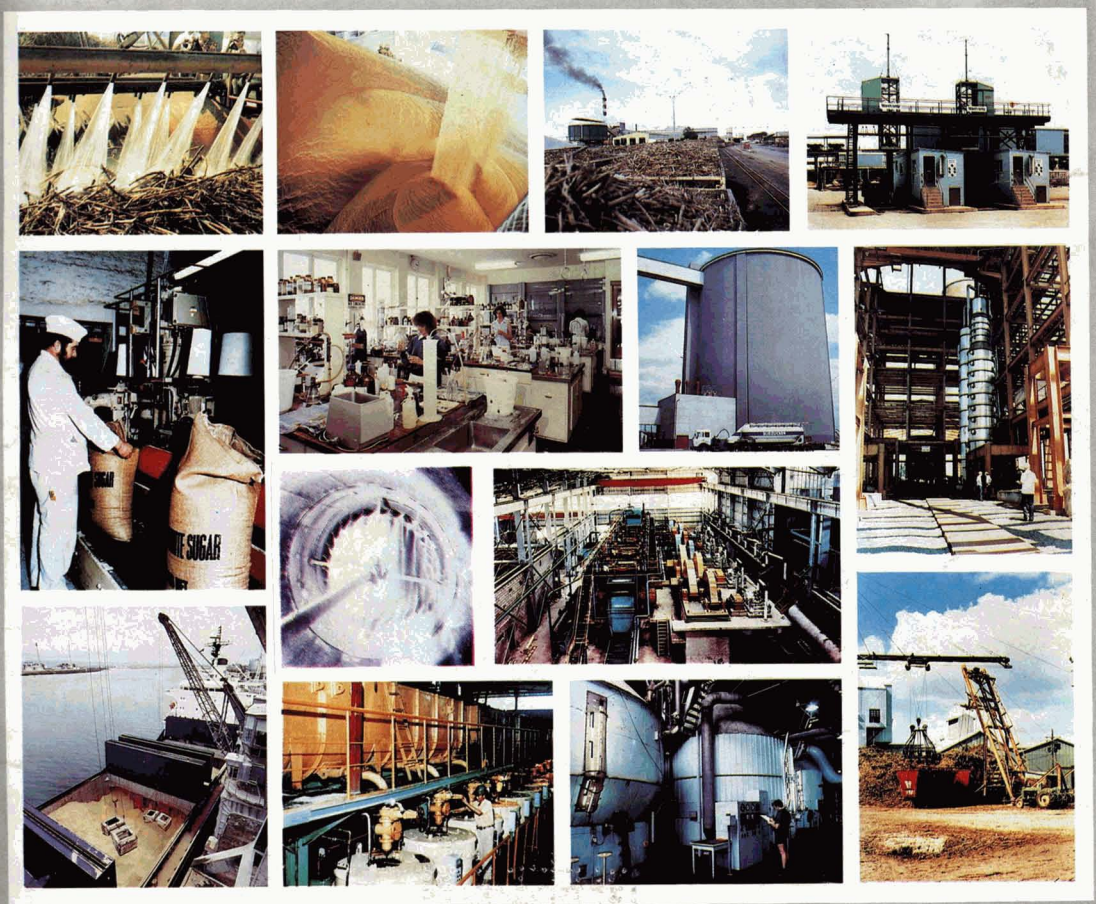
INTERNATIONAL SUGAR JOURNAL

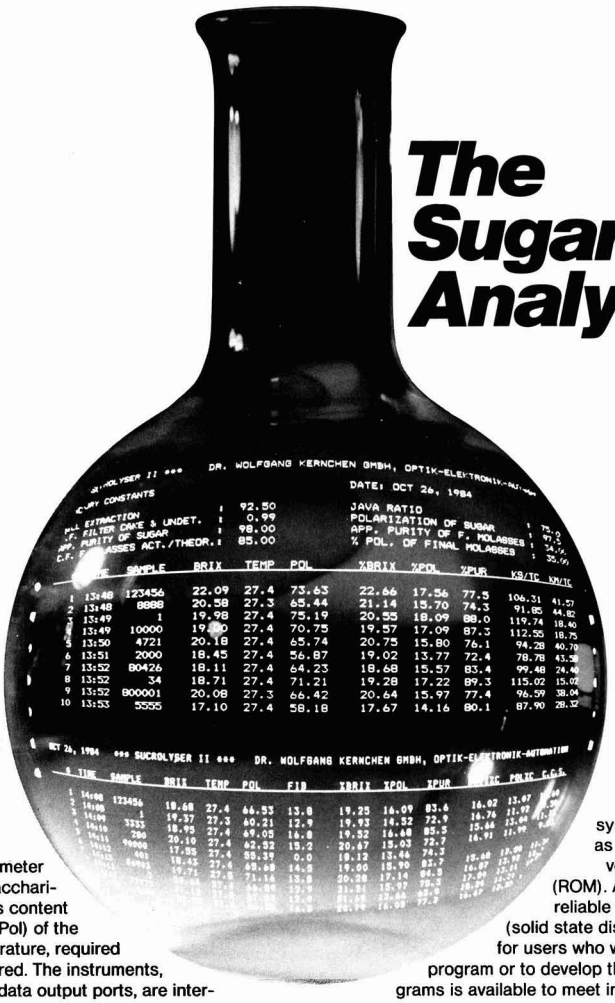


VOLUME LXXXVII/ISSUE No. 1037

MAY 1985

SUCROLYSER II

The Sugarcane Analyser



SUCROLYSER II is an automatic analyser for sugarcane juice purity determination and for computing quality data such as kg sugar/ton cane or C.C.S.

High precision instruments, BRIXOMAT automatic refractometer and SUCROMAT automatic saccharimeter measure the total solids content (Brix) and the sugar content (Pol) of the cane juice. The sample temperature, required for corrections, is also measured. The instruments, featuring digital displays and data output ports, are interfaced to an APPLE IIe personal computer which evaluates measured and manually entered data. At the end of each analysis, original and computed data appear in a list printout together with date, time and sample number.

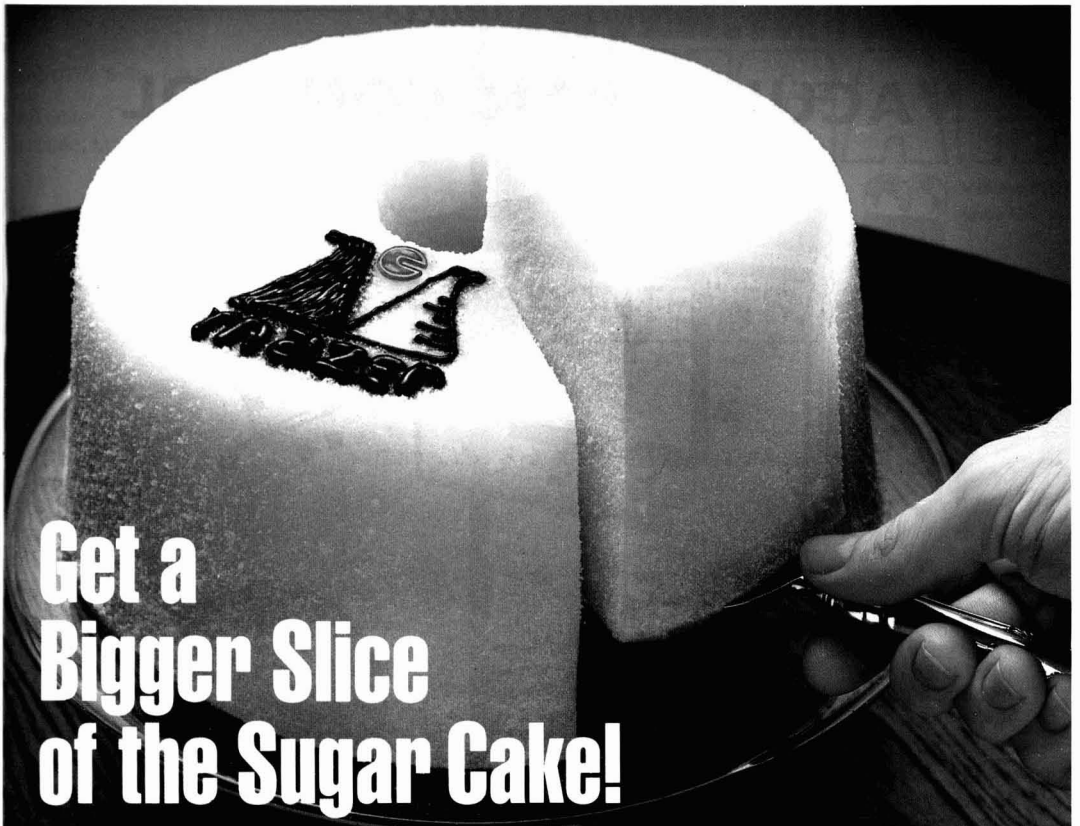
SUCROLYSER II is easy to operate. Clear messages on a video display screen safely guide the user. Instruments and data processing equipment are designed for reliable performance under adverse conditions typical for a cane laboratory environment. The computer program for operating the SUCROLYSER II system is normally supplied as "firmware" stored in non-volatile solid state memory (ROM). A diskette drive or a more reliable magnetic bubble memory (solid state disk) are offered as options for users who want to modify an existing program or to develop their own. A choice of programs is available to meet international requirements.

SUCROLYSER II is a powerful tool for improving sugarcane quality and for enhancing relations between planter and sugar factory. If you want more information please ask for our detailed brochure.

You are also welcome to see us at the ACHEMA 85 Exhibition in Frankfurt from June 9th to 15th, 1985, Hall 6, Stand H5/H6. On display is our wide production line of analytical instruments and systems for the sugar industry.

DR. KERNCHEN
Optik · Elektronik · Automation

Dr. Wolfgang Kernchen GmbH, P.O. Box 20140, D-3016 Seelze 2, West Germany
Telephone (511) 401 961, Telex 923 550 drker d



Get a Bigger Slice of the Sugar Cake!

Discover Mazer Chemicals for the complete treatment in sugar processing.

For optimum crystallization and general sugar manufacturing, choose the Mazer family of products—carefully formulated to serve you best.

MAZU® 400—Surface active agent for crystallization and production of sugar.
MAZU® 606—Surface active agent for improving sugar processing.
MAZU® EVAP 711—Surface active agent for inhibiting the formation of scale in the evaporators and improve processing capacity.
MAZU® DEFOAMERS—For all foam problems in the production of beet sugar.
MAFLOCS® —Flocculants in the processing of cane and beet sugar.
MAZTREAT® SDC—For clarification of syrups, molasses, and sugar decolorization.
MAZIDE® BC 800—Fungicide and bactericide used in controlling the growth of bacteria and fungus.

M-QUAT® 2950 & 2980—Quaternary ammonium compounds for sugar mill sanitation.
MAZON® CA 120—Descalant for cleaning evaporators, pans and heat exchangers.
MAZON® CA 200—Caustic accelerator.
MAZOL® 300—Additive for improving fluidity and reducing the tackiness and foam in molasses.
MAZVAP® 900—For inhibiting scale formation in the evaporators and distilleries.
MAZYME® I—A heat stable, starch decomposing enzyme for the cane industry.
MAZYME® DX—A dextran decomposing enzyme for the Sugar Industry.

mazer CHEMICALS, INC.

MAZER CHEMICALS, INC. U.S.A.
3938 Porett Drive
Gurnee, Illinois 60031 U.S.A.
Tel: (312) 244-3410
Tlx: 25-3310
Cable: MAZCHEM GURNEEILL

MAZER CHEMICALS, LTD.
Irlam, Manchester, U.K. M30 5BL
Tel: 061-775-1888
Tlx: 665546 LIBRA G

MAZER DE MEXICO S.A. de C.V.
Londres 226, Mexico D.F. 06600
Tel: (905) 533-44-83
Tlx: (383) 01761103 MAZEME

MAZER CHEMICALS (CANADA), INC.
Mississauga, Ontario L4Z 1H8
Tel: (416) 848-2500, Tlx: 06960351 CANBIZ MISS

INTERNATIONAL SUGAR JOURNAL

Volume 87
Issue No. 1037

CONTENTS May 1985

UK ISSN 0020-8841

Annual Subscription:
£40.00 post free

Single Copies
£4.00 post free

Airmail: £24 extra

Published by
The International Sugar Journal Ltd.,
23A Easton Street, High Wycombe,
Bucks., England HP11 1NX
Tel: 0494-29408 *Telex:* 21792 REF 869

Printed by Adams & Sons (Printers) Ltd.,
Blueschool Street, Hereford.
Telephone: 0432 54123.

Published by

The International Sugar Journal Ltd.

23A Easton Street, High Wycombe, Bucks., England HP11 1NX.

Telephone: 0494-29408 *Telex:* 21792 REF 869

US Office: P.O. Box 143773, Coral Gables Station, FL 33114-3773.

Inquiries regarding advertising should be addressed to the above offices or to the appropriate representative:

UK: T. G. Scott & Son Ltd., 30-32 Southampton Street, London WC2E 7HR *Tel:* 01-240 2032. *Telex:* 299181.

France: MaG-Watt International, 6 rue des Acacias, Vert-le-Grand, 91810 Essonne. *Tel:* (6) 456-00.15.

Belgium, Holland and West Germany: G. Arnold Teesing B.V., Prof. Tulpstraat 17, 1018 GZ Amsterdam. *Tel:* 020-263615. *Telex:* 13133.

Japan: Shinano International, Akasaka Kyowa Bldg., 6-14 Akasaka 1-chrome, Minato-ku, Tokyp 107. *Tel:* (03) 584-6420. *Telex:* J27850 Sinanoco.

Latin America: Mr. Mario A. Mascaró, 7321 S.W. 82nd Street No. 2, Miami, FL, U.S.A. 33143. *Tel:* (305) 667-1724.

Notes and comments

World sugar prices

After ending February at $115, the London Daily Price for raw sugar fell sharply to $106 on March 1 but rebounded very quickly to $117 two market days later and thereafter varied more gently but with a slight downward trend through the rest of the month which it ended at $108.50. The corresponding white sugar price started the month at $135 per tonne and ended it at $131 with minor fluctuations between a peak of $137.50 and a trough of $129.50.

This is the more remarkable since, during the month, the long-awaited fall in the value of the US dollar relative to other currencies started; the dollar declined by around 15% during the month, against only a 5% fall in the raw sugar price. It would seem, therefore, that the fall in the dollar stemmed what might otherwise have been a more severe fall in sugar prices, and the possibility of future changes in currency rates will complicate further the interpretation of changes in sugar prices.

Unfortunately, most of the factors influencing the market have been bearish, including Licht's estimate of a higher beet area for 1985, a raised FIRS estimate of EEC sugar output in 1984/85 and a reported large Cuban crop, while purchases of white sugar by India were so well covered by availabilities that they did not affect the market.

Europe sugar beet area, 1985[1]

At the end of January, the EEC Commission said that member countries had announced their intentions to grow less sugar beet this year and forecast that the beet area would decline by between 5 and 10%. F. O. Licht's latest survey indicates, however, that this will not be the case and that low world sugar prices bear little relationship to domestic sugar production. The same is true, Licht says, of most other West European countries while in Eastern Europe, planners do not respond to the ups and downs of the world free market. In short, the area sown to beet is set slightly higher than in 1984 and, unless weather plays havoc with this year's crop, European sugar production is unlikely to decline in 1985/86. Licht's estimates, plus the actual figures for 1984 and 1983, appear below:

	1985/86	1984/85	1983/84
		hectares	
Belgium/Luxembourg	125,000	120,000	115,000
Denmark	74,000	74,000	72,000
France	470,000	509,000	462,000
Germany, West	415,000	422,000	403,000
Holland	130,000	129,000	117,000
Ireland	37,000	36,000	36,000
Italy	215,000	210,000	222,000
Greece	43,000	29,000	38,000
UK	200,000	197,000	196,000
Total EEC	*1,709,000*	*1,726,000*	*1,661,000*
Austria	42,000	51,000	42,000
Finland	31,000	32,000	32,000
Spain	180,000	192,000	241,000
Sweden	51,000	53,000	53,000
Switzerland	15,000	15,000	15,000
Turkey	350,000	354,000	360,000
Yugoslavia	170,000	143,000	140,000
Total West Europe	*2,548,000*	*2,566,000*	*2,544,000*
Albania	10,000	10,000	10,000
Bulgaria	58,000	55,000	31,000
Czechslovakia	209,000	210,000	212,000
Germany, East	231,000	241,000	257,000
Hungary	105,000	108,000	107,000
Poland	485,000	470,000	487,000
Rumania	310,000	270,000	265,000
USSR	3,480,000	3,485,000	3,496,000
Total East Europe	*4,888,000*	*4,849,000*	*4,866,000*
Total Europe	7,436,000	7,415,000	7,410,000

Tate & Lyle purchase of GW sugar factories

Tate & Lyle PLC is paying $48.5 million ($21.5 million for six beet sugar factories in Nebraska, Montana and Wyoming and $27 million for stocks of white sugar, beet pulp, molasses and packaging materials)[2]. The seller is Great Western Sugar Co. which put its sugar properties up for sale in December[3]. The Great Western Beet Growers Association, which has been negotiating for the entire 13 factories, announced that talks are still in progress for the remaining 7 plants[4], while Tate & Lyle are engaged in talks with growers to ensure supplies for the next campaign. The US sugar industry is one of considerable over-capacity, especially after the inroads made by HFS, but the assets have been acquired rather cheap since GW is in receivership under Chaper 11 of the US bankruptcy code.

Tate and Lyle believe that there is opportunity for volume growth in the USA, as was spelt out by the Chairman, Sir Robert Haslam, at the company's Annual General Meeting in February; this is in contrast to outlook in Canada and the UK. The company's investment strategy is to invest in the sugar industry, provided the price is right and the business environment attractive, and also to expand the non-

1 F. O. Licht, *International Sugar Rpt.*, 1985, **117**, 125-128.
2 *The Times*, March 23, 1985.
3 *I.S.J.*, 1985, **87**, 42.
4 C. Czarnikow Ltd., *Sugar Review*, 1985, (1736), 44.

sugar businesses either by direct investment or acquisition[5].

Sugar surplus disposal

At the International Sweetener Colloquium in February last, sponsored by the US Sugar Users Group, Mr. N. G. Osman presented a paper in which he suggested two measures which could bring about an improvement in the depressed world sugar situation, and these have been reported in *World Sugar Journal*[6].

He pointed out that membership by importers in an international sugar agreement was not essential and that inclusion of a maximum sugar price target—included as a sop to importers—was not one which could be achieved in practice. He showed that, of net exports to the free market between 1979 and 1983, an average of 83% came from ten major exporters (Argentina, Australia, Brazil, Cuba, Dominican Republic, EEC, India, Philippines, South Africa and Thailand) so that a simplified agreement between these exporters to protect the price of sugar so that it does not move below a pre-determined level would be much easier to achieve than one involving the very much larger number of members of the 1977 Agreement. The ten could meet when pre-determined conditions occurred, in order to decide what action to take on a basis of prevailing conditions, as against trying to anticipate these five years in advance in a new ISA.

A preliminary requisite is a solution to the problem of the world sugar surplus and Mr. Osman suggests that this should be donated to poor countries, particularly those in Africa where hunger is rife and where consumption is very low because of lack of supplies. He emphasizes that no import demand would be replaced because such countries could not have afforded sugar imports at any price; they would benefit the recipients by improving food availability. The exporters would benefit as they would not be required to pay continuing storage and financing costs for the surplus and would also gain from an increase in the world market price. Consumers in the recipient countries will develop a taste for sugar which could lead to pressure for increased sugar imports in the future.

Cuban sugar crop enigma

Trade sources in Cuba have predicted that output from the current crop will reach 8.6 million tonnes and said in March that dry weather is continuing and allowing the harvest to proceed under perfect conditions. The season usually is halted by the onset of the wet season in April or May but on occasion has continued beyond, albeit with the penalty of low cane quality and problems in the factories.

However, official production figures for October-December 1984, passed to the International Sugar Organization, show that output reached only 538,440 tonnes, against 1,086,209 tonnes in 1983. Thus, the start of the 1984/85 season was significantly poorer than that of 1983/84, when production reached 8.3 million tonnes. Further, there have been reports that deliveries to Japan for the first half of this year have been postponed, and Cuba has purchased sugar to an estimated 750,000 tonnes, and it is unclear as to whether this is to support the market, make up a shortfall in Cuban supplies or is a roundabout means of securing supplies by the USSR.

Australian sugar industry to increase production[7]

Norman Dillman, General Secretary of the Australian Sugar Producers Association Ltd. and coordinator of the sugar industry review program, told the 1985 National Agricultural Outlook Conference that the Australian sugar industry must increase production and throughput if it is to survive. The program was set up by the four Queensland sugar industry associations last year and is studying deregulation of the industry's tightly-controlled institutional arrangements as a response to the changed sugar market environment. Dillman said that, if all available land for cane growing in existing mill areas were used, production of 4-5 million tonnes is possible without establishing new mills (Australia's 1984 sugar production was 3.55 million tonnes). He added that the only effective way to stabilize returns to growers is heavily to reduce peaks (quotas which include higher-priced domestic and export contract sales). Since this is not an acceptable option, given the high level of investment in the country's infrastructure, the industry must consider increased output.

Industry studies show that the market can accommodate increased Australian output if there is sustained economic growth. Australia's sugar marketing success relies, according to Dillman, on production and delivery of bulk raws, noting that present handling and transport costs do not make the sale of bagged whites or raws financially attractive. He said the industry, which is the world's most technically efficient and one of the three most economically efficient, must become even more competitive to survive since Australia competes without benefit of a large domestic market base or a subsidized export price. Any new system developed will need to be market oriented, allowing for mills and cane growers to make their own commercial decisions, he said.

US sugar quota and fee system

It is common to read attacks on the US sugar support system on the basis of the harm it does to former and current suppliers whose markets in the US have shrunk. Recently, however, an attack was made from within the US itself, in the *Amerop-Westway*

5 *Tate & Lyle News*, March 1985.
6 1985, 7, (8), 8-12.
7 F. O. Licht, *International Sugar Rpt.*, 1985, 117, 85.

Newsletter[8]. This claims that the US market quota and fee system, as it currently exists, is proving to be unworkable for all concerned. Refiners, exporters, industrial users and operators "are not prepared to predict or hedge in a market controlled by a government that has insufficient experience and data to properly predict or control an artificially-set supply and a demand ruled by economic factors. Projections of offtake have been inaccurate and the economic factors of the sweetener market have forced many traditional sucrose users to utilize HFS and alternative sweeteners.

"The sweetener policy is further dependent upon a finely tuned quota and shipping schedule. It assumes exporters will either withhold supplies from the market when prices are near or below the MSP (market support price), or that the shipping schedule will limit supplies sufficiently to provide an orderly market. This premise is inaccurate since the disparity in the US market level and the world market forces producers to ship sugars as quickly as possible. The current depressed state of the world economy in general—and of developing nations in particular—does not allow most exporters the luxury of withholding supplies or delaying shipment."

US Farm Bill[9]

The US Secretary of Agriculture has released details of the Administration Farm Bill, which comprises proposals aimed at a market-orientated program to allow farmers to rely more on market factors than on government for their income. The legislation also provides for an orderly transition from the present system over a period of time.

The major provisions of the Sugar Section of the proposed Act include the following: Beginning with the crop year 1986, commodity loans will be available at the rate of 12.00 cents/lb or 75% of the three-year moving average of US market prices, whichever is lower. Loans must be repaid in the same fiscal year as they are made to processors. Separate loan and target price rates are to be established for beet and cane sugar.

For crop year 1986 and thereafter a direct payment program to growers will be established and the payment rate will be the amount by which the "national season average" price is less than the higher of: (1) 75% of the "national season average" for the three fiscal years immediately preceding the crop year for which the payment is made, or (2) the "established price" (18.00 cents/lb for the 1986 crop year, 16.00 cents/lb for 1987, 14.00 cents/lb for 1988, 12.00 cents/lb for 1989 and 1990, and 75% of the three-year moving average US market prices in 1991 and thereafter).

Owing to the low world market price for sugar in recent years, the payment rate is phased down in 2.00 cent increments in order to provide an effective transition to a three-year moving average of US market prices. By dropping the loan rate to a maximum of 12.00 cents/lb for the crop year 1986 onward the risk to the Commodity Credit Corporation of being forced to take sugar in forfeiture would be substantially reduced in the light of these proposals.

To avoid making direct payments it would be necessary to maintain season average prices above the "established price"; this suggests that there would need to be a continuation of the quota system for the time being. Assuming national average prices are kept around the "established price" then, in effect, domestic production would decline and a corresponding increase could be expected in imports. The domestic price level would also decline, thus making sugar more competitive with corn sweeteners. Given the present depressed state of American agriculture, the Administration proposal is being widely criticized by both Democrats and Republicans. Most observers consider the ideas advanced to be more in the form of a base on which to build farm legislation rather than a Bill which would pass either House of Congress in its present form.

ACP supplies to the EEC[10]

A meeting was held recently between ministers from the ACP sugar exporting countries and the British Minister of Agriculture, who assured them that the British government remains fully committed to the Sugar Protocol of the Lomé Convention which guarantees access for a specific tonnage of preferential sugar without time limit. He said that the need to maintain a reasonable balance between cane and beet sugar interests during coming negotiations will be a major consideration for him.

The Guyana Minister of Finance and spokesman for the group said that sugar is the lifeblood of the major ACP sugar suppliers. It was particularly important as an earner of foreign exchange and as a source of employment. He added that there were few alternative economic acitivities open to most ACP suppliers and that great store was placed on the commitments to cane sugar expressed by British Ministers over the years. It was against the background of those assurances that the declining share of cane sugar in the UK market was so disturbing. He thought it pertinent to recall that the total of ACP quotas into the EEC has remained unchanged since 1975.

On the subject of the accession of Portugal to the European Community, he said that the cane sugar requirements of that country should be met from ACP sources and added that this would provide a unique opportunity to increase the total of ACP quotas. So far, all that the ACP countries appear to have been offered was 70,000 tonnes at world prices and on a temporary basis; this was totally inadequate in all three aspects.

8 1985, (135), 2-3.
9 C. Czarnikow Ltd., *Sugar Review*, 1985, (1735), 19.
10 *ibid.*, 20.

Sugar and alcohol—Copersucar and the Brazilian experience

The world knows that, alone of the major sugar producers of the world, Brazil has made a major diversification from sugar into the manufacture of fermentation alcohol to serve as an alternative to sugar when selling prices are low, to limit foreign exchange expenditure on petroleum products, and to provide a new exportable source of hard currency earnings. The program has succeeded admirably in all three aims.

A leader of this diversification is Copersucar—the Central Cooperative of Sugar and Alcohol Producers of the State of São Paulo. This group was formed in 1959 in order to organize cooperation among the many small sugar and alcohol producers in the state whose output was not profitably commercialized. By acting together these small companies have become a force to be reckoned with, able to influence sugar affairs, both Brazilian and international, in a way which was previously impossible.

At present, membership includes 66 sugar factories with annexed distilleries, two factories without distilleries, and 6 autonomous distilleries (those crushing cane and obtaining alcohol by juice fermentation without any sugar manufacuring capability). Of these 74 members, 60 are in São Paulo state and the others in Minas Gerais, Rio de Janeiro, Goias, Mato Grosso do Sul and Paraná states. Copersucar members produce approximately 40% of Brazilian sugar and 35% of the country's alcohol. Of about 8.5 million tonnes of sugar, tel quel, made in Brazil in the 1984/85 season, Copersucar members produced about 3.5 million tonnes, as well as 3400 million litres of alcohol out of 9000 million litres produced in the country.

The main function of Copersucar is the absorption, development and transfer of new technology to the member companies, through the Technical Centre which it established in Piracicaba in 1970. In addition to technical matters, the cooperative provides economic and accounting assistance and supplies, as well as acting as a lobby for the sector's interests. It owns the Companhia União de Refinadores which operates refineries producing 75% of refined sugar sold in the centre-south of Brazil as well as plants for roasting of green coffee. Copersucar is currently discussing the structure of the Brazilian sugar industry with the government.

The Technology Centre is located just outside the city of Piracicaba with a breeding station in Bahia and experimental areas in other states. An area of 3000 hectares is available for experiments, and the total labour force is 1000, including 120 graduates and 180 skilled technicians. Cane breeding is the most expensive part of the Centre's work, taking 40% of the budget, and a number of new varieties designated the SP series, have been released. Some of the varieties are especially suited to the low-fertility soils of some of the new cane lands in Brazil and give higher cane and sugar yields than the standard varieties which they are beginning to replace to a significant extent.

The Centre includes Departments concerned with agronomy, agricultural engineering, entomology, phytopathology, mechanical projects, industrial processes and industrial safety as well as a utilities department and central laboratory. It conducts research and development on soils, nutrition and fertilizers, farm planning, weed control, irrigation, disease and pest control, tillage and planting, design of cane loaders and other machinery, cane milling plant design and sugar manufacture, fermentation, distillation, alcohol storage, effluent treatment, bagasse drying, instrumentation, and laboratory techniques and instrumentation.

Standards have been developed for the sugar and alcohol produced by Brazil; in addition to the older criteria (colour, ash, pol, etc.), methods have been developed for assessing grain size, reflectance, absence of impurities, and use of these has spread among the Copersucar members and their customers. The alcohol program has meant that sugar is made from higher grade liquors, lower grades being fermented, so that sugar quality is generally higher than before the program. Most of Copersucar's output is produced as white sugar, with a small amount of raws. 25% of production is used by industry, 25% of the best quality is packed for retail, and some 50% of lower quality—about 300 ICUMSA colour—is sent for refining. Alcohol is produced in three qualities: anhydrous 99.3% ethanol, obtained by the benzene process and used mainly as an additive for gasoline; an industrial quality anhydrous alcohol; and the main product, 96% v/v or 92.3% w/w alcohol which is used directly as motor fuel. Consistent methods of analysis have been developed and are used throughout the member companies for quality assessment, records and payment. In 1984, 40% of alcohol production was exported, bringing an income of $150 million.

When the alcohol program was first instituted, all the alcohol was produced as anhydrous ethanol for mixture with gasoline and vehicles used in Brazil were adapted after the proportion rose beyond some 10%. The alcohol affected materials used in the previously gasoline-powered engines and there were a number of problems with, for instance, zinc alloys used in carburettors, plastic materials used as gaskets, etc. Motor manufacturers in Brazil collaborated with Copersucar and other Brazilian alcohol producers and methods were developed for overcoming the problems, for instance using a nickel plating on the carburettors and different plastic materials unaffected by alcohol.

Currently, some 70% of Brazil's cars, trucks and tractors use a blend of gasoline and 22% of anhydrous alcohol, while the remainder use ethanol alone as fuel. Almost all new vehicles (99.5%) are being made for use with alcohol alone, however, and it is

thought that there will be very few remaining gasoline-powered vehicles in 7-8 years time, and fuel will then be rather scarce for them. Some gasoline will still be needed, however, for the alcohol engines do not start as readily in cold weather and current vehicles have a small gasoline supply on which to start in such circumstances, after which the fuel supply is switched to alcohol. New methods such as a fuel heating system are being developed to overcome this need for gasoline but are not yet commercial.

The alcohol, weight for weight, contains only 65% of the energy of gasoline and the pump price is adjusted in this proportion. However, alcohol permits higher compression ratios in the engines and affords higher efficiency of power production so that in terms of fuel economy it gives 80% of the mileage of gasoline. With a price of 65% there is clearly an economic incentive for the consumer to switch to alcohol-powered engines and, since the early problems have been overcome, the alcohol-powered car is now the standard. Furthermore, alcohol now fuels trucks of all sizes and farm and industrial tractors. Only motor-cycles seem to be dependent on gasoline.

The adoption of alcohol has reduced Brazil's dependence on oil imports and no lead additives are now used; this and the cleanliness of alcohol as a fuel have resulted in 30% smaller amounts of incompletely burnt fuel entering the atmosphere although nitrogen oxides are about the same. Atmospheric pollution in Brazil's cities is markedly reduced by comparison with 1978 when the alcohol program (Proalcool) started. The program has had important effects on Brazil's society in other ways; it provides an anticyclical factor in circumstances of depression in the sugar industry. It has resulted, according to the F.A.O., in the creation of 500,000 jobs directly and a further 1.5 million indirectly. Food crops are now grown between the last ratoon harvest and the planting of a new cane crop, while the infrastructure of the country has improved where new lands have been brought into cultivation. There has been some complaint that too much land is being devoted to cane instead of food crops but statistics show that only a small proportion of cultivated land is devoted to cane, with much more to maize and other crops.

Alcohol use by Brazilian industry as a raw material for synthesis started in 1920 with the manufacture of ethyl chloride as a perfume spray and later in plastics and paints. In 1975 some 50 million litres were used as raw material but by 1984 this had grown to 500 million litres. Products are based on ethylene and acetaldehyde, both produced from alcohol at a cost competitive with oil-based manufacture. Discussion is taking place on the location of new plants; it is of advantage to be near a source of chlorine for the manufacture of PVC, for instance, while location near a sugar factory/distillery reduces transport costs and the plant can benefit from process steam and electricity generated in the factory.

People from other countries will have the opportunity of learning about the Brazilian experience with sugar and alcohol manufacture and use at the International Symposium which is being organised by Copersucar in June of this year, announced in our February issue. Participants will gather in São Paulo and will be welcomed by a representative of the new Brazilian government on the morning of June 24. The keynote speech will be made by the President of Copersucar after which the first session will be devoted to discussion of the role of government in the sugar and ethanol industry, with contributions by invited speakers from Australia, the EEC, Japan and South Africa. The sugar and alcohol policies of Brazil, the US and Latin America and the Caribbean will be described and discussed during the afternoon.

The theme for the second morning will be the outlook and 1985-1990 projections for sweeteners, including sugar, corn syrups, aspartame and others including non-caloric sweeteners. The overall implications of these projections and the prospects for the white sugar market will be discussed, while in the afternoon the Brazilian point of view in regard to an International Sugar Agreement will be presented and an analysis given of the effects of national policies on international sugar and alcohol markets. A senior executive of Coca Cola has been invited to provide the user's point of view on sugar market prospects, while Prof. A. J. Vlitos has been asked to speak on the myths and fallacies concerning sugar.

The role of ethanol in the European and US oxygenate markets is to be discussed on the morning of June 26, as are the possibilities for governmental ethanol as a fuel in countries other and the Caribbean, and the role of enthanol as a fuel in countries other than Brazil. In the afternoon, the impact of ethanol production on the sugar market will be discussed as will be the commercialization and distribution of ethanol in international trade. Thereafter a round table panel including representatives of the US Environment Protection Agency, São Paulo State Pollution Control Agency, the Brazilian automotive industry, the World Bank, Dupont, the Petrobrás research centre, and the Brazilian National Alcohol Commission will discuss the technical and economic feasibility of octane enhancer alternatives.

On the following morning, senior members of the Brazilian government, the Copersucar Board of Directors, and representatives of the Brazilian equipment manufacturers and the Brazilian chemical and automotive industries will present papers on the national alcohol program as a tool of economic policy, the roles of ethanol producers, equipment manufacturers and car producers, new uses for ethanol in the chemical industry and the logistics of the Proalcool program,

followed by a general debate. The afternoon will be taken up with a debate on the question "Is an ethanol program feasible in other countries?" with invited speakers who will argue "It is!" and others "Is it?".

On the following day, a range of optional visits will be arranged, including one to the Technical Centre, to a sugar factory/distillery, etc.

The centre for the Symposium will be the Maksoud Plaza hotel in São Paulo, a 5-star luxury hotel with all modern facilities. The fee for the Symposium will be $300. or $350 after May 20; this will include all the meetings, luncheons, gala dinner and the visit to Piracicaba, etc. Further information and a reservation form are included in the Copersucar advertisement in this issue.

The sugar refining process at the rebuilt Arlöv refinery in Sweden

By Gert Å. Åkesson and Kaj A. Lilja

(The Swedish Sugar Company)

Introduction

During the 20th century, the Swedish sugar industry has passed through extensive structural changes, with the result that, today, there are six white sugar factories, one raw sugar factory and one refinery. Imports of cane raw sugar vary between 0 and 15% of consumption in Sweden, depending upon the harvest yield. This sugar is refined in Arlöv, together with raw sugar from one of the beet factories; the other beet factories manufacture white sugar.

In 1979, the year when the decision to rebuild the refinery was taken, the old plant was in poor condition and had not kept pace with technical developments. Staff, energy and maintenance costs were very high and the working environment did not come up to modern requirements. Change was necessary and, after a lengthy period of examination and report, two alternatives remained for continued operations: these were to rebuild the raw sugar factory so that it produced white sugar during the campaign and operated as a refinery during the intercampaign seasons, or to modernize the refinery in Arlöv.

The second alternative was chosen for the following reasons:

(a) lower total costs (investment plus operation),
(b) workforce difficulties at the beet sugar factory, which is located in the countryside with poor access to labour, and
(c) better flexibility in adapting to meet variations in the beet harvest.

Planning

The objectives for the "new" refinery were as follows:

(a) The nominal capacity is 600 tonnes/day.
(b) The refinery is to produce one quality of white sugar from which the manufacturing and packaging divisions produce different end-products.
(c) Low investment costs. As a result of the low capacity, capital costs will be a large item in the total refinery costs. Thus, we cannot invest to the same extent as would a larger refinery to attain high sugar yield and low energy consumption.
(d) The equipment is chosen so that the individual units will be as large as possible. This leads to lower investments, less maintenance and simpler operational supervision. The disadvantages are severe disturbances if one of the units fails, and the uneven energy consumption (large vacuum pans).
(e) Only one process line through the refinery. Thus, we have chosen to refine one raw sugar type at a time and to be able to produce only one product—white sugar. Once again the goal here is low investment costs.
(f) High degree of automation. All staff should be able to work in a control room.
(g) No excess sweet-water. In the old refinery, a great deal of energy was consumed in evaporating sweet-water.
(h) Energy recovery.

Control systems—Principles

Our point of departure was that all processes could be "run" from control rooms, i.e. no staff were to be placed out at the machinery. Because of the layout of the premises, we were forced to have two control rooms. Control room 1 is for the processes from the raw sugar intake up to and including the ion exchanger. This control room is placed on the centrifugals level, for which reason the centrifugals operator is also placed here.

Control room 2 is for the processing from the evaporator to the sugar dryer. This control room is placed by the vacuum pans and here, the major

Condensed from a paper presented to the 43rd Ann. Meeting, Sugar Industry Technologists, 1984.

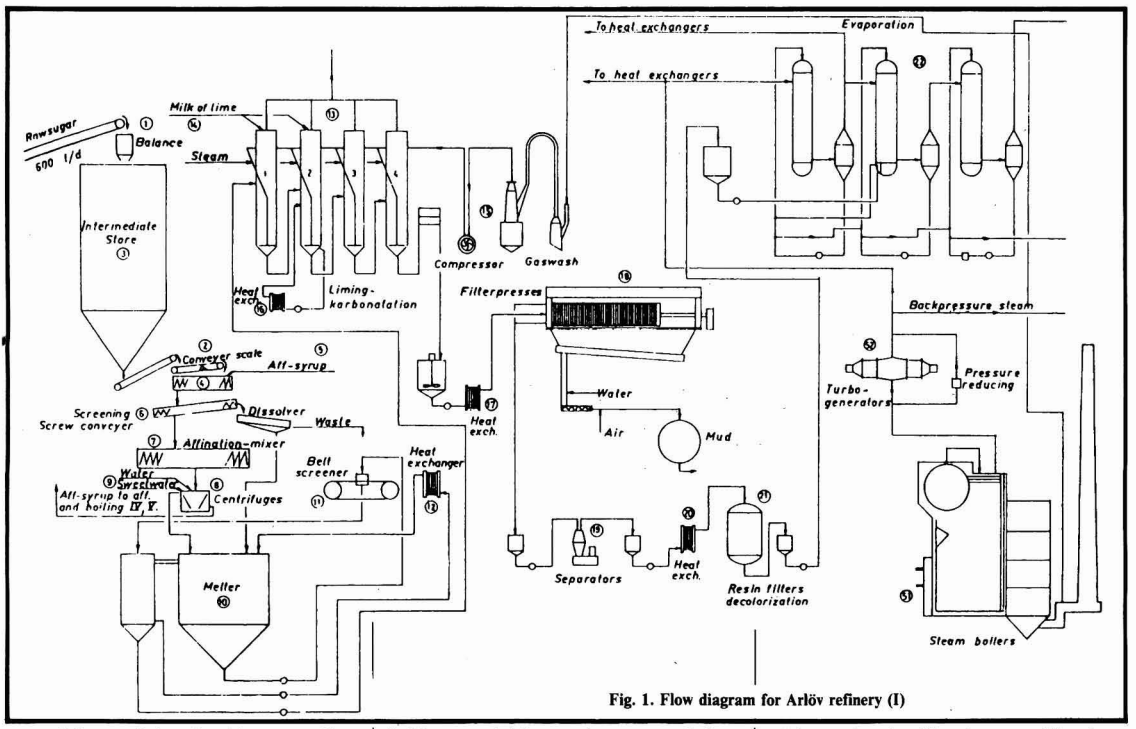


Fig. 1. Flow diagram for Arlöv refinery (I)

part of the work involved is, naturally, crystallization.

Control room 1 is built with programmable control and conventional regulators, while control room 2 is provided with two Siemens Teleperm M computers for regulation and control. We intend to place the recording of data, optimization calculations and the like in a separate computer which we are in the process of installing. All measurement values in the refinery process, energy process and laboratory will be handled in this computer and presented in the form of process images, time curves and reports. We will also be able to receive optimization calculations and recommended operational values.

Affination and melting

This is illustrated in Figure 1. The raw sugar is weighed on a container scale 1 and is placed in an intermediate container 3. From this the raw sugar is fed by a variable-speed conveyor belt to a conveyor scale 2 which controls, by proportional regulation, the amount of syrup to the affination mixer 4. The magma is screened in a screen trough 6 which consists of a screw conveyor with a perforated baseplate. The magma runs down into the mingler 7 and sugar lumps and foreign matter are conveyed to a small melter where the impurities are separated off. The level in the affination mingler is held constant by regulating the speed of the feed conveyor.

In the selection of affination centrifugals, we discussed continuous machines. We knew that such centrifugals were in operation at some factories, but that no-one was really satisfied with them. The greatest problems seemed to be the working life of the screens. However, we decided to test a continuous centrifugal and installed a BMA K1100 unit in parallel with our batch affination centrifugals. Not surprisingly, we encountered problems with the working life of the screens; on occasions they lasted only a few days, but this problem disappeared completely when we installed the above-mentioned trough 6.

Having solved the purely mechanical problems, we could concentrate on comparing the technological results of continuous and batch centrifugals.

We found that the affination effects were equal when using the same amount of washing water. This applied both to beet raw and cane raw sugar (see Table I). As expected, the continuous centrifugal was capacity-dependent; at 15 tonnes of magma per hour, the effect began to decline and at 20 tonnes/hr, it was unacceptably low. Hence, maximum capacity lay between 15 and 20 tonnes of magma per hour.

The Brix of the affination syrup was

Table I. Affination efficiency of continuous and batch centrifugals

		Capacity, tonnes/hour	*Affined sugar colour*	*Syrup Brix*
Cane raw sugar, colour 1447 units	Continuous centrifugals	11.3	538	68.6
		14.6	661	68.8
		18.0	858	70.0
	Batch centrifugals	12.4	571	70.4
Beet raw sugar, colour 450 units	Continuous centrifugals	11.3	75	68.6
		14.6	68	69.2
		18.0	76	69.2
	Batch centrifugals	14.8	76	70.6

approx. 2 units lower than for the batch centrifugal, but we believe that this is of no importance to yield, since the amount of washing water supplied is the same. The syrup purity was equal for both centrifugals.

After these tests, we opted for continuous centrifugals and installed three BMA K1100 machines with provision for dissolving in the centrifugal. They operate at a speed of 1150 rpm, and the cone angle is 30°, while the screen has holes 0.9×2.3 mm. The reasons for this choice were: considerably lower investment costs, lower operational costs (staff), considerably lower maintenance costs, a more even flow rate through the affination melter (significant for the smaller refinery), and lower investments in melters.

After 3 years operation, we have gained the following experience:

(a) The affination effect is good. We use as our standard affination in a laboratory centrifuge where the sugar is "washed out" and have always attained as good results in operation as in this laboratory centrifuge. On two occasions, when we have received cane raw sugar with a wide distribution of crystal size, we have attained up to 15% better affination effect in the continuous centrifugals than in the laboratory centrifuge.

(b) A major problem has been that the bagasse from certain cane raw sugar became attached to the under screen, with the result that it was necessary to flush the centrifugals once or twice per shift.

Carbonatation

This is the only process station which we have retained from the old refinery. It consists of four tanks each of 7 m^3, giving a residence time of 40 minutes. Lime is added to tank 1 in the form of $Ca(OH)_2$, and CO_2 is supplied to all four tanks. The carbon dioxide is in the form of the flue gases from the boilers which have been washed in a gas scrubber and compressed. By regulating the amount of carbon dioxide, the pH level is controlled to a predetermined value in each tank.

Filtering

We have installed two large chamber filter presses made by Ritterhaus und Blecher, each with 285 m^2 filter surfaces and 129 filter plates. The press-cakes are sweetened-off in the filter press, which requires less equipment and gives less sweet-water which is also cleaner.

In the refining of beet raw sugar, the cycle length is 700-800 m^3, and cane raw sugar 250-300 m^3. This corresponds to 1 day or 1 shift, respectively, so that sweetening-off and emptying require a minimum of work from the staff.

Emptying is effected automatically in that the plates are "leafed-through" but one operator must be present during this operation, which takes approx. 30 minutes. The press-cakes which, particularly with cane raw sugar, are very dry, are mixed with a small amount of water and pumped out of the factory for disposal.

Separators

Instead of safety filters after the main filters, we chose separators 19. The idea was that we would then avoid the operational disturbances caused by blockage of the safety filters when the main filter allows the passage of turbidity. This is achieved but only in cases of turbidity up to 300 ICUMSA units. With more severe turbidity, the slurry will stay in the bowl of the separator, causing vibrations, in which case the separator must be stopped and emptied, i.e. the same problem occurs as in safety filters.

We now believe that the correct quality of cloth in the main filters gives such a high degree of filtering that safety filters are not necessary. We regularly have turbidities of 10-20 ICUMSA units.

We have tested an in-line turbidity meter with very favourable results and now intend to mount it immediately after the filters, so that a rapid warning will be provided if turbidity occurs.

Ion exchanger

The ion exchanger was the first process rejuvenation to be effected at the refinery. The installation was put into operation in February 1980 and replaced a bone char station with 215 m^3 adsorbent in 24 cisterns.

The ion exchanger station 21 consists of three parallel filters with 7 m^3 of resin in each. Two filters are in operation whilst the third is being regenerated or on stand-by. The ion exchanger is a strongly basic anion resin of the acrylic type. Sweetening-off is fractional and backwashing is effected in the filter container. Regeneration is carried out using an alkaline (0.5% NaOH) 10% NaCl solution at 80°C. Fig. 2 shows the decolorization since 1981.

We also have an older "semi-automatic" ion exchanger which was used for polish decolorization after char in the old refinery. This consists of three filters with 5 m^3 ion exchange resin of the polystyrene type in each and was intended to be put in as a second stage after the new ion

THE KONTI 12-DCH

- With built in sugar melter
- With inner heating system
- With stainless steel curb

- With automatic feed-control
- With automatic Bx-control
- With syrup separation

HEIN, LEHMANN AG

Abt. Massentrennung · Fichtenstr. 75 · D-4000 Düsseldorf 1 · P.O.B. 4109 · Telefon (0211) 73501 · Telex 8582740 hld

INSCRIPTION FORM

1 - IDENTIFICATION

Surname/Name

Company/Organization

Position | Name for Badge

Address | City

ZIP Code | State/Province | Country

Telex nº | Telephone nº

IDENTIFICATION OF ACCOMPANYING PERSON

Surname/Name

Name for Badge

2 - INSCRIPTION FEE

	PARTICIPANT	ACCOMPANYING PERSON
UP TO MAY 20,'85	US$ 300.00	US$ 100.00
AFTER MAY 20,'85	US$ 350.00	US$ 120.00

SUB-TOTAL ..... US$ _____

3 - HOTEL RESERVATION

DATE OF ARRIVAL / / | DATE OF DEPARTURE / /

HOTEL	SINGLE	DOUBLE
☐ **MAKSOUD PLAZA***** (Symposium held here)	☐ US$ 85.00	☐ US$ 90.00
☐ CAESAR PARK*****	☐ US$ 72.00	☐ US$ 77.00
☐ SÃO PAULO HILTON*****	☐ US$ 72.00	☐ US$ 79.00
☐ BRASILTON*****	☐ US$ 61.00	☐ US$ 68.00
☐ FIRENZE***	☐ US$ 20.00	☐ US$ 25.00

SUB-TOTAL ..... US$ _____

GRAND TOTAL (inscription fee + 1 day stay) US$ _____

Send Inscription Form and Nominal Check to Copersucar for: Copersucar International Symposium on Sugar and Alcohol.
Rua Boa Vista, 280 - 7º andar - 01014 - São Paulo - SP - BRAZIL. No refundings will be made after June 10, 1985.
Remittance of Check and Inscription Form implies that the subscriber is aware and in agreement with the program of the Symposium.

DATE _____ SIGNATURE _____

INFORMATION

1 - Copersucar International Symposium on Sugar and Alcohol
June 23 to 28, 1985 - Maksoud Plaza

2 - What is included?
Inscription to the Symposium will entitle participants to the following:
- Opening cocktail
- Lunch meals during the event
- Gala dinner
- Visit to Copersucar's Technology Center in Piracicaba City
- Pre - and Post-Event publications
- Folder with materials concerning the Symposium

3 - Program for Accompanying Persons
The special program for Accompanying Persons will comprise social and touristic activities in São Paulo City and at seaside resorts in São Paulo State.

4 - Hotels
Daily rates of hotels suggested include:
- breakfast
- service charge

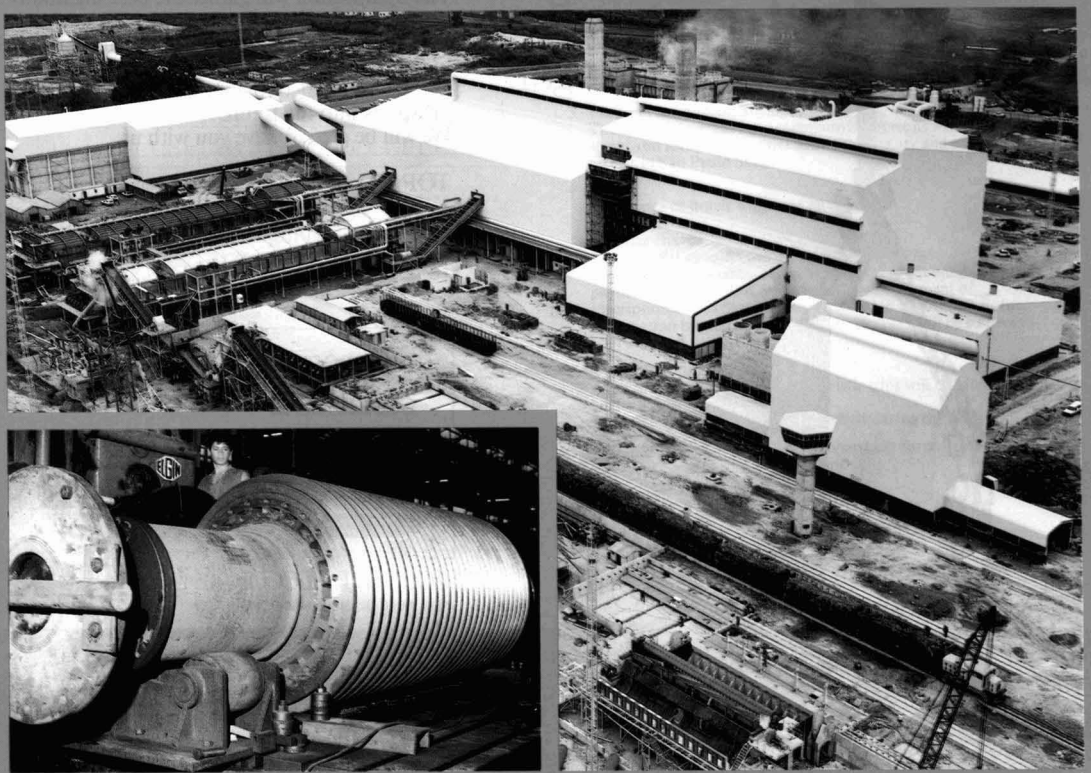
Reservations should be made up to May 20, 1985.
For reservation guarantee, participants are requested to provide payment for one (01) day stay jointly with payment of Inscription Fee to Symposium, as stated in Inscription Form.
Reservation requests paid after May 20, 1985 will be subject to confirmation.

5 - Tours after the Symposium
After the Symposium, several touristic trips will be offered to participants.
Informative brochures will be supplied during the event.

6 - For further details, contact the Copersucar International Symposium on Sugar and Alcohol.

Rua Boa Vista, 280 - 7º andar
Phone (011) 229-0611
Telex: (011) 23164 CPA - BR
São Paulo - Brazil.

WE RECORD OUR SUGAR ACHIEVEMENTS



Elgin Engineering (Pty) Ltd
3 Clydebank Road, Bayhead, Durban 4001
P.O. Box 301, Durban 4000, South Africa
Telephone:
National (031) 251461 International +27 31 251461
Telex 62-2116 SA
Telegrams & Cables 'Panelgin' 'Girders'

A Member of the Murray & Roberts Group M&R

ELGIN

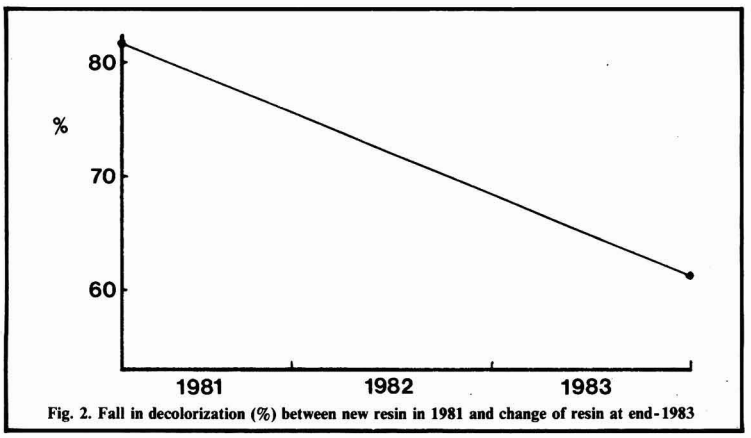


Fig. 2. Fall in decolorization (%) between new resin in 1981 and change of resin at end-1983

exchanger. However, we decided to test another process arrangement in which the smaller ion exchange station is used for decolorization of the remelt sugar from the 2nd and 3rd crops (Fig. 3).

This remelted sugar had caused us problems, particularly when refining beet raw sugar. Remelt pumped to the first melt had a colour of 2000 as against the 300 units of the affined sugar. This resulted in variable melt colours. By decolorizing separately to 500 ICUMSA units, we could use the 2nd and 3rd crop remelt for golden syrup instead of fine liquor, thereby reducing the load on the juice purification and decolorization stations.

The system has proved to operate very well as regards beet raw sugar in which one decolorization stage after the juice purification is fully sufficient. It is simpler to maintain exact control over juice purification and decolorization when no remelted sugar of varying quality is admixed. As far as cane sugar is concerned, the system is of more doubtful viability, since one decolorization stage is too small. Hitherto, we have been successful since the cane raw sugar which we have used is of good quality.

Evaporator

The decolorized juice is evaporated in a three-stage falling-film evaporator 22 from approx. 65° Bx to 75° Bx. The capacity is approx. 8 tonnes of water evaporated per hour.

(to be continued)

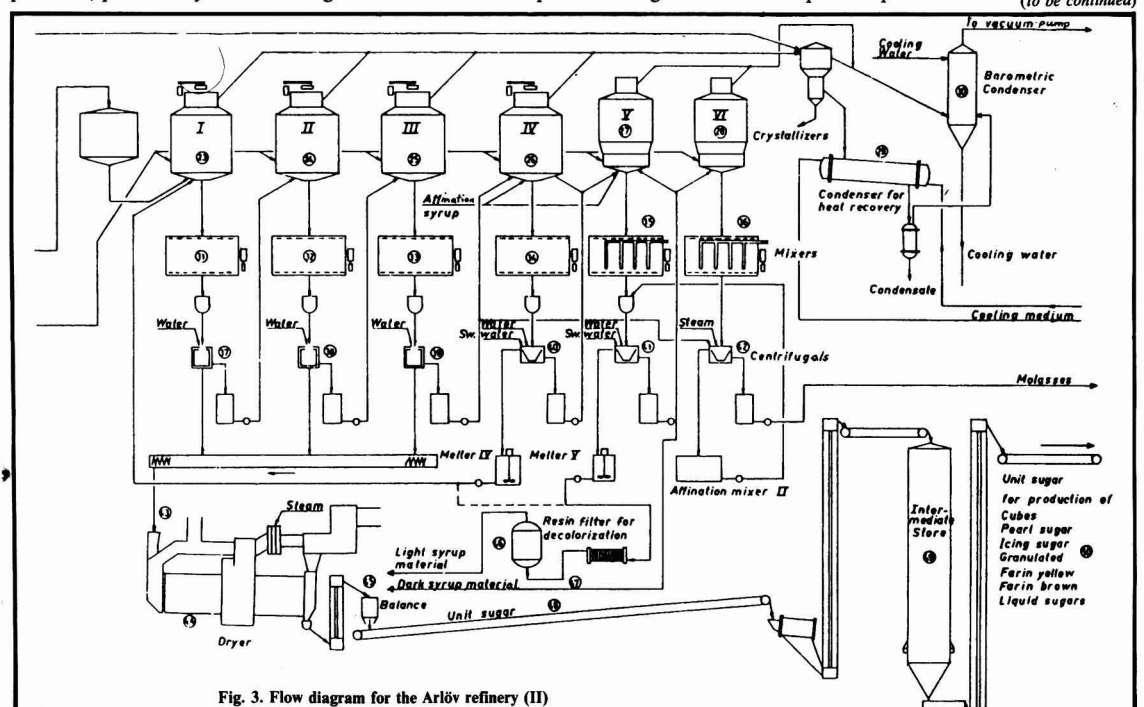


Fig. 3. Flow diagram for the Arlöv refinery (II)

Performance evaluation of a coal fired fluid bed for pulp drying

By D. C. Hogan, R. J. Parker and J. D. F. Wilkie

Introduction

British Sugar wished to obtain operating experience with fluid bed combustion as this technology could have relevance to future coal-fired plant or for conversions of existing plant. Fluid-bed combustion uses a bed temperature of the order of 900°C and is thus an ideal heat source for pulp drying applications.

A small unit was proposed, therefore, for use on an existing 2.0 m pulp dryer at Brigg factory for performance evaluation and to obtain this operating experience.

Specification and performance expectations

The existing pulp dryer had a design heat input of 10.72 MW although this full heat input was not normally fully used. The specification for the fluid-bed Hot Gas Generator (HGG) called for a heat input of 11.72 MW and the maximum utilization of flue gas circulation. The final gas temperature was to be 950°C but sufficient recycle gas was to be provided to reduce this temperature to 900°C at full load. Turndown is limited on a single-zone fluid bed and in this case a turndown of 2:1 was considered adequate, as it would be just one of four dryers. The HGG was to be suitable for installation outside the building with the hot gases ducted into the building and connected to the dryer just before the bullring. This ensured that the existing combustion equipment was available for use if required, with a minimum of preparation work.

The proposed manufacturer considered that this specification could be met and that the following additional operating parameters were anticipated:

(a) The HGG could operate with an excess air level as low as 10%, subject to the elimination of air ingress into the dryer system.

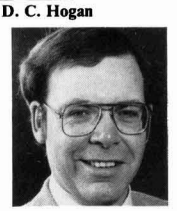
(b) The carbon carryover from the fluid bed into the pulp dryer would be of the order of 3%.

(c) The sand make-up requirements would not exceed 8 kg/tonne of coal.

(d) The bullring temperature would not vary significantly either from side to side or top to bottom of the bullring.

D. C. Hogan

R. J. Parker



J. D. F. Wilkie

Description of plant

The HGG is a rectangular box, approximately 4 m long x 3 m wide x 6.25 m high, lined throughout with cast refractory approximately 300 mm thick. Fitted in the bottom of this chamber is an air distribution system comprising pipes blanked at one end and with a series of holes drilled along their length. These pipes, usually called sparge pipes, are carefully spaced along the length of the chamber and extend across the full width to ensure even air distribution.

The open ends of the sparge pipes are connected to a refractory-lined plenum chamber fitted to the outside of the HGG as shown in Figure 1.

The plenum chamber is a tapered cylinder blanked at the small end and with connexions at the larger end for combustion air and recycle gas. An oil-fired preheat burner, having a heat output of 1.76 MW, is also fitted to the large end of the plenum chamber.

The bottom of the HGG is filled with sand, having a grain size of between 1 and 2 mm, to a height of approximately 250 mm above the top of the sparge pipes. Three thermocouples are fitted into this bed of sand in order to measure the bed temperature when in operation.

Fitted just above the sand bed are the two coal feeders each comprising a water-cooled fixed-speed scroll and a variable-speed scroll. The fixed-speed scrolls are connected directly to the HGG while the variable-speed scrolls feed into the fixed speed scrolls and are used to control the coal feed rate. The variable-speed scrolls draw their coal from the service hopper through coal shut-off gates. An arch breaker is fitted into the bottom of the service hopper to prevent the coal bridging or giving an uneven coal feed.

Purge air connexions are provided on the fixed-speed scrolls to prevent gases from travelling back along the screw, as the HGG operates at a slight positive pressure at full load.

Three secondary air injection points are fitted on each long side of the HGG just above the level of the coal feeders.

Paper presented to the 27th Tech. Conference, British Sugar plc, 1984.

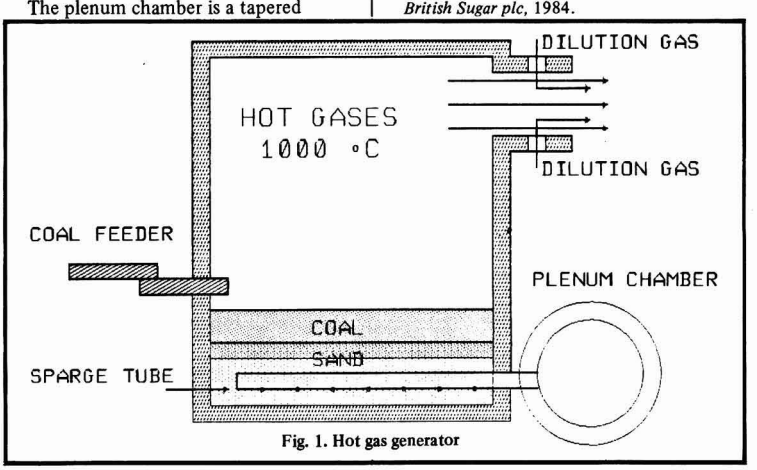


Fig. 1. Hot gas generator

ISJ Abstracts

Cane sugar manufacture

A new pilot crystallizer for massecuite exhaustion trials

R. Broadfoot and K. F. Miller. *Proc. Australian Soc. Sugar Cane Tech.*, 1984, 287-292.

A small-scale crystallizer developed by the Sugar Research Institute for investigations of low-grade massecuite exhaustion is described. Constructed as a free-standing, separate module with all items, apart from the stand, made of stainless steel, the crystallizer has a capacity of approx. 3.5 litres of massecuite; the vertical reservoir is surrounded by a water jacket and houses a top-mounted helical stirrer which is normally fully submerged in the massecuite to minimize entrainment of air, while moisture evaporation is kept to a minimum by the vertical arrangement of the reservoir. The massecuite temperature is regulated by a programmable controller. The stirrer normally operates at 1.8 rpm. The bottom of the stirrer shaft is located in a recess in the top of a removable cone which is screwed into the base of the crystallizer; the cone occupies a region in which the massecuite would otherwise be poorly mixed. At the end of an exhaustion test the cone is removed and a water-jacketed tube for pipeline viscosity measurement inserted in its place. Intermediate massecuite samples can be obtained by removing a plug in the base of the crystallizer. The value of the unit in assessing factory crystallizer performance, predicting exhaustion and determining the influence of pan additives on sugar recovery is discussed. Two of the experimental crystallizers have been built, and some results are reported. Close agreement between factory and pilot crystallizer molasses purities is shown: in one factory it was about 1 unit, in another about 4 units; the condition of the massecuite when dropped from the pan may have an effect on differences in exhaustion. Poem Z-200 massecuite additive was found in tests to have no effect on low-grade boiling or cooling in terms of molasses exhaustion, despite a positive indication obtained in previous factory experiments.

Characteristics of conductivity transducers for pan control

P. G. Wright. *Proc. Australian Soc. Sugar Cane Tech.*, 1984, 301-307.

The principles of good control of supersaturation and crystal content during the feeding period of boiling are outlined, and the value of electrical conductivity as an indicator of both variables is discussed. Recent laboratory work at the Sugar Research Institute has shown that the mother liquor conductivity of one type of molasses could be correlated by the expressions: $\log_{10} C = -1.8802 + 0.0223\,P + 0.0213\,T - 0.000193\,S^2$, where C = molasses conductivity (mS/cm), P = molasses true purity in the range 50 - 80, T = molasses temperature in the range 30 - 75°C, and S = molasses saturation temperature (°C). A graph of conductivity *vs.* mother liquor purity at 60°C shows a marked variation in the conductivity at saturation with purity. For raw sugar crystals of typical shape, massecuite conductivity is approximately equal to that of the mother liquor multiplied by $(1.0 - kc)$, where k = a factor allowing for the effective volume of crystals relative to their impedance to flow of electrical current in the massecuite, and c = massecuite crystal mass fraction; combining the conductivity equation and the crystal content effect permits calculation of the variations in conductivity during boiling. Tabulated calculations appear to follow the trend of Cuitometer readings; a graph of crystal content *vs.* supersaturation for a mother liquor of 80 purity indicates that a 2.0% (absolute) change in the crystal content has approx. the same effect on conductivity as a 0.01 change in the supersaturation coefficient. The sensitivity of conductivity to other effects is indicated. Results for *A*-, *B*- and *C*-strikes in a batch pan show the trajectory of conductivity values throughout the strikes and give an idea of the optimum "ramping" of conductivity controllers to give a "reasonably" optimum control sequence.

Tests on the defoaming ability of additives for sugar boiling

K. F. Miller. *Proc. Australian Soc. Sugar Cane Tech.*, 1984, 309-313.

Details are given of a laboratory technique for evaluation of the performances of anti-foam agents for use in pan boiling. Kemotan S20, a sorbitan monolaurate, gave the fastest defoaming rates with the molasses solutions used, but is relatively expensive (although an unbleached version is available at a lower price and would be expected to perform well). Other anti-foam agents rated as "good" included Kemmat S80 (a sorbitan monooleate) and glycerol monooleates; others that gave only moderate or poor foam dispersal rates are indicated.

The density meter—a new approach to measuring Brix

W. P. P. Abeydeera. *Proc. Australian Soc. Sugar Cane Tech.*, 1984, 325-332.

A model DMA-45 precision density meter was tested for Brix measurement. The instrument consists of an oscillator in the form of a hollow U-shaped glass tube mounted in the centre of a constant-temperature, double-walled glass cylinder, the space between the tube and the inner wall of the cylinder being filled with a gas of high thermal conductivity to ensure rapid temperature equilibration. The tube is electromagnetically excited to vibrate at its natural frequency at a given temperature. Introduction of a sample changes the frequency as a result of the change in mass of the oscillator, so that the period of vibration T becomes a function of the mass of the tube and

hence of the density of the sample inside it. A built-in timer measures *T*, while a microprocessor-based calculator, which stores in its memory the values of constants *A* and *B* (temperature-dependent constants accounting for the volume, spring constant and mass of the oscillator), converts the digital output of the timer to density readings. The program is continuously repeated every 2 seconds and the result registered on a digital display. Comparison of Brix readings by the instrument was made with pycnometer, Brix spindle and refractometer readings for pure sucrose solutions, raw and diluted juice, diluted final molasses and diluted *C*-massecuite. Results indicated excellent agreement between the DMA-45 and pycnometer readings, very close agreement with the Brix spindle in the case of raw juice and pure sucrose solutions (but a greater discrepancy for low-purity samples which was attributed to inherent errors in the hydrometer technique) but extremely poor agreement with refractometer readings except in the case of pure sucrose solutions (the much higher Brix readings of the DMA-45 being ascribed to measurement of any suspended or insoluble material as well as dissolved solids, whereas the refractometer measures Brix mainly in terms of dissolved solids). Advantages and disadvantages of the density meter are discussed; a major advantage is the ability to measure samples flowing through the cell, which makes the instrument very suitable for use in automatic control systems.

Rotary vacuum filter design

D. J. Hale and O. L. Crees. *Proc. Australian Soc. Sugar Cane Tech.*, 1984, 315-324.

A vacuum transmitter was mounted on the inside surface of the drum of rotary filters at five sugar factories in investigations of the effect of the static head of liquid in the internal piping and of flow restrictions in internal and external pipework on operation. Results, which are discussed, showed that the measurement of vacuum behind the filter screen is an extremely useful aid to diagnosing leaks and flow restrictions. It is emphasized that the studies are only preliminary and limited to qualitative aspects.

A rotating biological contactor for treatment of sugar mill wastes

R. Sadler, P. Carson and B. Rigden. *Proc. Australian Soc. Sugar Cane Tech.*, 1984, 343-349.

A rotating biological contactor (RBC) consists of a series of discs on a horizontal shaft rotating in a horizontal tank through which effluent passes; the discs act as a medium for microbial growth and rotate typically at 2-5 rpm so that 40% of their surface area is immersed in the effluent at any one time, while the remaining 60% may be open to the air or enclosed in an atmosphere of oxygen or compressed air. The RBC has the advantage of being able to withstand shock loadings. Following successful laboratory and field-scale trials using model RBC units, a 330-litre pilot plant containing 28 1-m diameter discs in four banks of seven was constructed for use as a pretreatment stage at Millaquin sugar factory; the tank, of semicircular section, was 1.5 m long, with a 75-mm clearance being provided between the tank and disc edges. The discs, each of which was isolated from the others by baffles, rotated at a peripheral velocity of 3.14 m/min, and the effluent was fed at rates between 1 and 6.5 litres/min. Osmocote was used as a slow-release nutrient source. Results of trials showed a COD reduction of up to 70.3% at an initial level of 9696 mg/litre and a loading of 32.53 $g/m^2/hr$.

Auto cane carrier drive

K. P. Venkatagiri and M. Sengottaian. *Maharashtra Sugar*, 1984, **9**, (7), 71-74.

An outline is given of a system for automatic control of the speed of the cane carriers at the authors' sugar factory; the control parameter is the level of the cane in the feed chute to the No. 1 mill.

A new concept in drying of bagasse (getting process steam as by-product)

K. S. G. Doss. *SISSTA Sugar J.*, 1983, **9**, (4), 2 pp.

The new concept consists in using superheated steam to reduce the bagasse moisture content, compressing the vapour and using most of it as process steam (a small amount being recirculated for production of the superheated steam). It is calculated that some 10-15% process steam on cane could be obtained, and about 5-7% of the bagasse (on cane) saved by "complete" drying from 50% moisture.

New developments in sugar mill repair and maintenance

N. S. Gopalakrishnan and N. K. Garg. *SISSTA Sugar J.*, 1983, **9**, (4), 3 pp.

Cane roller surface regeneration by arc-welding is discussed, and brief mention made of a new type of cane knife which provides good cane preparation at low cost.

Energy management through upgraded thermal insulation

P. S. Rajkumar and K. S. S. Kumaran. *SISSTA Sugar J.*, 1983, **9**, (4), 2 pp.

The reduction in heat loss that may be achieved by suitable insulation is briefly discussed.

Low-purity low-grade massecuite: working results of a continuous centrifugal

T. S. Thiyagarajan. *SISSTA Sugar J.*, 1983, **9**, (4), 25 pp.

The performances of NK 1100 continuous centrifugals as installed for low-grade work at Amaravathi Coop. Sugar Mills Ltd. are reported with the aid of tabulated data. The machines have been found to give lower molasses losses and consume less power than previous batch machines.

The new sugar grades

M. Anand, P. J. A. Rao, V. B. Rao and C. Chandrasekaran. *SISSTA Sugar J.*, 1983, **9**, (4), 7 pp.

Various aspects of the new sugar grade system introduced in India for the 1984/85 season are discussed. The previous five standard sizes have been reduced to three (average crystal size of 1.7, 1.18 and 0.6 mm) and the two colour grades of 29 and 30 retained.

Discharge of effluent gas

A. Sakdowoh. *Gula Indonesia,* 1983, **9**, 844-852 (*Indonesian, English*).

The use of a forced-draught system for boiler flue-gas discharge at Tasikmadu sugar factory is described, with an indication of its advantages and disadvantages.

Balance between steam production and consumption

–. Mashudi. *Gula Indonesia,* 1983, **9**, 865-868, 870-876 (*Indonesian, English*).

The author gives advice on how to reduce steam consumption and increase cane crushing capacity at a constant boiler output. A scheme for improved condensate processing is included.

Material balance of a milling station

R. Moch and T. Soemohandojo. *Gula Indonesia,* 1983, **9**, 877-894 (*Indonesian, English*).

Calculation of a cane mill balance is described, and its use demonstrated in the case of a system comprising two sets of knives and five mills.

A method to overcome a slip in the mills

–. Aspani and –. Mashudi. *Gula Indonesia,* 1983, **9**, 906-911, 929-931 (*Indonesian, English*).

Where a crusher has been replaced with a Unigrator, cane preparation is such that mill slip increases. The authors describe experience at Prajekan sugar factory which has shown that the problem can be overcome by making changes to the angle of slope of the feed plate, to the diameter of the feed roller, to the ratio between the feed opening and the delivery opening and to the distance between the feed roller and the top roller. Results obtained in 1983 are reported.

Level fluctuation in boilers

S. M. Sobrinho. *STAB,* 1984, **2**, (4), 38-42 (*Portuguese*).

For proper boiler operation, the level should be regular, but fluctuations occur owing to lag in control response of the feed pump and to operational factors such as the amount of impurities and foam formation in the feed water, etc. The latter can be overcome by using pure feed water or, as a palliative, by treatment with alkali, and a detailed account is given of a control system and its operation to avoid fluctuations.

Hydraulic pressure in the mill

D. G. Santiago. *STAB,* 1984, **2**, (4), 43 (*Portuguese*).

As part of a renovation or expansion program for sugar factories it may be considered appropriate to fit hydraulic pistons of larger diameter in the mill headgear. The author points out that, for instance, fitting pistons of 14 in rather than 12 in raises the force applied and the hydraulic pressure by 36%; this brings the specific hydraulic pressure above recommended levels and increases the mill's power consumption by the same extent, which makes its normal operation difficult. The need for careful study of such changes in equipment so as to achieve successful operation is emphasized.

Technological development and milling administration at Usina Barra Grande

J. E. de Almeida. *STAB,* 1984, **2**, (4), 50-52 (*Portuguese*).

A table is presented showing changes made in the milling trains at Usina Barra Grande during the six seasons 1978/79 to 1983/84. Data showing their effects are tabulated in respect of daily tonnage crushed, effective seasonal tch, average extraction, reduced extraction, average pol, average moisture, average imbition % cane and % fibre, and average mechanical efficiency.

Combustion of bagasse. Use of agricultural-derived waste

V. A. Cundy, D. Maples and C. Tauzin. *Fuel,* 1983, **62**, (7), 775-780; through *S.I.A.*, 1984, **46**, Abs. 84-857.

In most cane sugar factories, combustion of bagasse is carried out by pile burning, which requires a large amount of excess air, resulting in a low combustion efficiency. Tests on the full-suspension burning of bagasse were conducted in a full-scale research combustion chamber, with a pneumatic fuel feed device. Suspension burning enabled efficient combustion with only small quantities of excess air. Graphs show relations between moisture content, excess O_2 in flue gas, gas exit temperature and combustion efficiency. Drying the bagasse to a moisture content of 16% or 9% greatly increased the efficiency; further tests are needed to find the maximum moisture content compatible with suspension burning. The flue gas did not contain any appreciable concentration of CO until the excess O_2 was less than 1% (corresponding to 5% excess air). The bagasse should be pulverized so that 60-65% passes through a 30 mesh (0.6 mm) sieve.

Beet sugar manufacture

Recent data on the microbiological quality of sugar

L. Kerekes. *Cukoripar,* 1984, **37,** 25-28, 65-67 (*Hungarian*).

The literature on sugar micro-organisms and their counts is surveyed, and the results of three years of official quality control tests conducted in Hungarian sugar factories are reported. Bar charts indicate the counts of particular groups of micro-organisms found in granulated sugar in each of the 12 factories and as found in varying types of white sugar. The findings are related to ICUMSA standards, and it is shown how the numbers have fallen as a result of improved hygiene in the factories.

Construction of the mechanized beet reception system at Selyp sugar factory

G. Viszlo and J. Nemeth. *Cukoripar,* 1984, **37,** 70-76 (*Hungarian*).

Details are given of the overall system and of the individual units used for beet unloading from road and rail transport and for storage in semi-wet piles, a conventional large pile or a polar silo. Elfa wet unloading is used. The scheme has been developed in stages, and use thus made of experience at Selyp and at other factories. Results obtained in the operation of the system are discussed.

Storage of granulated sugar in silos at Kaba

F. Gal. *Cukoripar,* 1984, **37,** 78-80 (*Hungarian*).

Details are given of the design and operation of four bulk sugar silos, each of 20,000 tonnes capacity, built under licence from Lucks & Co. at Hajdusag sugar factory.

New equipment for sugar factories

J. Krecmer. *Czechoslovak Heavy Ind.,* 1984, (8), 17-20.

Developments in beet processing and sugar factory equipment as manufactured by ZVU at Hradec Kralove in Czechoslovakia are demonstrated by comparing the equipment installed in Dunajska Streda factory (put into operation in 1969), Deir Ez Zor factory in Syria (which started operations in 1981) and Sabac and Pozarovac factories in Yugoslavia, both of which were planned for start-up in 1984.

Evaluation of the power transmission system of a beet pump fed from a thyristor converter

J. Nazarko. *Gaz. Cukr.,* 1984, **92,** 25-26 (*Polish*).

The performance of the electric drive, with thyristor converter, of a centrifugal pump used to lift beet together with water over a height of 8-12 m to the flume at Chelmza sugar factory is discussed.

Rationalization of the heat economy in sugar factories

K. Urbaniec. *Gaz. Cukr.,* 1984, **92,** 27-28 (*Polish*).

Despite good beet quality, a ready supply of fuel and favourable climatic conditions in 1981/82 and 1982/83, fuel consumption in Polish sugar factories averaged 7.6 and 8.4% on beet in the two campaigns (68 and 66% on sugar, respectively, the latter figure being attributed to a higher beet sugar content in 1982/83), which is considered too high by comparison with values for sugar industries in highly industrialized countries. Reasons for the inadequate heat efficiency in Polish sugar factories are examined, and means of reducing fuel consumption indicated, including the processing of beet varieties of high sugar content.

Which boilers for a sugar factory?

E. Otorowski. *Gaz. Cukr.,* 1984, **92,** 29-31 (*Polish*).

Despite the popularity of package boilers because of their low capital costs, reduced space requirements and ease of installation, sometimes their performances have fallen below requirements after a few years of operation, and the various problems encountered are discussed. Factors having a major effect on boiler operation are examined, including the quality of water used as boiler feed and for spraying from the nozzles of the pipeline desuperheater used in package boilers. It is pointed out that manufacturers, particularly in West European countries, favour package boilers; with proper use, they can be more efficient than conventional boilers equipped with surface desuperheaters.

Effluent aeration by jet pump

S. Murawski and F. Nowak. *Gaz. Cukr.,* 1984, **92,** 39 (*Polish*).

Details are given of the effluent oxygenation plant at Naklo sugar factory. The battery of 10 jet pumps, each of 50 m^3 hourly capacity, is located at the outlet from the sedimentation basin from which the effluent is discharged to the river. The aeration reduces the COD by approx. 40% and removes all odour. The power rating of the battery is about 90 kW.

Foam in the sugar industry

H. Gruszecka. *Gaz. Cukr.,* 1984, **92,** 41-45 (*Polish*).

The mechanism of foam formation is explained, and the problem of foam in sugar factory processes discussed. Two "natural" sources of foam at the juice end are discussed: air trapped in the cossettes as a result of rapid scalding, and CO_2 with which the juice is saturated in carbonatation. The effect of beet quality on foaming intensity is considered, particularly the adverse influences of storage and/or frost damage. The effects of factory

intermediate products and of a number of sugars, acids, albumin, saponin, etc. on the surface tension of a 0.1N NaCl solution were determined; the significance of the results for foam formation and its prevention is discussed.

Effectiveness of the sugar industry in Comecon countries in regard to environmental protection

T. Wolski. *Gaz. Cukr.*, 1984, **92**, 45-46 (*Polish*).

A conference was held in Sofia in May 1983 on the subject of effluent treatment in the sugar industry, and the situations in Hungary, Poland, Rumania, the USSR and Yugoslavia are summarized.

A graphical method for calculation of a boiling house scheme. III. White sugar crystal

V. Valter, F. Gerza and J. Gebler. *Listy Cukr.*, 1984, **100**, 145-156 (*Czech*).

The vector diagram technique for calculation of a boiling house balance[1] is applied to a 3-massecuite scheme from which one white sugar is produced. Two variants are considered, viz. where all the material is produced in the same factory, and where some raw sugar is introduced from another factory.

Technico-safety parameters of sugar

J. Gebler, R. Stengl and R. Foniok. *Listy Cukr.*, 1984, **100**, 156-163 (*Czech*).

Parameters associated with the explosive properties and flammability of fine sugar and sugar dust were determined for six samples, including two icing sugar-starch mixtures and floor sweepings as well as an icing sugar, a fine crystal sugar and a milled sugar. The parameters studied were the ignition temperature of the sample as a deposit or in a cloud, the relative velocity of flame spread in a layer of sugar/dust, the explosion point and the minimum energy for flame initiation. The findings are discussed, and the need for vigilance against explosion, particularly in the final stages of handling such materials, is stressed.

Automation of white sugar massecuite boiling

Z. Hotovy and J. Radek. *Listy Cukr.*, 1984, **100**, 163-168 (*Czech*).

Details are given of the AV 15 B automatic control system as applied to massecuite boiling (of >96 purity) at Melnik sugar factory. Circuits are included for massecuite temperature measurement and indication; for pressure measurement, control and indication; for massecuite level measurement, control and recording; and for consistency measurement, control and recording. Results of tests on white sugar boiling showed a 4.2% increase in crystal sugar output and a 22.2% lower crystal ash content by comparison with manual boiling control.

Intensification of the recrystallization of boiling sugar suspensions

S. I. Potapenko, R. A. Ramutite, I. G. Bazhal, L. I. Trebin and E. P. Dzyubenko. *Izv. Vuzov, Pishch. Tekh.*, 1984, (3), 65-67 (*Russian*).

A study of recrystallization in massecuite boiling was carried out under laboratory conditions, in which a suspension of saturated syrup with crystals added was boiled under controlled conditions, after which the leader crystal (the largest one initially present) was weighed after removal of mother liquor; from the change in weight was calculated the equivalent radius as a function of time. The results showed that crystal growth rate fell with increase in the amount of suspension under otherwise constant conditions, as a result of reduced circulation. This was confirmed by determining the number of times the leader crystal came into contact with the heating surface, found to be proportional to the lineal growth rate of the crystal and increasing with fall in the amount of suspension. Under factory conditions, such a desirable fall in massecuite level may be achieved by applying alternating current to increase heat flow per unit volume of massecuite and thus permit a reduction in the initial syrup feed. This was tested with a constant weight of suspension, using NaCl to reduce the electrical resistance to the solution. As the electrolyte concentration was raised, the current increased and so too did the amount of heat liberated and of water evaporated; this was accompanied by increased recrystallization.

Scale effects in continuous diffusers

A. I. Fel'dman and V. M. Lysyanskii. *Izv. Vuzov, Pishch. Tekh.*, 1984, (3), 85-90 (*Russian*).

Mathematical modelling of continuous beet diffusion is discussed, particularly the difficulty of calculating heat transfer resulting from problems of scale. Corrections have to be made to the values of the Fourier number and of the ratio between solid and liquid phase in the model to allow for the effect of scale change when converting to full size, and equations are given for calculation of these corrections.

Accelerated sugar extraction from beet cossettes in an electric field

I. G. Bazhal, L. G. Vorona, M. P. Kupchik, N. Y. Fishchuk and L. D. Bobrovnik. *Izv. Vuzov, Pishch. Tekh.*, 1984, (3), 114-116 (*Russian*).

Investigations are reported on diffusion in a laboratory unit in which the diffusion cell (made of Textolite resin

1 Valter *et al.*: *I.S.J.*, 1985, **87**.

laminate) was divided into an anodic, a neutral and a cathodic compartment by neutral membranes, with a graphite and a titanium plate as conductors. Constant voltage was applied to the electrodes, and distilled water was used to extract the sugar from the cossettes. Juice purity and Brix were functions of time (5-60 min) and of voltage (0-20 V/cm), but optimum was 30 min and 5-10 V/cm, giving a purity of 93.88 and a Brix of 8.6-8.8° by comparison with purity values of 87.88 and 88.75 and Brix values of 6.6° and 8.0° at 5 and 60 min, respectively, without electrical charge.

Uilization of the heat content of carbonatation vapours

G. Witte and H. Schiweck. *Zuckerind.*, 1984, **109**, 706-710 (*German*).

See *I.S.J.*, 1983, **85**, 378.

Informative investigations on effect and retention of some disinfectants used in the sugar industry

A. Nickisch-Hartfiel and W. Mauch. *Zuckerind.*, 1984, **109**, 711-718 (*German*).

Microbiological investigations showed that formalin, thiocarbamates, cresol and hydrogen peroxide used as disinfectants in beet diffusion may be reversibly adsorbed by the cossettes but then desorbed by the diffusion water, so that their bactericidal properties are not greatly diminished and only trace quantities remain in pressed pulp; however, amounts will remain in subsequent processes, although exposure to 120°C reduces their activity, and no disinfectants in molasses will inhibit fermentation processes. Quaternary ammonium compounds and cationic and amphoteric surfactants may be irreversibly adsorbed by the cossettes during diffusion and may interfere in microbial treatment of pressed pulp, which should not be used as animal fodder if it is so contaminated. Any disinfectant not adsorbed during diffusion will leave the juice as a component of carbonatation mud, and tests showed that the mud will be characterized by the bacterial action of the disinfectant. While the disinfectants at concentrations needed to kill thermophiles would probably not have any spontaneous inhibitory effect on growth of *Saccharum cerevisiae*, they could produce yeast mutants suffering from respiration defects.

Programmable controls in the sugar industry

K. A. Schultes and J. Merkl. *Zuckerind.*, 1984, **109**, 721-725 (*German*).

The development of programmable controllers, their construction and operation as well as their salient features and selection criteria are discussed, and a description is given of the fully automatic candle filter station at Hohenau sugar factory in Austria which has a total thin juice throughput of 500 m^3/hr.

Increase in throughput of a single-stage clarification plant with activated sludge treatment

H. van Lam. *Zuckerind.*, 1984, **109**, 725-728 (*German*).

Measures adopted to overcome the difficulties of treating regeneration effluent from the Quentin and deliming stations at Weetzen are reported. The waste water treatment plant, consisting of a pre-acidification pond (of 7500 m^3 capacity), an activated sludge tank (of 1500 m^3 capacity) and two secondary sedimentation tanks (of 370 m^3 total capacity) operating in parallel, was able to treat all the factory waste water biologically with the exception of the resin regeneration effluent, which had a high pollution load and chloride content and exhibited a marked fall in pH after the acidification stage in the activated sludge tank; the formation of incrustation caused frequent disruptions to the activated sludge process, resulting in a fall in throughput and even occasional stoppages. Modifications to the plant included the installation of special aeration units for aerobic pre-degradation, and dilution of the waste water in the activated sludge tank with warm excess condensate. The pre-acidification pond was divided into three ponds of greater depth so as to increase their volumetric capacity and extend the residence time by comparison with the previous arrangement; one pond, of 5700 m^3 capacity, was designed to pre-aerate the concentrated regeneration effluent, one (of 3100 m^3 capacity) was for storage and cooling of the condensate, and the third pond, also provided with aerators and of 3000 m^3 capacity, was designed for control of the proportions of waste water from the first two ponds. Results for the 1983/84 campaign showed that the condensate permitted the desired pH rise in the third pond, where the temperature range was optimum for bacterial activity. The chloride content was reduced from an average of 11,000 mg/litre previously to 3200 mg/litre; average daily throughput was raised from 380 m^3 in 1982 to 725 m^3 in 1983, and the average BOD_5 in the storage ponds was reduced to 0.005 g/g organic dry solids per day despite the absence of condensate for dilution of flume water as previously. There was a considerable reduction in the odour which had previously proved troublesome.

The state of the water economy in working sugar factories and recommendations on its improvement

A. P. Parkhomets. *Sakhar. Prom.*, 1984, (8), 25-27 (*Russian*).

Fresh water usage and waste water treatment (with a view to maximizing the amount recycled so as to reduce fresh water requirements) in the USSR are discussed, and references made to practices in other countries. Advice is given on optimization of the factory water economy.

Sugar refining

Sterilization of a fine liquor stream by ultraviolet light treatment in a sugar refinery

Y. Yokota, S. Matsubase and Y. Kondo. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1984, **33**, 14-20 (*Japanese*).

In 1980, a Steritoron ultra-violet sterilizer of the type generally used for water treatment was modified for treatment of fine liquor at the Osaka refinery of Daishin Sugar Refining Co. Ltd. Fine liquor has a high temperature, a high sugar content and poor U.V. transmittancy, and the spectral energy of a U.V. lamp reaches maximum at room temperature, after which it is dissipated with increase in temperature. Because of this, an aeration device was attached to the sterilizer to cool the lamp. Transmittancy was improved by reducing the thickness of the layer of liquor passing through the sterilizer. Results of five preliminary tests are tabulated, showing an average reduction in the bacterial count of 81.3% compared with 69.1% when the liquor layer was thick. Optimum flow rate was 600 litres/hr. Operation of the sterilizer over a period of three months showed an average reduction of 82.3%, from 67 to 12 counts per 10 g solid, compared with a final count of 35 per 10 g before use of the sterilizer. Average granulated sugar count was 5 per 10 g, compared with 15 per 10 g before installation of the sterilizer. Sugar quality was unaffected. A lamp life of more than 7000 hours is expected.

Selection of an optimum scheme for obtaining white sugar from raw by means of decolorization with ion exchange resins

M. Delgado P. and T. M. M. Álvarez Ch. *ATAC*, 1983, **42**, (4, 5 & 6), 32-36 (*Spanish*).

Total substitution of active carbon by ion exchange resins in Cuban refineries is not practical and studies have been made to seek more effective purification methods which will aid the use of resins for decolorization of the sugar liquor. The procedures tested were defeco-sulphitation in two stages and as a simultaneous process, defeco-saturation (single carbonatation), and a combination of defeco-saturation and sulphitation. In all cases the liquor was brought to pH 7.4-7.6, and was filtered before decolorizing with strongly basic anion exchange resin on the Cl^- cycle. The four methods of clarification gave 46%, 56%, 38% and 62% decolorization, respectively, and the resin treatment raised this to 96%, 94%, 85% and 89%, respectively.

Optimal conditions of phosphatation

O. Janigova and J. M. Alonso. *ATAC*, 1983, **42**, (4, 5 & 6), 38-42 (*Spanish*).

Laboratory experiments have been made to determine the optimum conditions for phosphatation of affined sugar liquor to maximize the purification achieved. The results of variation in conditions are presented in graph form, and it is concluded that the best time of contact (out of 5, 10 and 20 minutes) is 10 minutes, less being insufficient for good clarification and more harming the colour removal and increasing reducing sugars. The best temperature (out of 50°, 80° and 90°C) is 50°C to avoid appreciable caramelization and inversion. Better results were obtained with a 6% phosphoric acid solution (than 4%) added to give 0.02% P_2O_5 on solids (rather than 0.01% or 0.03%). The literature recommends a liquor Brix of 65°, but of the four examined (50°, 55°, 60° and 65°Bx), the lowest gave best colour removal. Of the two liming agents tested, calcium saccharate gave better results than 5°Bé milk-of-lime.

Mechanization of parcelling of packeted refined sugar

S. A. Brenman, A. U. Dmitrenko and R. M. Grishchenko. *Sakhar. Prom.*, 1984, (7), 33-35 (*Russian*).

Hitherto, parcelling of packeted sugar in the USSR has been done manually, but an automatic system, the A5-PUA, has been developed for parcelling 12 1-kg packets of sugar together in double-layered paper packages. A description is given of the plant and of its operation.

Energy program at Imperial Sugar

Anon. *Sugar J.*, 1984, **47**, (1), 20.

Details are given of the measures proposed by DuPont Energy Management Services Division for energy saving at Imperial Sugar Co. whereby an annual saving of $673,000 could be made. Implementation of some of the suggestions has permitted an overall reduction of 15.4% in the number of Btu consumed per 100 lb raw sugar.

Cyclic regeneration of activated carbon in fluidized beds

K. Chihara, M. Suzuki and J. M. Smith. *A.I.Ch.E.J.*, 1982, **28**, (1), 129-134; through *S.I.A.*, 1984, **46**, Abs. 84-943.

Cyclic thermal regeneration of powdered activated carbon containing adsorbed sucrose was studied in fluidized beds at 1151°K and 101.3 kPa (1 atm). The regeneration process consisted of three steps: (a) drying; (b) thermal decomposition; and (3) gasification of residual carbon with steam. Maximum restoration of adsorption capacity (98.5% recovery after each regeneration) was obtained when gasification removed an amount of carbon equal to the residual adsorbed carbon after thermal decomposition. The time required to attain optimum regeneration could be calculated from available kinetic data for the steam-carbon reaction. For the sucrose-activated carbon system tested, this time was about 180 sec at 1151°K.

Laboratory studies

The dependence of the refractive index on the concentration of aqueous solutions of glucose, fructose and invert sugar

A. Emmerich, B. Prowe and K. J. Rosenbruch. *Zuckerind.*, 1984, **109**, 525-537 (*German*).

An automatic precision goniometer (spectrometer), developed by the Physikalisch-Technische Bundesanstalt in collaboration with the firm, Dr. J. Heidenhain, and earlier described by Rosenbruch & Stenger[1], was used in investigations to determine the effect of concentration, temperature and wavelength on measurements of refractive index and thus provide values of the index for glucose, fructose and invert sugar of greater accuracy than hitherto. A description is given of the goniometer and of its hollow copper prism with details of the filling and constant temperature devices. Glucose and fructose of high purity (containing 0.0006% and 0.0012% ash, respectively) were further purified, but subsequent measurements of the refractive index showed no significant differences, so that the treatment could be omitted. Solution concentration was established by weighing, with correction for temperature, air pressure, relative humidity and residual moisture content of each sugar (as found by Karl Fischer titration). Measurements were made at concentrations in the range of 0-70%, at temperatures of 15°, 17.5°, 20°, 22.5°, 25°, 27.5° and 30°C and wavelengths of 589.28 (sodium line) and 546.07 nm (mercury line). The measured values were fitted by polynomials expressing refractive index as a function of concentration, temperature and wavelength, and concentration in terms of refractive index and the other two parameters. Values of coefficients are tabulated. An accuracy of between $\pm 2 \times 10^{-6}$ and $\pm 3 \times 10^{-6}$ in refractive index was obtained, corresponding to a concentration accuracy of ±0.001-0.002%. Tabulated values of concentration are given for glucose, fructose and invert sugar at 20° and 27°C and refractive index values in the range 1.334-1.464 at 0.001 intervals. The refractive index of invert sugar solution at higher concentrations was found to be greater than the mean value for glucose and fructose solutions of the same concentrations, a difference which exceeded the measuring error limits at concentrations above 25%. The differences between the new values and earlier values are shown in graph form, indicating a noticeable rise with increase in concentration from 40% upwards.

Microbiological control in sugar and alcohol manufacture

Anon. *Boletim Tecnico Copersucar*, 1983, (22-83), 2-17, 32; through *S.I.A.*, 1984, **46**, Abs. 84-717.

Samples, collected from various points at 11 factory/distilleries and one autonomous distillery in 1982/83, were analysed for pH and microbial populations (total, lactic bacteria, and moulds + yeasts) by standard methods. Results are tabulated and interpreted. Cane wash water should be kept alkaline to avoid significant microbial growth, although no clear correlation was found between this and data on mixed juice. Extraction equipment always had sources of contamination, particularly of lactic bacteria; these remained the predominant group in clarified and sulphitated juices, although in decreased numbers. Yeast inoculum at pH around 2 contained very few lactic bacteria but also had a lower yeast count. Approximate limits are set for the counts in various liquids.

Sugar research and development in South Africa

Anon. *Ann. Rpt. Sugar Milling Research Inst.* (Natal), 1983-1984, 4-14.

Chemical losses of sucrose: A laboratory heating cell, currently used to simulate pH and temperature conditions to which various process streams are subjected, has two major advantages: (i) samples can be removed from the vessel during a test and up to 10 data points are obtainable, thus giving an accurate estimation of degradation rate, and (ii) because of continuous pH measurement and control, juice or syrup can be subjected to high temperatures for long periods, producing significant and easily measurable sucrose losses. Using sucrose/phosphate buffer solutions, 16 runs were made to determine the effect of temperature (100-120°C) and pH (5-7) on inversion in synthetic solutions. In view of the considerable errors that can arise in estimation of temperature, pH and sucrose under such conditions, the results were considered to be in reasonable agreement with values obtained by other workers. It is important to measure pH at the operating temperature because of the dependence of the temperature coefficient on the nature and quantity of impurities present. This is demonstrated by a table showing values of ΔpH per °C for mixed juice, syrup, diffusion juice and four clear juice samples from four different factories: −0.002, −0.008, −0.009, −0.011, −0.012, −0.013 and −0.017, respectively. The heating cell was to be used in the subsequent season to determine the effects of juice and molasses impurities on sucrose decomposition.

Gas chromatographic analysis of cane: While GC analysis for fructose, glucose and sucrose has been applied to most sugar factory products and has gained widespread acceptance in South Africa as the official method for sucrose determination in mixed juice and molasses, it has been suggested that it be extended to measurement of the sucrose content in cane consignments from individual growers. Consequently, GC methods were developed which would be suitable for quantitative measurement of fructose, glucose and sucrose at concentrations typical of extracts used for direct analysis of cane

1 *Messtechnische Information Dr. J. Heidenhain*, 1980, **8**, 2-8.

should this need arise. Two GC techniques were compared and found to be equally acceptable in terms of accuracy; however, the splitless method was less precise than the conventional split technique (which included a time-consuming freeze-drying step). Therefore, it was recommended to use concentration by freeze-drying prior to split injection for precise results, particularly on composited samples, while the less precise splitless technique is suitable for high-throughput, rapid results. The normal split technique could be used for determination of sucrose alone.

The determination of reducing sugars using the Reductomat: Earlier tests on a Reductomat, which is based on polarographic measurement of the amount of periodate used to oxidize invert sugar and expression of the value in terms of reducing sugars concentration, had shown that the method was unsuitable because of differences between glucose and fructose in their reactivities with periodate. Further development by the manufacturer showed that the reaction rates were identical at 40°C, and the instrument was re-evaluated against the GC method on final molasses. Results showed that the values given by the Reductomat were invariably much higher than those given by GC, but there was no constant difference factor, suggesting that other reducing substances have a significant influence on the Reductomat method. It was therefore concluded that the method is not suitable for reducing sugars determination in low-purity materials such as molasses.

Comparison of reducing sugar determinations by the Luff-Schoorl and Ofner methods: Although ICUMSA has long since rejected the Luff-Schoorl method for the determination of reducing sugars in raw sugars and recommended its replacement by the Ofner method, the latter method has practical disadvantages, especially for routine work. Therefore, a variety of coated and VHP sugars were selected for determination by the two methods as well as GC in order to establish the specificity of the more convenient Luff-Schoorl method. It was found that the Ofner method gave consistently higher results than the Luff-Schoorl and GC methods, the differences increasing with decrease in sugar purity. There was a similar pattern in comparison of the Luff-Schoorl and GC methods, but to a much lower degree, and comparisons for sugars of as low a pol as 98.7°S were good.

The distribution of impurities in inclusions in sugar crystals

S. Y. Guo and E. T. White. *Proc. Australian Soc. Sugar Cane Tech.*, 1984, 333-342.

Sugar solutions to which given quantities of Ca, K, glucose, molasses and Li had been added were boiled in a laboratory vacuum crystallizer to a desired supersaturation, a weighed amount of seed crystals then added and Impurities studied appeared not to co-crystallize but only to occur in the crystal inclusions. The inorganic impurities did not concentrate to any great extent in the inclusions, in contrast to glucose, while colour concentrated by a factor of about 4.

A combination of invertase (ß-D-fructofuranosidase) reactor and glucose oxidase electrode for the successive determination of glucose and sucrose

F. Scheller and C. Karsten. *Anal. Chim. Acta,* 1983, **155,** 29-36; through *Anal. Abs.,* 1984, **46,** Abs. 7F12.

A layer of glucose oxidase immobilized on gelatin (approx. 20 µm thick) is sandwiched between two Nephrophan dialysis membranes (17 µm thick; VEB Chemiekombinat, Bitterfeld), and the membrane sandwich is attached to the tip of a modified 0 electrode. To determine glucose and sucrose, the electrode is placed in 2 ml of a stirred solution of 0.1M phosphate buffer (pH 7) at 25°C until a steady baseline current is attained. Then 50 µlitres of the sample solution is added, and the current is recorded automatically *vs.* time until a steady-state current is obtained for glucose (approx. 30 sec). Then immobilized β-D-fructofuranosidase (prepared by cross-linking the enzyme and bovine albumin with glutaraldehyde) on a silk carrier is inerted into the solution to hydrolyse the sucrose, and the current is again recorded *vs.* time (for approx. 3 min). The slope of the current-time graph is rectilinearly related to sucrose concentration (in the measurement cell) up to 7 mM, and sensitivity for sucrose is independent of glucose concentration up to 0.6 mM. Between 10 and 12 samples can be analysed in 1 hour.

Growth rate curves of sucrose crystals

A. VanHook. *Zuckerind.,* 1984, **109,** 638-641.

The growth of optically clear ("good") and of white, opaque ("poor") sucrose crystals, grown singly and as crops of crystals, was investigated in order to explain differences between crystallization theory and experimental data and to decide whether the growth rate is a 1st or nth order reaction. Single crystals were grown at 0° and 24.1°C and crystal suspensions at 26.4°C and relative supersaturations of 0.00-0.70. Results showed that the pattern of the growth curve was a function of crystal perfection; good crystals grew more slowly than poor ones and exhibited non-linearity at low supersaturation. The difference decreased with increase in concentration and as the growth progressed, whereby the poor crystal showed improved perfection. The findings endorse the BCF theory of Burton *et al.*[1] and the model of Valicic & Nikolic[2] describing it.

1 *Phil. Trans. Royal Soc.*, 1950/51, **243A,** 299.
2 *I.S.J.*, 1981, **83,** 283.

By-products

Production of single-cell protein from Egyptian cane sugar molasses. II. Effect of some environmental and nutritional conditions on growth and protein content of *Candida humicola*

M. A. Osman, A. H. Bezberador and L. E. Voina. *Egypt. J. Microbiol.*, 1983, **18**, (1-2), 79-85; through *S.I.A.*, 1984, **46**, Abs. 84-771.

C. humicola 6 was grown on a medium containing cane molasses and salts. Biomass and protein yields were a maximum at the highest aeration rate tested, 30.5 mg O_2/litre per min. The optimum initial pH for yeast growth was 5.0-7.0. Growth was good at all sugar concentrations tested: 0.86, 1.77, 3.49 and 6.06%; with increasing concentration, biomass concentration increased from 3.6 to 21.2 g/litre, but protein content was maximum (55-56%) at the two intermediate sugar concentrations.

Factors causing the hard bleaching of sulphate bagasse pulp

W. C. Hsieh and J. P. Yang. *Rpt. Taiwan Sugar Research Inst.*, 1983, (102), 29-35 (*Chinese*).

The hard bleaching of sulphate bagasse pulp was found to be mainly due to a higher iron content in the pulp originating from clay in the bagasse under the effect of high-temperature cooking. There was an inverse relationship between iron content and pulp brightness, whereby 50 ppm iron caused a reduction in brightness by 1.4-2.0 units. Washing unbleached pulp with acid before or after chlorination decreased the iron content and gave the desired brightness. Another cause of hard bleaching was the presence of decayed bagasse taken from the surface layer of a wet-stored bagasse pile; this resulted in a pulp which was dark brown, and a higher K number, was lower in freeness and had poorer physical properties. If there is less than 10% total raw bagasse in the form of decayed bagasse going to the digester, there is no appreciable influence on bleaching nor on the physical properties of the pulp.

Synthesis of the chemical derivative nitrolignin from bagasse hydrolytic lignin

C. J. Triana F., X. González, R. Martínez and R. González Q. *CubaAzúcar*, 1983, (April-June), 57-61 (*Spanish*).

After hydrolysis of bagasse cellulose the residue, hydrolytic lignin (or hydrolytic cellolignin if the hydrolysis has not been complete) may be converted into nitrolignin by reaction with a mixture of nitric and sulphuric acids. This reaction was studied with variations in the HNO_3 and H_2SO_4 concentrations, time of reaction and ratio of acid:lignin. The results are tabulated in respect of yield, N content and solubility in 15% NaOH solution.

Obtaining carboxymethylcellulose from bagasse dissolving pulps

S. Ashkienasi, C. J. Triana, M. Legón, G. Díaz, J. Hernández and Y. Saev. *ATAC*, 1983, **42**, (4, 5 & 6), 52-57 (*Spanish*).

Studies at the Cuban By-products Research Institute (ICIDCA) on production of carboxymethylcellulose from cellulose in the form of bagasse dissolving pulp have indicated that it is of sufficiently high quality for use in the oil, soap and perfumery, textile and food industries and could therefore be made in Cuba with the saving of foreign exchange on imported material.

Ethanol production by fermentation: trends in technology

G. Goma. *Biomasse Actualités Suppt.*, 1984, (6), 14-20 (*French*).

A short account is given of substrates suitable for ethanol fermentation, including sugar beet and cane, with yields and productivities tabulated and an outline of the stages in alcohol manufacture. It is stated that, although molasses is still the substrate of choice, developments in sugar manufacture, e.g. the use of sequestering agents, treatment by ion exchange as in the Quentin process, etc., have resulted in molasses of lower fermentability; moreover, there is competition between various fermentation processes for molasses, as well as competition with animal fodder. Reduction in the amount of sugar extracted so as to increase the fermentation value of the product is discussed, and mention made of the EX-FERM direct fermentation process[1], which would require less capital investment while providing better rates of conversion of sugar to alcohol. Physiological constraints on alcoholic fermentation are discussed, including inhibition of the anaerobic process by glucose when there is a considerable excess of substrate; those yeast strains most affected are less tolerant to ethanol than the insensitive strains. Another constraint is inhibition by the newly formed alcohol itself, which limits transfer of further ethanol from inside the yeast cells — this and the inhibitive action of glucose are additive and irreversible. Added alcohol was found to have only slight inhibiting effect, indicating its inability to penetrate to the inside of the cells and emphasizing the greater effect of the freshly formed alcohol. The intracellular alcohol was found to denature the hexokinases and α-glycerophosphate dehydrogenase, and those strains of greater tolerance to alcohol were those of lower lipid content. The need for a small quantity of oxygen to increase the activity of oxidative enzymes is a third constraint; unsaturated fatty acids contribute to ethanol tolerance, and addition of as little as 2.8 μmoles of oxygen raises their content to 82% from 18% under strictly anaerobic conditions. Addition of specific unsaturated fatty acids considerably reduces the inhibiting effect of ethanol. Other aspects of alcohol fermentation discussed include technico-economic constraints whereby

1 Rolz: *I.S.J.*, 1980, **82**, 47-51.

industrial systems operate at below maximum potential capacity, means of increasing the fermentation rates, extending the field of application of substrates, increasing their tolerance to ethanol, and improving their physiological properties as well as raising the level of fermentation technology; three schemes are indicated which represent the stages of development of the technology: the conventional process with simple recycling, the Vacu-ferm process with recycling and simultaneous fermentation and extraction in the same vessel, and the Flashferm system of fermentation with extraction carried out in the recycle loop.

Molasses as a stockfeed

D. C. Nicol, J. J. Daly and P. J. Round. *Proc. Australian Soc. Sugar Cane Tech.*, 1984, 37-44.

Normally, about 25% of the total molasses yield in Australia is used as animal fodder, although the demand is strongly influenced by drought, when the quantity used as stockfeed increases substantially. Because of this, the amount available for industrial fermentation falls, and it is suggested that storage of molasses at farms during drought-free years would help to alleviate the situation. However, there are a number of problems that need to be solved, particularly in regard to spontaneous degradation at high temperatures and the effect of total sugar content. The possible effect of long-term storage on the nutritive value of molasses, particularly under the influence of the temperature extremes experienced in Queensland, needs to be studied.

Disposal of spent wash of distilleries

G. S. Narwani and A. K. Mital. *Maharashtra Sugar*, 1984, **9**, (7), 39, 41.

Of four systems of vinasse treatment mentioned, lagooning and anaerobic treatment followed by land disposal of the effluent is not favoured by State Pollution Boards although used by almost all distilleries in India, and methane fermentation effectiveness is being doubted. A National Sugar Institute scheme involving ammonification and nitrification has been adopted by only one distillery, while the Kinetics Technology India Ltd. method of vinasse incineration entails high capital costs that are beyond the means of distilleries. Since this KTI system is effective in reducing pollution and providing energy, the author insists that the Indian Government should be prepared to extend financial help for its adoption.

Integrated molasses alcohol units economical energy cycle and pollution control

M. Singh. *Indian Sugar*, 1984, **33**, 717-719.

To alleviate the problems of vinasse disposal and fuel sufficiency, the author proposes a scheme for molasses alcohol distilleries in which the vinasse is evaporated from approx. 10% to 60% solids at which it is suitable as a liquid fuel for steam raising. The ash from the vinasse could be used as fertilizer.

Ethanol production from sucrose and sugar beet substrates using a mixed culture of *Saccharomyces* spp

L. P. Jones, D. Alexander and J. E. Zajic. *Dev. Ind. Microbiology*, 1982, **23**, 367-377; through *S.I.A.*, 1984, **46**, Abs. 84-1031.

Of 22 yeast strains tested, 7 which showed good tolerance to 30% sucrose w/v and to 8% ethanol by volume were selected for further study. Six of them were successfully adapted to grow on a medium based on beet molasses and containing 15% sugar w/v. *Saccharomyces uvarum* ATCC 26602 and *S. cerevisiae* (brewer's yeast) showed the greatest tolerance to sugar (30% w/v) and ethanol (11% by volume). Ethanol yields were low (0.23 and 0.22 g/g sugar consumed). In a 10-litre batch fermentation using these two organisms together and an initial sugar concentration of 33%, there was no lag phase, and ethanol concentration reached 7.9% w/v after 48 hours and a maximum of 8.5% in 60 hours. Yields of ethanol and biomass were respectively 0.299 and 0.043 g/g sugar consumed.

Cultivation of chlorella on the basis of wastes from alcohol manufacture

A. F. Berenshtein. *Ferment. i Spirtov. Prom.*, 1982, (2), 13-15; through *S.I.A.*, 1984, **46**, Abs. 84-1040.

Algae may be grown cheaply on a yeast-free medium containing preboiled vinasse (e.g. 0.3% condensed solubles from either alcohol or yeast manufacture) and a growth factor (0.1% maize extract, yeast autolysate or malt extract). Optimal conditions are 30-35°C, pH 6-7, illumination 8-10 thousand lumens, with a residence time of about 4 days. The algae consume all the P and 90% of the N present, and will utilize side-fermentation products from alcohol manufacture. The product can be used directly as a fodder supplement. Food use demands breakage of the tough outer walls, e.g. by acid hydrolysis, proteinase-1 or sudden pressure release.

Inspection ports are installed at this level, fitted with purge air connexions to maintain cleanliness and avoid overheating. A hot gas outlet connexion is provided from one side of the HGG, near the top. A duct is taken from this connexion to the pulp dryer bullring and provision is made in this duct for the injection of additional recycle gas.

A thermocouple and oxygen analyser probe are fitted between the gas outlet from the HGG and the additional recycle gas injection point and a further thermocouple after this point.

The diagramatic arrangement of the plant is shown in Figure 2.

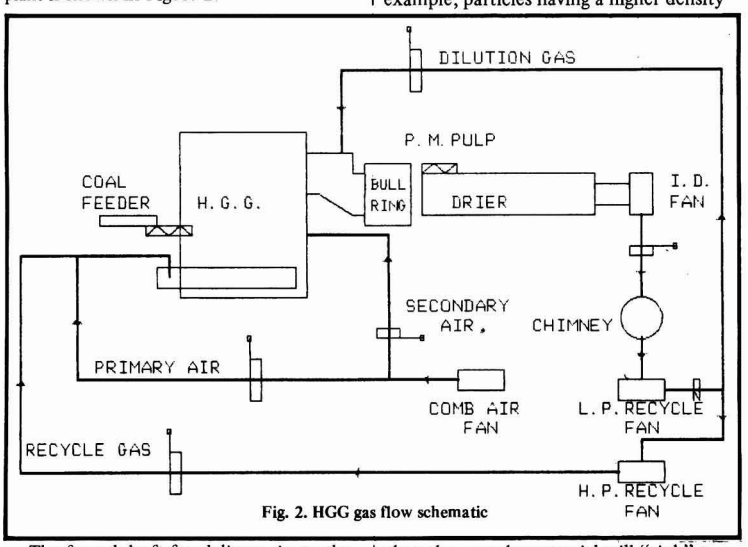


Fig. 2. HGG gas flow schematic

The forced draft fan delivers air: to the plenum chamber, as primary air through a control damper; to the preheat burner, as combustion air through a second control damper; and to the secondary air injection points through a third control damper.

The recycle gas is taken from the pulp dryer outlet, after the dust cyclones, to a low-pressure recycle fan. The outlet from this fan splits into two ducts, one connected to the HGG gas outlet duct through a control damper and the other to the high pressure (HP) recycle fan inlet. The discharge from the high pressure recycle fan is taken through another control damper to the plenum chamber.

Principles of operation and control philosophy

When a uniformly distributed stream of air is passed upwards through a bed of granular materials, contained within a chamber, a force will be exerted on each grain. As the velocity of the air stream is increased the upward force will eventually balance the force due to gravity and the individual grains will be suspended in the air stream.

The velocity at this point is known as the fluidizing velocity because, above this velocity, the solid granular material exhibits the properties of a fluid. For example, particles having a higher density than the granular material will "sink" to the bottom of the bed, higher particles will "float" to the surface and materials of generally similar density added at one point will disperse fairly quickly throughout the bed. The fluidizing velocity is a function of the mass and density of the granular material. A bed of granular material in this fluidizing state is often referred to as a "fluid bed" and this expression will be used to refer to this state.

The granular material used in this application is sand having rounded grains, sometimes called "pebble sand". The fluidizing velocity for grains 1-2 mm in diameter is about 2-3 m/sec hot.

Fluid bed combustion is established by raising the bed temperature, with air heated by the preheat burner, to above the spontaneous ignition temperature of the fuel, between 500 and 600°C for coal, and then adding the fuel to the bed.

The coal will begin to burn, in the fluidizing air, causing the bed temperature to rise; once combustion is established then the preheat burner can be shut down. The bed temperature will continue to rise as the coal firing rate is increased. The bed temperature cannot be allowed to rise above 1000°C as above this temperature there is a significant risk that the ash constituents of the coal will melt and cause the bed to fuse together.

There is also a risk that the sand itself will melt at higher temperatures. To give a reasonable safety margin, the bed is therefore limited to a temperature below the ash fusion point, usually between 900 and 950°C. This limit temperature occurs at a relatively low coal firing rate, and to increase the firing rate a bed temperature control mechanism is required.

The simplified control schematic is shown in Figure 3. When the bed temperature reaches its temperature set point the damper starts to open to admit high-pressure recycle gas to the plenum chamber. This gas, in theory, is low in oxygen and therefore does not contribute to coal combustion but does carry heat away from the bed. It is, therefore, an effective control for bed temperature; it is not, however, in itself sufficient.

The damper controlling secondary air above the bed now starts to open; thus, as the coal feed rate increases, only part of the required combustion air passes through the bed.

The inadequate air supply through the bed results in the carbon burning to carbon monoxide with a much lower heat release, and so also limiting bed temperature rise. The carbon monoxide produced is burnt above the bed by the secondary air which is sufficient to complete combustion.

The primary and secondary air dampers are characterized and programmed to maintain the appropriate air:fuel ratio from when the high pressure dilution

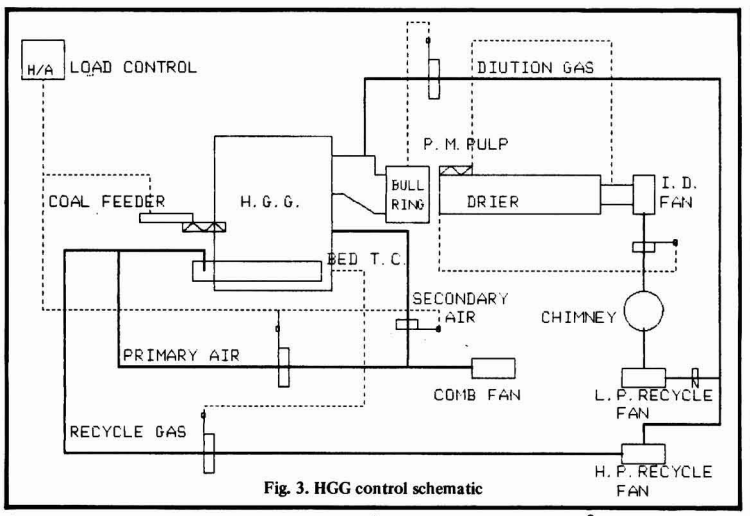


Fig. 3. HGG control schematic

damper starts to open.

Below this firing rate the critical requirement is to maintain fluidizing velocity and thus excess air levels tend to be much higher at low loads.

The combustion of carbon monoxide above the bed causes a rise in gas temperature leaving the HGG. This temperature can rise to 1300°C at full load. A separate bullring temperature control is therefore required. The low pressure recycle damper starts to open, as the bullring temperature rises above the set point, thus injecting additional recycle gas into the duct and controlling the bullring temperature.

There are two stop procedures provided, the controlled stop and the emergency stop. The controlled stop is used for normal operation and non-hazardous plant faults; the coal feeder is slowed down and then stopped but the fans are left running for a few minutes to burn out residual carbon from the bed.

The emergency stop is for use in hazardous fault conditions such as the trip-out of a dryer drum drive or induced draught fan drive. The coal feeder and fans are stopped immediately and nothing further should happen. However, the bullring suction may cause some air to be pulled through the bed which would burn some of the residual carbon and cause the bed temperature to rise. If the bed temperature approaches 1000°C then steam is injected into the bed until the temperature returns to normal. The type of stop procedure used is selected either by the operator or automatically depending upon the type of fault detected.

Under the action of the fluid bed, the ash produced from coal combustion breaks down into a fine dust which is carried out of the bed in the gas stream. Thus there is no progressive ash build-up within the bed and, in addition, the sand suffers attrition and loss into the gas stream. Therefore, a sand make-up system is provided to maintain the correct bed level.

The sequencing and operating control of the HGG is fairly complex, with a significant number of parameters which may require adjustment during commissioning or in service, making micro-processor control desirable. The plant has been provided, therefore, with a Texas PM550 unit with selectable control parameter indication and a separate alarm and sequence annunciator.

The installation was intended as a development unit initially and so the operator was presented with only a coal feeder speed adjustment and speed indication, a start button and the two stop buttons, an alarm indication and an alarm accept button. The original pulp dryer controls were retained in use with only one control mode in which the tail temperature controlled the pulp feed scroll speed.

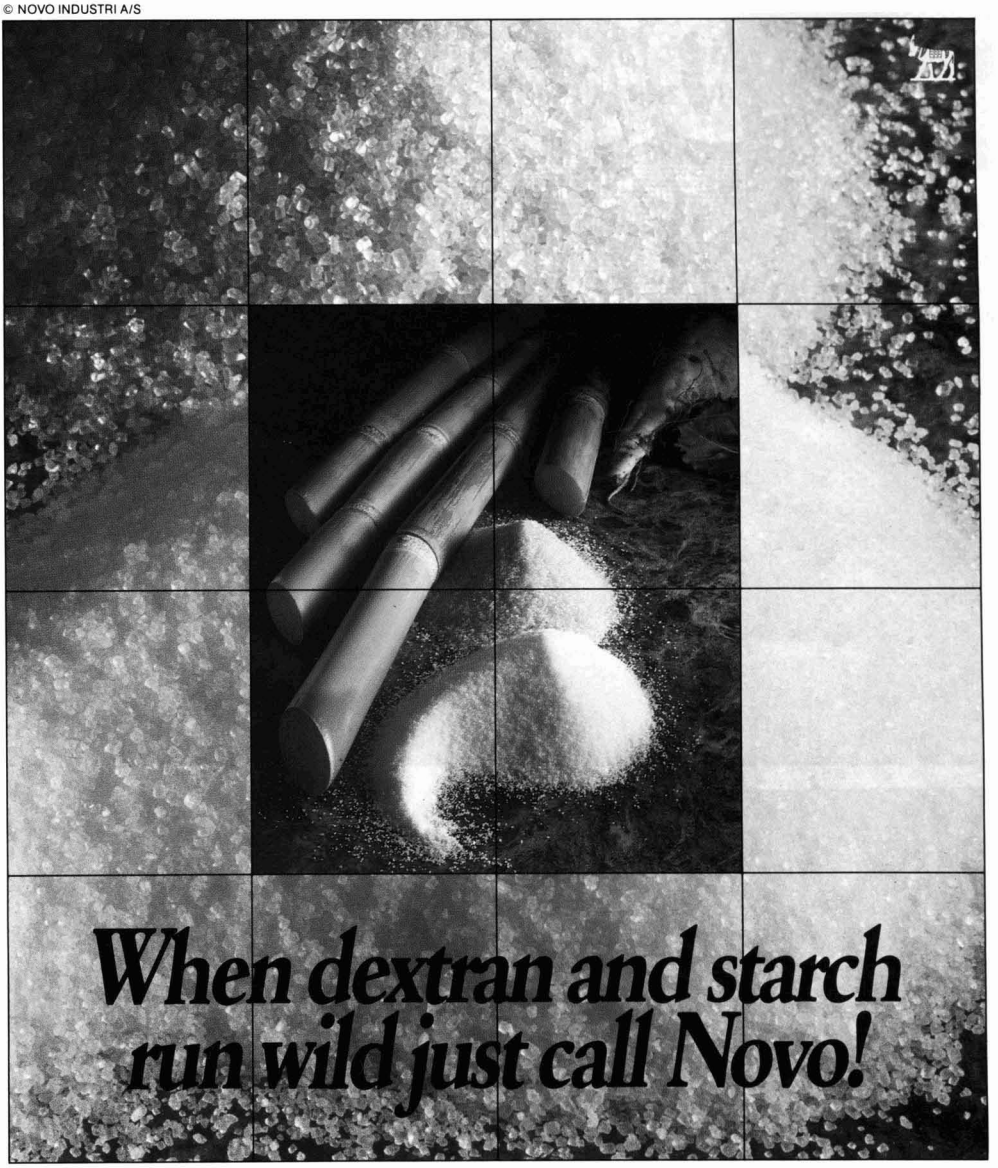
Selection of a suitable coal

There are a number of substances

Table I. Data on substances whose presence in dried pulp is limited by legislation or by dietary consideration

	I Limit values, (EEC directive)	II Typical values, (Gas-fired)	III Brigg values* (Oil-fired)	IIIa Previous data†
	mg/kg			
Arsenic	4	0.2	0.2	–
Fluorine	150	8	–	6
Lead	10	0.6	0.6	–
Mercury	0.1	0.016	–	0.003
	UK regulations, mg/kg in whole feeding stuff			
Iron	1250	650	470	
Iodine	40	–	–	
Cobalt	10	–	–	0.68
Manganese	250	–	42	–
Zinc	250	–	19.9	–
Molybdenum	2.5	0.59	–	0.23
Selenium	0.5	–	–	–
Copper	50	5.9	4.1	–
Soluble ash %	–	–	–	7.9
Insoluble ash%	–	–	–	2.3

* Samples taken from the adjacent oil-fired dryer at the same time as the HGG dryer test.
† Data obtained from factories other than Brigg or on composite samples from more than one factory.



There are times when dextran and starch will reach unacceptable levels in the cane juice - not only disturbing the manufacturing operations but also causing serious quality problems in the final product.

That is why more and more modern cane sugar mills today rely on enzymatic hydrolysis - preferably with enzymes from Novo, who is the leading supplier of both enzymes and know-how in this field.

Through hydrolysis with Dextranase Novo and Termamyl® the negative influences of dextran and starch are reduced or totally eliminated in a process thoroughly described in our folder for the cane sugar mills.

Supplemented with the matching application sheets it will bring you all the information you need to decide if your problems should be solved the Novo way.

NOVO

Worldwide leader in industrial enzymology.

NOVO INDUSTRI A/S · Enzymes Division · DK-2880 Bagsvaerd, Denmark · Tel. +45 2 98 23 33 · Telex 37173

whose presence in dried pulp for animal feeds is limited through legislation, through their animal nutrition effects, or through commercial considerations. A number of these substances with their limits are listed in Table I. Some of these substances may occur naturally in pulp and Column II shows an analysis of dried pulp from a gas-fired pulp dryer. For all practical purposes natural gas has no ash, therefore Column II is the base case or background level of these substances.

The concentrations of these substances is likely to be a function of the soil in which the beet is grown. Column III is therefore the analysis of dried pulp from Brigg factory for growing area comparison. This pulp is dried using heavy fuel oil which has an ash content higher than natural gas but still relatively small in overall terms.

Column IV shows the permissible increase above the base case which could be derived from the fuel. Present pulp pressing standards and pulp dryer efficiences mean that one tonne of coal will dry approximately 4 tonnes of pulp. This may increase to 5 tonnes of dried pulp with projected improvements in pulp pressing and pulp dryer efficiency.

Column I of Table II repeats the permissible increases above the base case which could be derived from the fuel. Column II shows the permissible levels in coals based on the following assumptions:– (1) that all the ash in coal is carried forward, (2) that all the ash carried into the pulp dryer with the hot gases is retained by the pulp, (3) that none of these substances is present in any significant amount in the sand used for bed make-up, and (4) that one tonne of coal actually dries four tonnes of pulp. Column III shows the analysis of the coal chosen for the test.

Table II. Margin for increase in trace elements derived from fuel, maximum levels in coal to meet the limit values in pulp and actual levels of trace elements in chosen coal

	I Margin for increase*	II Limit in coal†	III Actual value in coal test sample	IIIa Actual value in previous samples of coal‡
	mg/kg			
Arsenic	3.8	15.2	7.3	8.6
Fluorine	142	568	–	30
Lead	9.4	37.6	13.6	9
Mercury	0.084	0.34	–	0.23
Iron	600	2400	3870	4500
Iodine	–	–	–	–
Cobalt	9.32	37.3	–	6
Manganese	218	872	53.4	41
Zinc	230	920	9.4	12
Molybdenum	1.9	7.6	–	–
Selenium	–	–	–	–
Copper	44.1	176	15	–
Soluble ash %	–	–	1.89	–
Insoluble ash%	–	–	1.11	–

* Column I from Table I minus highest value from columns II, III, and IIIa.
† Based on one tonne of coal to dry four tonnes of pulp.
‡ Data from coal analyses at start of campaign from National Coal Board.

Commissioning and operation

The pre-commissioning of the plant was carried out progressively as the erection of equipment was completed. This included rotation checking of motors, adjusting valve and damper travel, and checking light-up sequences.

The first commissioning activity was to cure the refractory lining by firing the system under carefully controlled conditions. The heat input in the later stages would be such that the gases would have to be cooled in the dryer drum to prevent overheating of the induced draught fan, etc. It was originally intended that this should be undertaken after the commencement of slicing so that pulp would be available for this cooling activity.

It was felt to be essential to carry out this activity earlier, to ensure that performance data would be available right from the start of the campaign, and to give a better time margin for any remedial action if problems were encountered in the refractory cure. Fine water sprays fitted to the front of the feed chute had proved effective in refractory curing on oil-fired installations and these were therefore installed at Brigg. The HGG was fired and the refractory cured, a process which required some 4 days of continuous firing during early September 1983. The plant performed satisfactorily with no significant problems other than the modifications to the program and adjustments normal to the first light-up of a new plant.

The production from the pulp dryer fitted with the HGG could be sampled at any time as shredded pulp and, using a reject pulp system, shredded pulp production could be separated from the other dryers. The pulp nutting plant, however, was common to all four dryers so that pulp nuts could only be produced from the HGG dryer if the other dryers were shut down. It became apparent that another factory would be slicing for a full week before Brigg started, and arrangements were therefore made to bring pressed pulp in and run the HGG dryer to produce some pulp nuts for feeding trials before the other dryers started.

The HGG was warmed through satisfactorily as soon as pulp was delivered from the other factory. However, the fixed-speed coal feeders tripped out on overload after only five minutes. Several other attempts were made but with the same result on each occasion.

It was eventually found that a simple manufacturing error had resulted in the final flight of the scroll having a smaller cross section than the preceding flights. The coal therefore was being compressed against the casing in the final flight and causing an overload. The fault was remedied and the plant then ran satisfactorily.

The oxygen content of the recycle gas was found to be higher than expected, owing to air ingress to the dryer. The primary air was reduced as far as possible,

but design conditions could not be achieved as further reduction in primary air would have caused inadequate fluidization at low loads.

The first time that the dryer load increased to the point where the dilution gas damper should have opened, the bullring temperature continued to rise. It was found that the dilution gas damper had been expanded by radiant heat from the hot gas ducting and could not be opened. The dryer was shut down and the damper became free as the temperature fell. It was not possible to move the damper to a position where it would not be affected by radiant heat at that time, but this was to be done during the off-season. The problem was overcome by fixing the damper at about 16% open; the recycle gas flow then kept the damper cool, but the bullring temperature was no longer under control.

This damper was also arranged to open to 80% on shut-down in order to provide gas to transport the pulp out of the dryer drum. A fire had occurred on the first shut-down owing to pulp remaining in the drum and being overheated by residual heat in the dryer drum steelwork.

A few short stoppages occurred during this period: to replace the coal feed screws with correctly manufactured scroll geometry; to change the drum rotation speed; and to install various test connexions. These stoppages were all of fairly short duration with subsequent hot starts in which the preheat burner was not required. The sand bed retains its heat for a long time.

The HGG during this period was operated at the load to give maximum dryer output, while a series of pulp samples were obtained and preparations made for the performance tests.

Performance evaluation

The primary consideration in the performance evaluation was product quality. Sampling of dried pulp was commenced as soon as stable drying conditions were established. Samples of shredded pulp were collected at hourly intervals from the dryer outlet. Analysis of these samples began as soon as the first batch had been delivered.

Table III. Comparison of actual pulp analysis with expected values and limit values

	I Expected values	II Actual test values	IIa Previous test values*	III Limit values	IV % of limit
	mg/kg				
Arsenic	2.0	1.2	–	4	30
Fluorine	15.6	–	15	150	10
Lead	4.02	1.6	–	10	16
Mercury	0.073	–	0.01	0.1	10
Iron	1445	808	–	1250	65
Iodine	–	–	–	40	–
Cobalt	2.19	–	1.98	10	20
Manganese	55.5	48.4	–	250	20
Zinc	22.3	21.1	–	250	8
Molybdenum	–	–	0.81	2.5	32
Selenium	–	–	0.16	0.5	32
Copper	7.87	4.57	–	50	9
Soluble ash %	8.38	7.62	–	–	–
Insoluble ash%	2.58	1.62	–	–	–

* From pulp analysis at start of campaign.

It was quickly found that, even using single determinations, the analysis could not keep pace with the sample rate. The sampling rate was maintained but the analysis rate adjusted to ensure that analysis kept pace with operation, unused samples being stored for possible future analysis. The initial samples were analysed for ash (soluble and insoluble), lead, arsenic, copper and iron. The levels detected were very satisfactory with the exception of iron which was both high and variable from sample to sample. One determination was done for mercury and this was also satisfactory. The iron content in the analyses for the second day of operation showed a dramatic drop to a very satisfactory level indicating perhaps that rust was being cleaned from the system. Analyses for the second and third days remained satisfactory and included some analyses of fluorine. During this period pulp was provided for feeding trials which proved satisfactory.

The following week the factory started slicing beet and therefore was drying its own pulp as opposed to that brought from another factory. The analysis was reduced to once per shift on a composite of the hourly samples. However, not all shift samples were analysed. After five days analyses were completed. They were averaged and appear in Table III, Column II.

The quality of the pulp based on these analyses was very satisfactory and the emphasis shifted to the other areas of performance evaluation.

The first activity was a preliminary test of grit and dust emissions from the pulp dryer chimney. This verified that the test points had been correctly installed and the readings taken from the plant instrumentation showed that the plant was operating as expected. The small quantity of dust collected was submitted for analysis and found to have levels of arsenic and iron which in part explained the very satisfactory levels in the dried pulp samples.

Arrangements were made for a performance test. This would require 3 days: one day to set up the test equipment, one day involving the test of nominally 9 hours duration and third day for additional or repeat tests and for the dismantling of the test equipment.

(to be continued)

Brevity

Fiji cyclone damage[1]

Two powerful cyclones which in January hit Fiji caused damage to cane, sugar factories and stores. The damage to the cane crop is estimated at between 5 and 10%; however, the worst blow came from damage to 70,000 tonnes of sugar in store when a warehouse roof was blown away. The Fiji Sugar Corporation hoped to salvage part of this sugar, but hoards of bees which began feeding on it were making the task almost impossible.

1 F. O. Licht, *International Sugar Rpt.*, 1985, **117**, 65.

New books

WSJ directory of the world sugar industry, 1984

Eds. N. G. Osman and P. A. Williams, 410 pp; 25×29 cm. (Pressprint Publishing Ltd., 20 Rose Street, Wokingham, Berks. RG11 1XU, England.) 1984. Price: $275.00.

This is a completely new sugar directory which, for each sugar-producing country, provides not only the addresses of the companies and factories but also a brief report on the sugar industry and economy of the country in question and panels of general information on areas, climate, population, etc. Weather information relating to the growing areas is included for some countries. The bulk of the publication is, as to be expected, devoted to information of this type, but there is also a preceding collection of feature articles: Likely prospects for the ACP-EEC sugar relationship during the next ten years (by F. Thomlinson), Sugar in the Arab World (by T. M. Burley), The production of white sugar from cane and its growing market importance (by M. C. Bennett), Prospects of beet sugar production in a tropical country like India (by P. J. M. Rao) and Outlook for low-caloric sweeteners (by S. Vuilleumier). A sugar atlas occupies the back section of the book; it indicates the locations of sugar factories and refineries in each country as well as (in some cases) growing areas, research institutes, sugar-handling ports, meteorological stations, distilleries, etc.

The book is clearly printed and the information neatly set out. The data have been compiled from information obtained in the countries concerned; as a result of lack of such information, there are a number of countries not represented which, in a directory of this type, should be included. Such countries are Bangladesh, Bolivia, Brazil, Costa Rica, Cuba, Japan, Poland and Taiwan plus certain others having only small industries. It is expected that the publishers will have assembled data for these countries so that future editions of the directory will be comprehensive.

Die Qualität der Zuckerrübe. Bedeutung, Beurteilungskriterien und züchterische Massnahmen zu ihrer Verbesserung (Sugar beet quality. Importance, evaluation criteria and breeding measures for its improvement)

W. Oltmann, M. Burba and G. Bolz. 159 pp; 16.5×24.5 cm. (Paul Parey, Lindenstrasse 44-47, D-1000 Berlin 61, Germany.) 1984. Price: DM 76.00.

This is No. 2 in a series of supplements (entitled "Advances in plant breeding") to the *Journal of Plant Breeding*. Its authors are members of the staff of the Institut für Pflanzenzüchtung of KWS Kleinwanzlebener Saatzucht AG, one of the leading sugar beet breeding establishments. However, while the emphasis of the material is on breeding aspects, much of the book concerns the composition and processing quality of beet and means of determining and evaluating it, so that the work could be regarded as having some interest for the beet sugar chemist, provided he can read German. The contents are well arranged, with neat printing and there is a subjects index as well as an alphabetical list of authors' references. Each of the 13 main chapters is summarized in English.

Glucose syrups: science and technology

Ed. S. Z. Dziedzic and M. W. Kearsley. x+268 pp; 23×15 cm. (Elsevier Applied Science Publishers Ltd., Crown House, Linton Road, Barking, Essex IG11 9JU, England.) 1984. Price: £35.00.

This book is divided into seven chapters dealing with all aspects of glucose syrups from the raw material for their manufacture to their use in food products. Chapter 1 describes the raw material; all types of starches are discussed and particular problems associated with each presented. Methods of extraction and purification are given where appropriate. Chapter 2 discusses the conversion of the raw material to glucose syrups by enzymatic methods, and provides information on process economics as well as on the unit operations involved. Chapter 3 covers the production and properties of hydrogenated glucose syrups, and discusses their advantages over the more conventional syrups. Chapters 4 and 5 describe the physico-chemical and physiological properties of glucose syrups, while Chapter 6 examines the latest techniques available for glucose syrup analysis. The final chapter discusses the food uses of the syrups according to their particular properties.

Summary of trade and tariff information. Sugar and other sweeteners

Anon. 68 pp; 21.4×28 cm. (United States International Trade Commission, 701 E Street NW, Washington, D.C. 20436, USA.) 1984.

A recently released USITC publication (No. 841) provides the latest official information available on the US sugar and sweeteners industry, and includes details of imports, exports, production, uses, customs treatment and competition in the US and world markets for sugar and other sweeteners. It highlights the drop in sugar imports and consumption during 1979/83 while production and consumption of HFS rose rapidly. A price support system was made effective in early 1982; this provided for a price above that of the world market so that the domestic producers were protected from imports first by imposition of import fees and then by import quotas. The US per caput consumption of sugar dropped from 89.3 lb in 1979 to 71.4 lb in 1983, while that of HFS rose from 15.5 to 30.3 lb. While the supply of domestic sugar remained steady, imports fell from 5.1 million short tons in 1981 to 2.6 million in 1982.

British Society of Sugar Cane Technologists

The 1985 Annual General Meeting of the B.S.S.C.T. was held at the Royal Commonwealth Society in London on April 1 and was followed by a Technical Meeting devoted to the theme of "Training within the sugar industry", under the Chairmanship of Dr. R. A. Yates.

It is a requirement of the UK government that training be provided by all but the smaller companies and this was originally (from 1964) carried out by training boards for the various groups of industries such as the Food, Drink and Tobacco Industry Training Board, which were financed by direct levies usually related to payroll costs. Both Tate & Lyle and British Sugar had existing training schemes which were approved by the authorities and they were levy-exempt. In 1981 most of the Boards were abolished in favour of voluntary arrangements and a joint program was developed under the aegis of the UK Sugar Industry Association.

Annual reports are required by government and an account of the latest report and of the activities of the scheme were described by the executives in charge of training for Tate & Lyle Refineries Ltd. and British Sugar plc, Mr. J. Ogden and Mr. A. Hewitt, who described the facilities and extent of training given to people at a wide range of levels from graduate management trainees through skilled technicians and artisans to school-leavers.

Mr. P. D. James of BSD Ltd., the consultancy division of British Sugar plc, described as a mixture of triumph and trauma the training of overseas personnel in the UK beet sugar industry. Such persons were usually staff from industries to which BSD was providing technical aid and he described the problems involved in ensuring that the trainee received as much benefit as possible from the opportunities provided, as well as those concerned with work permits, funding, etc., which might prevent any training being given.

In Tate & Lyle it had been recognized that there were highly competent technical personnel who had received no commercial and management education and for whom detachment for a residential course at a business school was difficult or impossible. Mr. R. Bayliss, Training and Graduate Recruitment Consultant for Tate & Lyle PLC, described the development of "distance learning" by Henley Management Centre and the Open University whereby such personnel could gain management knowledge in their spare time without formal attendance at lectures, etc. This system is the modern version of the "correspondence course" but uses up-to-date techniques including the use of audio and video cassettes and other teaching aids, and is, of course, less expensive than the full-time alternative.

Mr. J. Marjoribanks of the Commonwealth Development Corporation presented a film on the Mananga Agricultural Management Centre in Swaziland and then supplemented this with further information on its methods and achievements. It provides courses of various lengths up to 11 weeks for both senior and junior management, at education levels from school leaving certificate to Ph.D., and has trained some 1200 people from 40 countries. About 1 in 6 are from the sugar industry, and the Centre's location in the middle of the Swaziland sugar belt, provides an excellent opportunity for such training. Trainees are encouraged to learn and develop for themselves skills in man management, accounting and economics as well as some of the broader issues affecting third world management.

Finally, Mr. J. F. N. Wheeler, formerly of Booker Agriculture International Ltd., described the training of management in countries where BAI held contracts, for instance at Mumias in Kenya, Bacita in Nigeria, and Ramu Sugar in Papua—New Guinea, etc., where training for replacement of expatriates by local management was embodied in the contract. He discussed some of the problems which arose but, by means of a series of graphs, illustrated that sugar production has increased steadily during the change from management by expatriate to local staff.

Membership of the Society is intended for UK nationals and residents, and details may be obtained from the Secretary-Treasurer, c/o TLA, 45 Homesdale Road, Bromley, Kent BR2 9TE, England, who can also provide texts of some of the papers presented at the 1985 meeting.

Brevities

Frost damage to US mainland cane

The Florida sugar cane crop sustained damage from frosts in January but there has been no accurate indication of the extent of the damage[1]. Some 55% of the crop had already been harvested and farmers were trying to bring in the remainder of the crop as quickly as possible to avoid further damage. Sugar cane crops were also probably damaged in south-central Louisiana where temperatures remained below the critical 25°F (-4°C) for 8-10 hours. In December 1983 the Louisiana crop was stricken by a freeze, with a low temperature of 13°F (-10.6°C) and by 15 days later the cane was unacceptable for processing.

Molasses utilization in Pakistan[2]

The government of Pakistan has approved six industrial projects, all utilizing molasses as raw material: two ethanol units, two PVC units, one polyethylene resin factory and one ethylene glycol factory. These projects will require around 1.1 million tonnes/year of molasses, while production is expected to reach 1 million tonnes/year by 1987/88. Meanwhile, Pakistan will continue to be a net exporter of molasses.

St. Kitts diversification plans[3]

In a New Year message, the St. Kitts Prime Minister listed among major projects for 1985 one whereby bagasse from the island's sole sugar factory will be used for generation of electricity. The government has also entered into an agreement with private investors for setting up an alcohol distillery in association with the sugar factory.

1 F. O. Licht, *International Sugar Rpt.*, 1985, **117**, 61.
2 *Amerop/Westway Newsletter*, 1985, (135), 14.
3 F. O. Licht, *International Sugar Rpt.*, 1985, **117**, 62.

Brevities and statistics

Biodegradable plastic from sugar[1]

Two or three years ago, ICI exhibited as a scientific curiosity a plastic material PHB (polyhydroxybutyrate) produced naturally by bacteria. Now, several tonnes are made annually by Marlborough Biopolymers, the company which leased the process from ICI. Initial investigations showed that PHB had properties very similar to polypropylene but would cost about twice as much to produce in Western Europe because of the relatively high cost of the sugar needed to feed the bacteria. But PHB has a major advantage for some purposes; it is biodegradable and breaks down completely in the human body, at a controlled rate and causing no inflammation or toxic reaction. It also breaks down at a controlled rate in the soil. At first, low-volume, high-value applications were sought for PHB, such as surgical sutures, drug-delivery implants and wound dressings. But Marlborough Biopolymer's investigations reveal a much larger market for BHP produced by very large-scale fermentation plants in areas such as Brazil, the Caribbean and South-East Asia where there are surpluses of sugar. There, PHB could be competitive with oil-based plastics now and increasingly so in areas with no reserves of gas or oil but with sugar-growing capacity. The company has already put together a financial package with British and American banks to assist developing countries to build big PHB plants.

Personal notes

A number of changes have occurred in the senior management of British Sugar plc owing to retirements and promotions. **David Horsley,** Chief Chemist, retired on March 31 after 35 years with the company which he joined as personal assistant to the then Chief Chemist, subsequently serving as senior works chemist from 1957 and Deputy Chief Chemist in 1967 and Chief Chemist a year later. His successor, **Dr. Charles Harvey,** has been with British Sugar since 1970 and has worked in the company's sugar factories, the research laboratories and in the chemical control service.

Donald Hibbert retired as Head of Central Laboratory on March 31 and his colleague **William Woodwark** is to become Manager of the laboratory. Both men worked at the laboratory when it started in 1946 and Mr. Hibbert then spent a period at Spalding factory before returning to Peterborough. He became Head of the laboratory in 1956 when Mr. Woodwark was appointed Assistant Head. Both men have been closely connected with developments in analytical methods and Mr. Hibbert has been a staunch supporter of the activities of ICUMSA, serving as Secretary since 1966.

Tom Lubienski, Chief Mechanical Engineer, retired on February 1 after a career dating back to 1950 when he joined British Sugar as a technical assistant, with subsequent promotions to design office work, as assistant mechanical engineer, works engineer at Spalding in 1956, design office project manager in 1976, and Chief Mechanical Engineer in 1979. He is to be succeeded by **Derek Brown,** who joined British Sugar in 1982 after 22 years with ICI Ltd.

Dr. Malcolm Branch, one of British Sugar's three Group Production Managers, has been promoted to Director of Production, responsible to Executive Director **Bob Chappell;** he will be replaced by **Tony Warnes,** Manager of Bury sugar factory, and his appointment will permit continuity in senior production management when Mr. Chappell retires in 1986.

Zimbabwe sugar exports, 1984[2]

	1984	1983
	tonnes, raw value	
Algeria	0	44,690
Botswana	37,430	37,038
Burundi	0	1,054
Canada	40,277	30,576
EEC	24,858	38,614
Morocco	15,815	0
Mozambique	0	8,473
Portugal	36,060	29,138
US	13,926	32,397
USSR	14,972	0
Zaire	0	1,054
Unknown	0	2,982
	183,338	226,016

US sugar import fee[3]

On March 5, for the second time in the first quarter of the year, an interim import fee of 1.00 cents/lb came into effect, increasing the total fee to 2.2875 cents. On March 25 it was announced that the fee established for the next quarter would be 2.7185 cents/lb, effective from April 1. There had been considerable speculation within the trade over whether it would be announced that the fee was to be suspended but this was not mentioned in the announcement. While this does not preclude later removal of the fee, it does bring into question the quantity of imported raw sugar that will arrive in April, May and onwards. Shipping to the US market when so large a fee is in existence will be extremely expensive and it seems likely that, until the matter of fee suspension is resolved one way or the other, shipments will be delayed to the latest possible date.

New Bangladesh sugar factory[4]

The Natore Sugar Mills in Bangladesh, built for the Bangladesh Sugar Industries & Food Corporation, was opened on February 4. The plant, which has a crushing capacity of 1500 t.c.d., will produce plantation white sugar using the sulphitation process. The factory, which was built by the Pakistani state-owned Heavy Mechanical Complex Ltd., Taxila, is the second to have been built for export; the first went to Indonesia.

Switzerland sugar production[5]

Aarberg sugar factory sliced 478,785 tonnes of beet in the 1984 campaign to produce 66,792 tonnes of white sugar, while Frauenfeld factory sliced 380,928 tonnes of beet to yield 53,881 tonnes of white sugar; total Swiss sugar production was thus 120,673 tonnes, white value.

Taiwan sugar crop reduction plans[6]

Taiwan's sugar production target will be sharply reduced to 550,000 tonnes, tel quel, in the 1985/86 season from 650,000 tonnes in 1984/85, according to the Taiwan Sugar Corporation. The reduction is due to record low prices, and the company has also set a lower export volume for 1985 of 120,000 tonnes, down from 131,500 tonnes in 1984.

Indian sugar exports possibility in 1985[7]

India may resume exporting sugar during calendar 1985, according to the Chairman of the State Trading Corporation, because latest indications are for an increase in production from 5.89 million tonnes in 1983/84 to seven million tonnes in the current season. The Corporation is negotiating to sell 22,000 tonnes of sugar to the US and 10,000 tonnes to the EEC under quota.

Record Yugoslavia beet sugar campaign[8]

In 1984 a record harvest of 6,789,000 tonnes of beets was grown in Yugoslavia, compared with 5,520,000 tonnes in 1983. With 212,000 tonnes of beets imported from Hungary, the country's 23 sugar factories produced a record 900,000 tonnes of sugar, white value, against the previous record of 790,000 tonnes set in 1981.

Japan beet sugar campaign, 1983/84[9]

The total beet crop for the 1983/84 campaign amounted to 3,376,744 tonnes, reduced by bad weather from the 4,107,929 tonnes of 1982/83, although grown on an area of 72,522 ha against 69,683 ha. The sugar recovery was lower at 13.90% vs. 14.94% and sugar production was 469,405 tonnes, white value, against 613,678 tonnes.

Mexico medium-term sugar program[10]

Mexico aims to produce 3.8 million tonnes of sugar annually between 1988 and 1994, according to a report from Azúcar S.A., the state agency coordinating the sugar industry. This compares with the 3.05 million tonnes achieved in 1983/84 and 3.3 million tonnes expected from the 1984/85 crop[11]. The report attempts to identify the factors which led to the economic and financial collapse of the industry. Included are an assessment of the current state of the industry, an examination of the prospects for exports and concrete proposals to raise production, control prices and break away from dependence on state subsidies.

1 F. O. Licht, *International Sugar Rpt.*, 1985, **117**, 174-175.
2 *I.S.O. Stat. Bull.*, 1985, **44**, (1), 50.
3 C. Czarnikow Ltd., *Sugar Review*, 1985, (1736), 45.
4 F. O. Licht, *International Sugar Rpt.*, 1985, **117**, 103.
5 *Zuckerind.*, 1985, **110**, 81.
6 F. O. Licht, *International Sugar Rpt.*, 1985, **117**, 103.
7 *Reuter Sugar Newsletter*, January 29, 1985.
8 F. O. Licht, *International Sugar Rpt.*, 1985, **117**, 96.
9 *Zuckerind*, 1985, **110**, 84.
10 *World Sugar J.*, 1985, **7**, (7), 30.
11 *Public Ledger*, January 29, 1985.

Trade notices

Peristaltic pumps for use with liquid sugar

Bredel Machine- en Constructiebedrijf B.V., Alphen aan den Rijn, Holland.

Problems with various types of pump prompted the Finnish Sugar Co. Ltd. to conduct tests on liquid sugar dosing at Porkkala using a Bredel SP 40 peristaltic pump fitted with a 4 kW, 1420 rpm motor with speed reduction gear; a static inverter was used to adjust speeds within close limits. Two sugar solutions were used, of 65° and 77°Bx, and the pump was operated at 50 and 80 rpm during 3 and 2 minutes, respectively. Results showed that the pump was highly suitable for the task. Bredel pumps are self-priming up to 10 m and are designed for pressures up to 15 bar and deliveries up to 60 m^3/hr. The hose, manufactured from thick-wall elastomers reinforced with braided nylon, has a life exceeding 4000 running hours, and the pump is able to deliver at constant capacity despite fluctuations in viscosity.

Powder handling systems

Spiroflow U.K. (Machinery) Ltd., P.O.Box 7, Clitheroe, Lancs. BB7 1QG, England.

Literature from Spiroflow gives details of conveyors, batch weighing systems, metering and blending units, feeders, mixers, filling and weighing systems, sack fillers and emptiers, drum tippers, hopper and silo discharge aids, and bin level indicators available from the company for the creation of complete handling systems. The rotating-spiral conveyor consists of a length of spiral spring, to which a drive motor is coupled, rotating within a nylon tube; throughputs range from 100 kg to 7 tonnes/hr. Sugar is one of the products for which the conveyor is applicable.

Single-stage turbines

Coppus Engineering Corporation, 344 Park Avenue, Worcester, MA 01610, USA.

A 20-page catalogue from Coppus Engineering describes their mechanical-drive single-stage turbines ranging from ¼ to 4000 hp. The total line includes the radial-split, horizontal-shaft RLA series; the radial-split, vertical-shaft RLVA series; and the horizontal-split, horizontal-shaft RLHA series. Among new features in the RLA and RLVA series is the Coppus special safety trip which is capable of stopping a fully unloaded turbine and can be re-opened against full-line pressure and flow; other design features include a removable steam strainer, non-compressible valve stem bushings with intermediate leak off, and ball thrust bearings that are locked to the shaft. All Coppus turbines are designed for immediate start-up to full load.

Zanini export sales of sugar machinery

The US Sugar Corporation has acquired four 3-roller Zanini-Farrel mills, with 84×39½ in rollers, as well as reduction gears for the units. The Corporation, Okeelanta Sugar Division of Gulf & Western, and Sugar Cane Growers Cooperative of Florida have all ordered equipment for cane preparation from Zanini. Ingenio San Martín del Tabacal, in Argentina, has signed a contract for cane preparation equipment, including an 84-inch shredder, two turbines and gearing for the shredder and knives, seven "press rollers", one Donnelly feed chute, carriers, etc., which will raise both mill capacity and extraction. In addition, a number of mill components have been sold to P. T. Gunung Madu Plantations in Indonesia.

Sugar plant licence

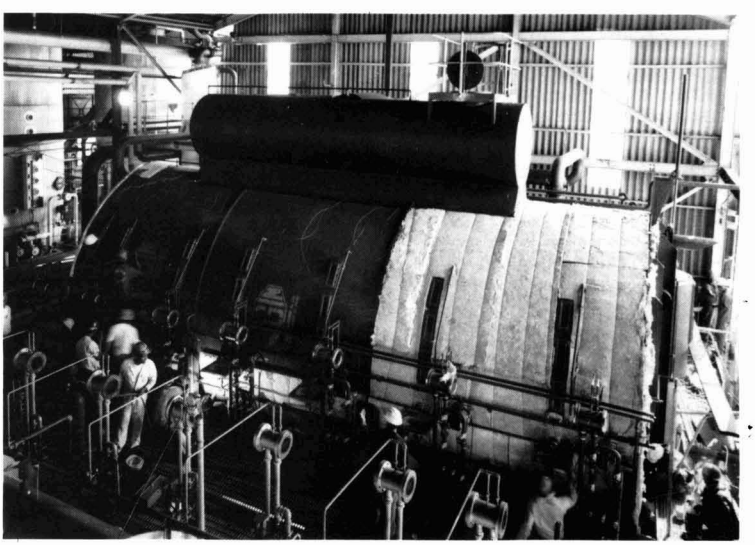
Kawasaki Heavy Industries Ltd. (KHI) has granted P. T. Barata Indonesia, an Indonesian state-run industrial machinery manufacturer, a licence to build sugar plant. Under the agreement, KHI is to provide technology on such equipment as cane mills, and Barata will build the plant within a few years' time.

Animal fodder weighing

The Beemol plant at the Peterborough factory of British Sugar plc has recently taken delivery of a weigh-filler (plus ancillary equipment) manufactured by Darenth Ltd. Intended for open-mouth bag weighing and filling, the unit is based on the Darenth patented pneumatic weighing system which incorporates an analogue dial indicator calibrated in 26 kg×50 g divisions.

Continuous vacuum pan licence

Elgin Engineering (Pty.) Ltd., of Durban, South Africa, recently signed an agreement with North Queensland Engineers & Agents (Pty.) Ltd., of Cairns, Queensland, Australia, for the marketing and manufacture by Elgin of the SRI-NQEA continuous vacuum pan, developed by the Australian company in association with the Sugar Research Institute. One of the pans has already been installed at the Sezela sugar factory of C. G. Smith Sugar Ltd. for low-grade massecuite. The illustration shows the pan, of 400 tch rated throughput, in its final stages of construction.



The Leces bagasse pulp and paper mill

On February 26th, 1980 an Austrian-German consortium, consisting of the companies Voest-Alpine AG, of Linz, Austria, Voith AG, of St. Pölten, Austria, and Coutinho, Caro & Co., of Hamburg, Germany, signed the contract for the turn-key erection of a bagasse pulp and paper mill for P.T. Kertas Leces, of Leces, East Java, Indonesia.

The technical leader of the consortium was Voest-Alpine AG. Voest-Alpine AG was responsible for the complete pulp plant starting with the handling of the raw material bagasse, the complete recovery system consisting of evaporation, the recovery boiler, recausticizing, the lime kiln and electrolysis with chlorine and soda production, as well as all bagasse and oil transport (trucks and wagons). Voith AG was responsible for the complete paper plant, and Coutinho, Caro & Co. delivered the power plant, the oil terminal and was responsible for the complete civil works and the erection of the plant.

The Kertas Leces project comprises a fully integrated bagasse based pulp and paper mill of 264 tonnes/day saleable capacity in various grades of writing, printing and tissue paper plus coated board and includes all essential and supporting finishing and servicing equipment.

Bagasse to be used for pulp production is supplied by three sugar factories (Semboro, Jatiroto and Wonolangan) located around 20-80 km from the pulp mill. At Semboro sugar factory bagasse is moist- and wet-depithed and wet-stored for use between cane harvests.

Bagasse supplied by Jatiroto and Wonolangan is moist-depithed at the sugar factory and moist-depithed and washed at the Leces site and immediately used for production at the pulp mill.

Equipment at the sugar factories includes the following:

Jatiroto:
5 moist-depithers
Total capacity: 490 tonnes bone-dry material (BDMT)/day

Semboro:
5 moist-depithers,
5 wet-depithers
Total capacity: 500 BDMT/day
Bagasse wet storage capacity is 80,000 BDMT.

Wonolangan:
2 moist-depithers
Total capacity: 70 BDMT/day

Leces site:
4 moist-depithers,
4 washers
Total capacity: 490 BDMT/day
Bagasse wet storage capacity is 40,000 BDMT.

Aerial view of the Kertas Leces bagasse pulp and paper plant

The system employed at the Leces pulp mill consists essentially of continuous digestion, based on the soda process, three-stage washing, screening consisting of centrifugal screen and three-stage cleaner group and bleaching with the sequence C-E-H. Black liquor is recovered by a closed recovery circuit consisting of evaporation plant, recovery boiler, causticizing plant and lime kiln. Heat generated by burning of evaporated black liquor in the recovery boiler is also used to produce electrical power.

The chlorine and soda are produced in a new membrane-cell-electrolysis plant consisting of three units and salt preparation.

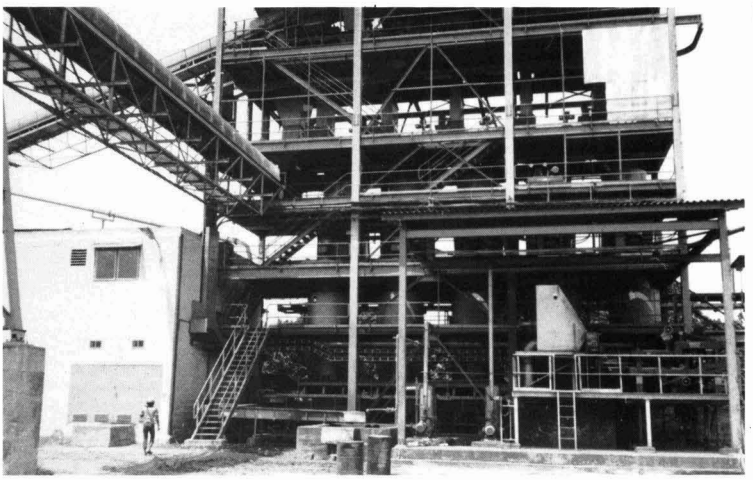
Capacity of the pulp mill is 180 BDMT/day bleached pulp, while that of the continuous digester is approx. 210 BDMT/day, working at 170°C cooking temperature.

The washing plant is of 200 BDMT/day capacity, and the mill has 60 tonnes storage capacity for unbleached pulp after screening and cleaning.

The bleaching plant is of 180 BDMT/day capacity, producing pulp of 82°GE brightness and strength index 250 km. Storage capacity for bleached pulp is 120 tonnes.

Source: VOEST-ALPINE AG, Linz, Austria.

The Leces bagasse pulp and paper mill



Bagasse depithing installation at the Kertas Leces plant

The electrolysis plant produces 12 tonnes/day of chlorine and 13.6 tonnes/day of NaOH (100%), as well as 0.33 tonnes/day of hydrogen.

Pulp produced at the pulp mill is supplied to the paper mill comprising two existing paper machines—one of them had to be rebuilt under the contract—and two new paper machines.

Mainly the two new paper machines are used to work up the bagasse pulp. One of the new machines (PM 3) is used to produce writing, printing and coating base paper and the other (PM 4) is used to produce various tissue papers. The coater is designed for two-side coating of base paper and board.

Capacity of the PM 3 is 220 tonnes/day of unisized paper (60 g/m^2) or 180 tonnes/day of surface-sized paper of the same weight. Machine speed is 600 m/min and working width 5450 mm.

Capacity of the PM 4 machine is 44 tonnes/day of uncreped paper (17 g/m^2). It runs at 1200 m/min with a working width of 2100 mm.

Capacity of the coater is 848,000 m^2/day for 60/70 g/m^2 paper.

After the paper mill there is a finishing department designed to produce 12,600 tonnes/year as rolls and 33,600 tonnes/year as sheets.

In addition to the integrated pulp and paper mill the contract also included three power boilers with two turbo-alternators as well as fresh water and effluent water treatment, fire protection and several service equipments, additional fuel oil terminals at the sugar factories and the pulp and paper mill as well as that at the harbour at Probolinggo.

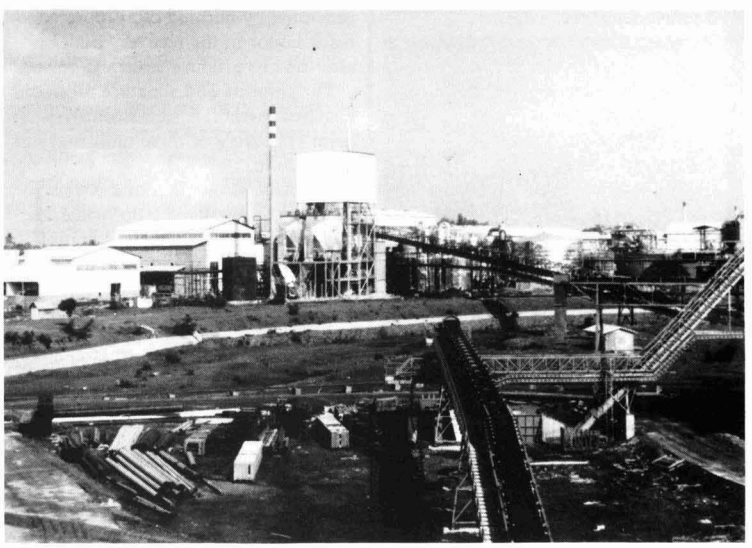
The power plant includes 3 boilers generating 90 tonnes/hour each of steam at 45 bar and 440°C.

There are two turbo-alternators, one condensing and one back-pressure, with a capacity of 19.4 MW each.

Storage capacity at the oil harbour is 20,000 m^3, while ship unloading capacity is 450 tonnes/hour. Loading capacity for trucks and wagons is 60 tonnes/hour.

During construction of the new pulp mill, the bagasse-fired boilers of the sugar factories at Semboro and Jatiroto had to be converted from bagasse to fuel oil firing.

Final erection was completed in 1983, with the first pulp produced in July 1983. The complete plant was accepted by the client in April 1984.

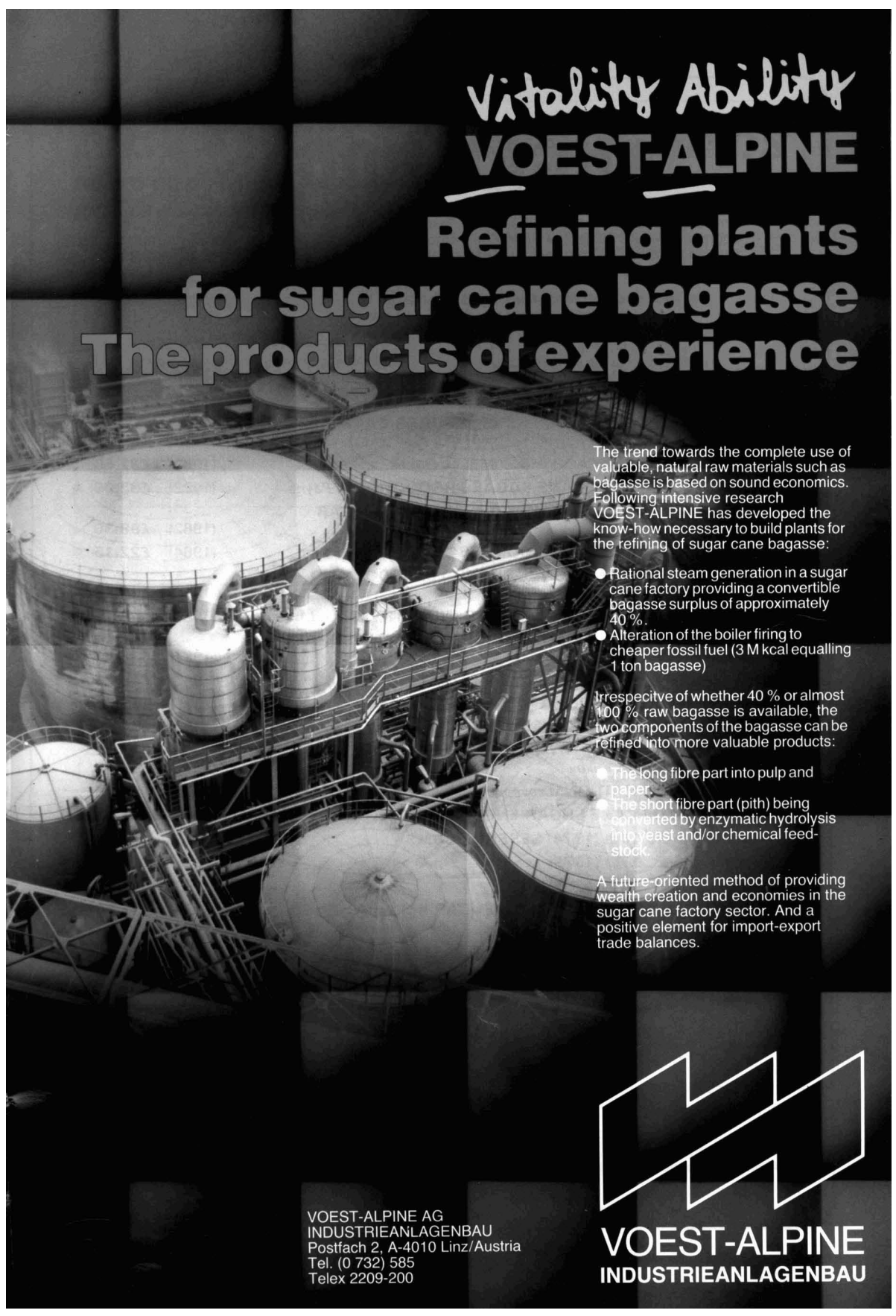


View of the recovery boiler, evaporation plant and pulp line

Rex Omega couplings

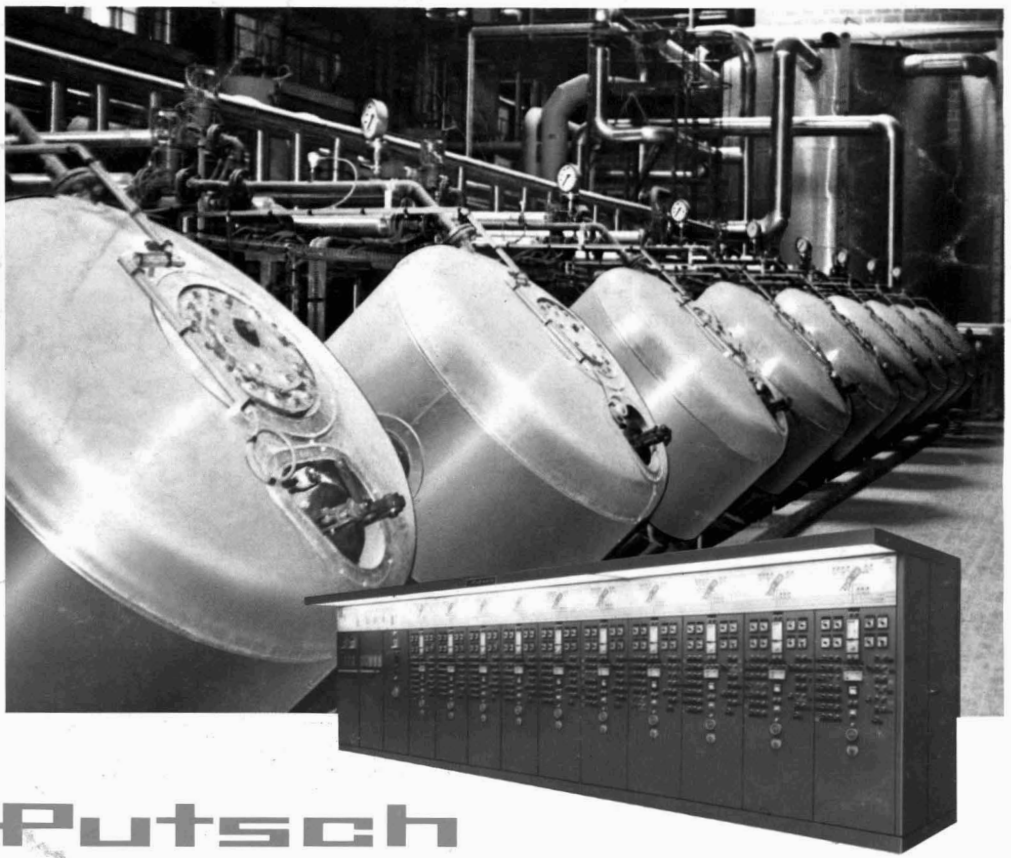
Mechanical Power Division, Rexnord, P.O. Box 2022, Milwaukee, WI 53201, USA.

A new 14-page brochure features Rex Omega standard, mill motor, spacer and extended spacer elastomer couplings which are easy to assemble and dismantle, provide a longer system life and contribute to lower maintenance costs. The tough urethane element transmits torque, accepts misalignment and reduces both vibration and noise.


Vitality Ability
VOEST-ALPINE
Refining plants
for sugar cane bagasse
The products of experience
The trend towards the complete use of valuable, natural raw materials such as bagasse is based on sound economics. Following intensive research VOEST-ALPINE has developed the know-how necessary to build plants for the refining of sugar cane bagasse:
Rational steam generation in a sugar cane factory providing a convertible bagasse surplus of approximately 40 %.
Alteration of the boiler firing to cheaper fossil fuel (3 M kcal equalling 1 ton bagasse)
Irrespecitve of whether 40 % or almost 100 % raw bagasse is available, the two components of the bagasse can be refined into more valuable products:
The long fibre part into pulp and paper.
The short fibre part (pith) being converted by enzymatic hydrolysis into yeast and/or chemical feed-stock.
A future-oriented method of providing wealth creation and economies in the sugar cane factory sector. And a positive element for import-export trade balances.
VOEST-ALPINE AG
INDUSTRIEANLAGENBAU
Postfach 2, A-4010 Linz/Austria
Tel. (0 732) 585
Telex 2209-200
VOEST-ALPINE
INDUSTRIEANLAGENBAU

Index to Advertisers

Performance proves Putsch Quality



Putsch

Plate filters produce clearer juices!

Putsch

Plate Filters are fully automated, and operated preferably with pre-coat.
The filters are mounted at an angle of about 45°. In operation the filter plates stay in a horizontal position. For cake removal the central shaft is turned slowly.

Putsch are experts in filtration.

After all – it's performance that counts!

H. Putsch & Comp.
International Group

H. Putsch GmbH & Comp. · P.O. Box 4221 · 5800 Hagen 1/W.-Germany · Tel. (23 31) 3 10 31 · Telex: 8 23 795
In the USA: H. Putsch & Company, Inc. · P.O. Box 5128 · Asheville, N.C. 28803 · Tel. (704) 6 84-06 71 · Telex: 577 443
In Italy: Putsch-Meniconi: Loc. Bellavista, 48 · 53036 Poggibonsi (Siena) · 0577/979146 (3 Linee) · Telex: 571 169
In Spain: Putsch-Nerva. SA. · Apartado 406 · Valladolid 8 · Tel. (83) 272208-12-16 · Telex 26383