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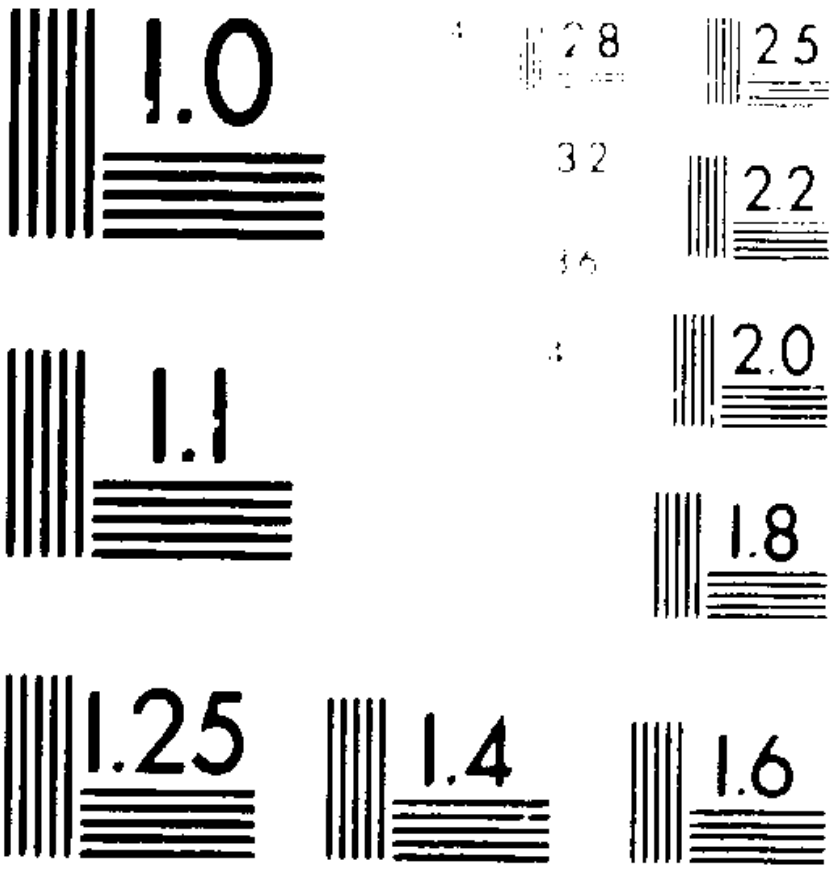
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 1010a
(ANSI and ISO TEST CHART No. 2)

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RESTRICTED

8 June 1984

ENGLISH

India. BIOSCIENCE AND ENGINEERING.

DP/IND/80/003

Technical Report *

Mission 7-20 January 1984

Prepared for the Government of the Republic of India
by the United Nations Industrial Development Organization,
acting as executing agency for United Nations Development Programme

Based on the work of John D. Bu'Lock,
Consultant on Conversion of Glucose to Ethanol

United Nations Industrial Development Organization
Vienna

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1. Introduction

The purpose of this mission was to advise and assist the staff of the National Chemical Laboratory (NCL) in their studies on conversion of glucose into ethanol and to participate in the International Chemical Reaction Engineering Conference (ICREC) 9-11 January 1984, Pune, organized by the National Chemical Laboratory.

The time in Pune was divided between attendance at ICREC, combined with informal discussions, and intensive formal discussions of the whole Bioscience and Engineering project DP/IND/80/003, in which I took part alongside the two other consultants, Professor Moo-Young and Professor Bungay; we are reporting independently but our work was very much in concert. The principal NCL participants were:

Professor L.K. Doraiswamy (Director)
Dr. R.A. Mashelkar
Dr. M.C. Srinivasan (cellulose utilization)
Dr. C. Siva Raman (retd)
Dr. A.I. Mascarenhas (plant tissue culture)
Dr. Mrs. H. Siva Raman (immobilization, biogas)
Dr. P.K. Ranjekar (genetics)
Mr. S.R. Modak (culture collection)
Dr. N.G. Karanth (ethanol reactors)

In Bombay I had useful discussions with Dr. Mitchell and Mr. Nesargi at the British Council Offices.

3. General comment on NCL.

Before making more detailed comments on the project studies I wish to record a general opinion regarding NCL. The ICREC meeting provided an occasion on which a wide variety of international experts could form their own opinion of NCL's organizing capability and effectiveness, as seen through the ICREC meeting, and also of the general standard of their work as noted in the numerous informal visits being paid to different parts of the complex during this period. Throughout, all these aspects found high praise and there was a complete and remarkable absence of adverse comment.

4. Cellulose Conversion Studies.

The work reported to us was scientifically sound and tactically correct but there are some uncertainties regarding middle- and long-term strategy. As regards the long-term strategy some uncertainties are inevitable since progress elsewhere, in programmes which are undeniably more advanced, has not yet resulted in any wholly-agreed scenario. The present view of alternatives comprises ...

4.1. Direct bioconversion of native lignocellulose (NLC) e.g. wood waste, cereal straw, or specific 'energy crop'), with minimal pretreatment, into desired end-products.

The available end-products each correspond to a specific overall process, and process choice therefore requires decisions about end-product market values, and about what specific NLC it is intended to use as the raw material for processing. Examples would be SCP, as in the Waterloo Chaetomium process, or a biologically delignified energy feed (for ruminants), or "solvents" including ethanol or acetone/butanol from suitable combinations of cellulolytic and fermentative organisms. "Minimal pretreatment" is cost-sensitive and must avoid discarding any utilizable fractions such as pentosans (hemicellulosics).

The only NCL work in this category has been that done with Penicillium janthinellum.

*

I feel this is now due for strategic evaluation. If in the light of this the route offers any specific advantages, a plan for process development should be set up for evaluation.

Additionally, the NCL group should set out to gain some modest first-hand experience with cellulolytic Clostridia, possibly thermophilic or mesophilic. These organisms seem likely to be important in mixed-culture systems for direct bioconversions of NLC.

4.2. Fractionating pretreatment of NLC, without effective saccharification of the cellulose component.

Processes like that developed by Iotech use physico-chemical means to resolve the NLC and leave the cellulose component as a polymeric glucan. Their value, if proved to be practicable, will depend on the total use-value of all major product fractions. Possible uses of the lignin fraction giving sufficient added value (eg as phenolic feedstocks) are needed. The hemicellulose fraction will normally be obtained as a hydrolyzate and optimum uses for pentoses, not necessarily by bioconversions, need to be found. The cellulose fraction may be partially depolymerized; it may be suitable for direct bioconversions (in which case cf. 4.1 above); it may be usable directly as a ruminant energy feed; it may be an optimal substrate for enzymic saccharification (see 4.3., below).

NCL has no direct experience with this approach.
*
I think its main role here should be to keep a close and informed watch on what is going on elsewhere. However some specific outcomes of this aproach would repay study using some of NCL's physico-chemical expertise. First is to make an analytical study of the possible Indian demand (market) for furfuraldehye (obtainable from hemicelluloses/pentoses by wholly known technology). Second is to initiate some laboratory studies of possible technical uses for lignin fractions in the Indian context. Work on the bioconversion of crude pentoses to ethanol or to acetone-butanol is not recommended, but their conversion to SCP with Candida yeasts should be "firmed up" so far as is necessary to permit strategic evaluation.

4.3. Hydrolysis of NLC.

4.3.1 Chemical hydrolysis. A number of attractive technical approaches to NLC hydrolysis, with minimal pretreatment, are now canvassed or will shortly be announced. Their critical evaluation in an Indian context is very desirable
*
Someone at NCL should accept this as an on-going responsibility, taking full account of the nature and alternative use-value of raw materials in the Indian context and the need to ensure maximum added value from all the hydrolysis products.

The actual (rather than notional) suitability of the hydrolyzates for bioconversion should be considered, noting that processes which postulate simultaneous bioconversions of different sugars are unlikely to be practicable.
The advantages of chemical hydrolysis are speed, efficiency, and versatility with respect to raw materials. Potential utilization of the hydrolysis products is equally versatile since sugars are the 'classic' substrates for so many fermentation processes, but the suitability of the actual hydrolyzates for the chosen organism must be demonstrated.

4.3.2 Enzymic hydrolysis. Satisfactory enzymic hydrolysis of cellulose almost certainly requires more extensive pretreatment, out of which any other utilizable substrates (e.g. pentoses) must be recovered for exploitation. The pretreatment may thus amount to NLC fractionation, as in 4.3 (above). Enzymic hydrolysis is slower and less intensive, so requires larger plant equipment, but should be fully bio-compatible both for simultaneous and for subsequent bio-processing.
From the work on Penicillium funiculosum, NCL has its own very promising leads to cellulase enzyme production.
*
As priorities for this part of the programme I recommend an intensive attempt at improving the wild-type strain by selection and mutation using a simple and standardized primary screen.

Simultaneously, using the wild-type strain, the possibility of 'switching-on' a satisfactory rate of enzyme secretion by nutrient changes on a high concentration of sugar-grown mycelium should be investigated as a basic problem in microbial biochemistry.

It will then be possible to decide on the optimum tactics for enzyme production, which should then be followed in detail using the best selected strain available by that time.

In parallel with the above work, the not-negligible problem of the actual process technology for a successful enzyme hydrolysis of specific pre-treated NLC should be investigated as a separate study.

5. Molasses bioconversions.

Strategically the important feature of NCL's actual and potential contributions in this field is that, unlike the situation with regard to NLC exploitation (above, 4.1-4.4) molasses-based industries actually exist as an important sector of the Indian economy. The particular situation with regard to industrial alcohol production is complex and has been very well reviewed in an important series of articles in the Indian 'Economic Times', copies of which are appended to this report.

*

Contributions from NCL are therefore to be sought not only in the devising of new overall process technology, but in shorter-term improvements to the economy, overall profitability, and social benefit of an existing industry whose individual installations are at very varied technical levels.

5.1 Improved yeasts.

Important limiting factors in industrial alcohol production in India are the tolerance of the yeasts used to temperature, to the inorganic salts content of the molasses, and to ethanol itself; these tolerations are also interdependent (eg supraoptimal temperatures affect ethanol tolerance). It is by no means self-evident that suitable strains can be selected from within the normal range of Indian distillery isolates but there are good grounds for believing that better strains, which are also fully compatible with existing practical technology, can be found, particularly by using appropriately selective methods such as are now being described in the literature.

*

I recommend this as an integral part of the programme, well suited to NCL's existing set-up, and with due attention to the technology-transfer aspect, making the new strains available to industry with good feed-back concerning their practical performance.

The particular problem of developing strains which combine a good spectrum of tolerances with other desirable features such as adhesion or high flocculation will also be directly relevant to the optimisation of some kinds of new process technology specifically for practical fermentations using Indian molasses (see 5.2 below). Such combinations of features can be secured by the standard methods of classical microbial genetics, and are not without basic science interest.

If the operating temperatures of Indian distillery fermenters can be allowed to be higher, with considerable direct advantages, some simple improvements in the basic process technology will also be desirable and are considered as research objectives below, 5.2.2 .

5.2 Immobilized yeast technology.

5.2.1. Immobilized yeast reactors.

The NCL team has successfully developed most aspects of the technology needed to design, operate, and assess the pilot scale immobilized-yeast reactor.

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It is important that laboratory-scale research on the basic procedures (yeast selection, immobilization procedures) should continue, with the added aspect that it will be possible to test improvements on the larger scale.

Physical properties of the immobilizate that are actually crucial will only become apparent on scale-up.

*

The problems associated with gas hold-up can only be tested meaningfully in the larger reactor and this will be one of the most important lines of experimental work, for which simple reactors of various designs should be tested.

I do not preclude the eventual adoption of horizontal-bed reactors, which if suitably constructed incur only the minor penalty of floor-space.

5.2.2. The pilot plant project.

The basic technology now available at NCL is sufficiently advanced to justify the agreed project of building a pilot plant which will include facilities for all five stages of a full process, namely

(1) substrate preparation
(2) catalyst preparation
(3) fermentation stage
(4) product recovery by distillation
(5) stillage (effluent) treatment

Such a complete installation is now necessary for meaningful experimentation to be pursued on each one of the above aspects. Recommended topics for NCL to pursue would include:

*

substrate preparation: finding suitable flocculating agents to improve clarification of Indian molasses and investigating settler design;

catalyst preparation: see 5.2.1. above; scale-up of procedures;

fermentation stage: see 5.2.1 above; also temperature control (see below); ethanol recovery from vented CO_2, especially if the operating temperature can be raised;

product distillation: heat-pump applications, if possible to include refrigeration of fermentation stage (5.3 below).

stillage treatment: continuous biogas production from a real stillage, see 5.4.

Note once again that most of these objectives, if realized, could have benefits in the existing industry and be applied piecemeal, but their effective pursuit will only be possible if the different experimental lines can be operationally linked to the running of the pilot-scale plant.

5.3 Ethanol recovery.

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As already indicated, operation of the pilot plant will be essential for meaningful demonstration of the application of heat-pump technology to ethanol distillation. However, the transfer of this application into practical distilleries, which could constitute a major operational economy, does not depend on the technology of the pilot-plant as a whole, and should be pursued as an independent objective. At the same time extension of the heat-pump technology so as to provide refrigeration should be investigated as this will be very advantageous, first for allowing better temperature control in fermentations and second for facilitating ethanol recovery from off-gases.

5.4 Effluent treatment

*

Efficient and cost-effective biogas generation from stillage is almost certainly the best answer to the very real problem of distillery effluent. The basic directions of the technology that is needed are already clear, and the availability of a real stillage - from the pilot-scale distillation systems, see 5.3 above - is the essential pre-requisite for effective research and process development on this aspect. As with distillation systems, however, the development of a practical technology will find direct applications into existing distilleries.

6. Conclusions

On the overall the biotechnology programme at the National Chemical Laboratory is in good state and provides an excellent basis for fruitful future work.

Detailed technical and strategic recommendations are given in Chapter 4 and 5.

THE ECONOMIC TIMES

MID-WEEK REVIEW

WEDNESDAY, JANUARY 11, 1984

ALCOHOL

High cost affects industrial consumption; production potential remains untapped

By
Sahetiya Srichand
The Economic Times Research Bureau

Despite an anticipated increase of nearly 12 per cent in industrial alcohol production during the alcohol year 1982-83 (November-October), the alcohol-based industries in the country are faced with large underutilised capacity. The prices of several alcohol-based products have come down in recent months with adverse effect on production.

The exorbitant price of alcohol imported by the alcohol-based industries in the deficit states from the from the surplus states have turned the situation precarious during 1982-83. They had however, performed satisfactorily during 1981-82.

The alcohol-based industries improved their capacity-utilisation during 1982 inspite of the shortfall in the supply of alcohol, but have suffered setback during 1983. This was mainly because of sluggish demand for their products, while the cost of operations has gone us substantially.

The high price incurred by the consuming industries on industrial alcohol is not because of want of sufficient capacity in the distilleries in the country; nor there has been shortage of molasses, the raw material required for alcohol production.

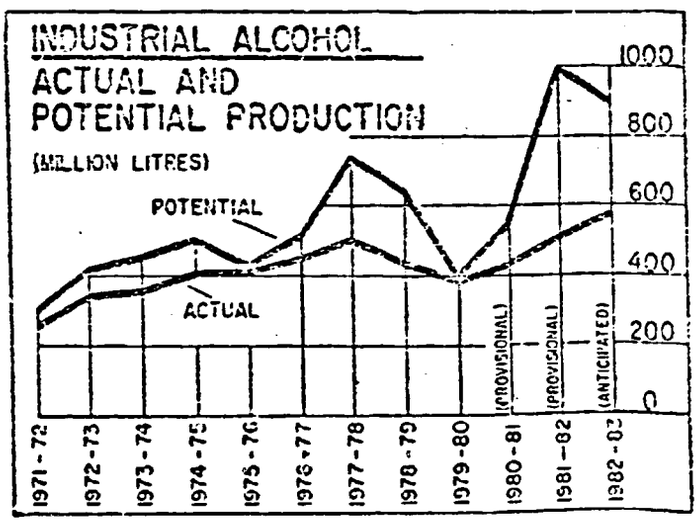
The number of distilleries in the country in September 1982 totalled 141, with an installed capacity of a little over 900 million litres. A feasible utilisation of 80 per cent of the installed capacity would have easily enabled about 750 million litres of alcohol production, sufficient to meet the prevailing demand.

That the molasses stock with the distilleries has also been good is evident from the decision of the government to permit their export. The decision has ostensibly been taken to relieve the distilleries of their large accumulation with them.

Evenso, capacity-utilisation has remained consistently below expectation. With alcohol output estimated at 575 to 650 million litres during the alcohol year 1982-83, the likely capacity-utilisation will be about 67 per cent. In the previous year, the output of alcohol was expected to be 515 million litres and capacity-utilisation was higher at 73 per cent.

Following a sharp setback in alcohol output during 1979-80, the capacity-utilisation in the distilleries had reached a low of 49 per cent from 68 per cent in 1978-79. This had led to its severe shortage then and severely affected the alcohol-based industries during 1979-80 and 1980-81.

The demand for industrial alcohol during 1982-83 was estimated at 650 to 700 million litres. With expected production remaining below 600 million litres, the shortfall between availability and requirements has been nearly 100 million litres. The gap between demand and supply was thus about 100 to 150 million litres in the preceding year.



But for the existing sluggish demand for their products, the size of the estimated shortfall in alcohol requirements would have produced considerable adverse impact on the working of the alcohol-based industries. Instead, necessiated by the uneconomic operations, they have been forced to curtail their industrial alcohol offtake from the distilleries at the prevailing prices.

Alcohol is the basic feedstock for such chemical industries as acetic acid, acetic anhydride, styrene, polyethylene, butyl acetate, etc., which have grown appreciably in recent years. And their performance has been in accordance with the availability of the feedstock at a reasonable price.

The capacity-utilisation in the acetic acid industry improved from 62 per cent in 1980 to 73 per cent during 1981 and was estimated at 80 per cent during 1982. Similarly, acetic anhydride industry showed a higher capacity-utilisation at 59 per cent during 1982 as compared to 55 per cent in 1981. But during 198, though data on production performance are not available, indications are that the situation has turned depressing for them.

The growth rate in the annual industrial alcohol requirements in recent years is around 10 per cent. To sustain the growing demand for alcohol, therefore, steady increase in molasses output is necessary. In other words, the fluctuations in alcohol output are closely related to sugarcane production, whose waste by product, after extracting sugar, is molasses. While there has been constant reviews of policy decisions on sugarcane and sugar industries, the problems faced by the alcohol and alcohol-based industries have been treated casually.

As sugarcane production fell by 15 per cent in 1979-80 over the previous year, sugar output registered a much sharper fall of 34.3 per cent and molasses production suffered an even sharper setback of 38.3 per cent in production. Consequently, industrial alcohol output declined by 11.9 per cent to 386 million litres from 438 million litres during 1978-79 (Table 1).

The fall in production resulted in its acute shortage during 1979-80 and in the early part of 1980-81. The step up in various levies imposed by the surplus states at this juncture further aggravated the situation.

Following a bumper sugarcane harvest of 154 million tonnes during the sugar season 1981-82, sugar output reached a peak of 8.4 million tonnes. Production of molasses also spurted by 82.2 per cent to 4.0 million tonnes over the previous sugar year. Though a slight decline in sugar cane during 19821-83 is on the cards, molasses output is expected to fall to 3.6 million tonnes

Nevertheless, the level of molasses output in the last two sugar seasons is adequate enough for alcohol production of 900 to 1000 million litres during the years 1981-82 and 1982-83. As against this, the anticipated production have been about 500 to 600 million litres.

Ironically, while decline in molasses output resulted in a serious setback to alcohol output during 1979-80, an appreciable rise in molasses output during 1981-82 with nearly a repeat performance during 1982-83 has not brought about a proportionate jump in alcohol production. This has been because even though huge potential production of alcohol has been enabled by the record molasses output in the last two years, actual production has been kept low on account of its lower offtake due to prohibitive cost for the consuming industries. In addition, sluggish demand for the alcohol-based products has deterred

increased consumption by industries from the surplus states.

Perhaps, the off-take by the alcohol-based industries would have been better despite the existing sluggish demand for their products, had the price of industrial alcohol been kept at a more reasonable level. But this has not been so. In the process, large molasses stocks in the wake of bumper sugarcane production, and alcohol, in the face of lower off-take accumulated with the distilleries in recent months.

Alcohol-based industries, therefore, affected by slack demand on the one hand and by exorbitant prices of their feedstock on the other, have been constrainted to operate on a low-key. Their off-take of industrial alcohol from the distilleries has attenuated over the months. This has led to large inventory accumulation of alcohol and molasses with the distilleries forcing their exports even at none-too-remunerative prices. But it is a moot point whether exports offer the right remedy.

Maharashtra, Uttar Pradesh, Tamil Nadu, Andhra Pradesh an Karnataka are the leading alcohol producing states in the country. Te first two mentioned states account for nearly 50 per cent of the total annual industrial alcohol output in the country.

As alcohol has to be produced from agro-based cellulosic materials or materials containing starch or sugar, the waste by-product of sugarcane (molasses) has gained importance. The problem of disposing the waste turned into a revenue earning source to the sugar industry by establishing distilleries to produce alcohol.

Evidently, instead of incurring expenditure on the disposal of molasses, the sugar factories in the producing states have been benefited by earing income in producing alcohol in their distilleries. In the beginning, the price per tonne of molasses was kept low. But subsequently in order to ensure good quality of molasses, its price for A-grade was raised from Rs. 40 to Rs. 60 per tonnes, including Rs. 20 per

By
Saketiya Srichand
The Economic Times Research Bureau

tonne for construction of storage tanks.

In accordance, the supply price of industrial alcohol was also fixed at Rs. 1.07 per litre. However, the price paid by the consuming industries has been high and different from states to state depending upon the duties imposed. In addition, the commodity attracts central Union excise duty of Rs. 30 per tonne and a surcharge of 5 per cent. Thus, in Maharashtra, the cost of industrial alcohol has been Rs. 1.55 per litre, in Uttar Pradesh it is available at Rs. 1.45 per litre, in West Bengal the price per litre has hovered at Rs. 2.00 to Rs. 2.20 per litre and in Gujarat, the price quoted was, at one time, Rs. 3.0 per litre which was later brought down to Rs. 1.95.

In the circumstances, only a coordinated approach on the part of the related industries can help to mitigate the hardships caused by the accumulation of alcohol and molasses stocks with the distilleries, while the consuming industries in the deficit states have been forced to curtail off-take because of high price of alcohol obtained from the surplus states. Various committees appointed by the government in the past have emphasised on the urgent need for having a national policy on alcohol.

The Nagaraj Rao Committee on alcohol (1956), the Jalan Committee (1976), the Swaminathan Committee (1977) and more recently the Bhattacharya Committee in 1980 had all vociferously recommended on the need for having a uniform approach. Besides several important recommendations, these committees had stressed on better utilisation of capacity in the distilleries through efficiency and modernisation of their plants. For a smooth flow of alcohol for consumption within the states as also from the surplus states to the deficit states at a reasonable price, these committees have unequivocally stressed on streamlining the multiple set of state and central government duties on industrial alcohol.

In this regard, the perspective plan for the production of alcohol-based chemicals suggested by the Bhattacharya Committee assumes significance. According to it, on the basis of estimated demand for the alcohol-based chemicals like acetone, styrene, SBR, acetic acid, VAM, etc., their requirements of alcohol are expected to reach 775.5 million litres by 1985-86 and 1163.2 million litres by 1990-91. Inclusive of alcohol for portable purpose, the production of alcohol should reach 900 million litres by 1985-86 and nearly 1400 million litres by the turn of the next decade.

If so, this calls for a proportionate step up in the capacity of the distilleries and higher availability of molasses to meet the increased requirements of alcohol in the coming years. An upward revision of molasses from the present rate of Rs. 60 per tonne has been suggested by the sugar industry in this regard. But any hike in molasses price will lead to a rise in alcohol prices. This will have immediate adverse repercussions on the operations of the alcohol-based industries.

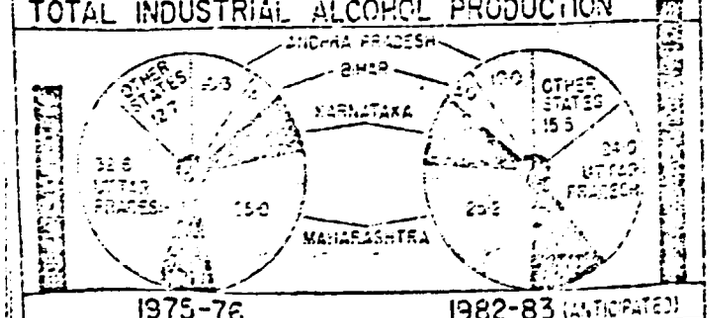
Admittedly, increased availability of molasses is necessary for higher alcohol production. While part of the anticipated higher alcohol requirements can, therefore, be met if good sugarcane harvest is assured in the coming years, the supply can be augmented by making use of the khandsari and bagasse for sugar revoery. The sugar so recovered can be fermented for additional alcohol output.

It is evident that the avilability of molasses from the organised sugar industry to the distilleries will fluctuate in accordance with the sugar cane harvest.

Any large-scale requirement can be had only by diverting part of sugarcane meant for khandsari and jaggery production to the organised sugar industry. But such a diversion is not possible as the khandsari and jaggery production is given preferential treatment under the small-scale activity.

It is necessary that in view of the impending growth in the consumption of industrial alcohol, every effort should be made to augment its capacity. The efforts to augment capacity should be accompanied by adequate measures to maintain the cost of industrial alcohol at a more reasonable level. For, the growth prospects of alcohol and the alcohol-based industries are closely related.

STATEWISE PERCENTAGE DISTRIBUTION OF TOTAL INDUSTRIAL ALCOHOL PRODUCTION

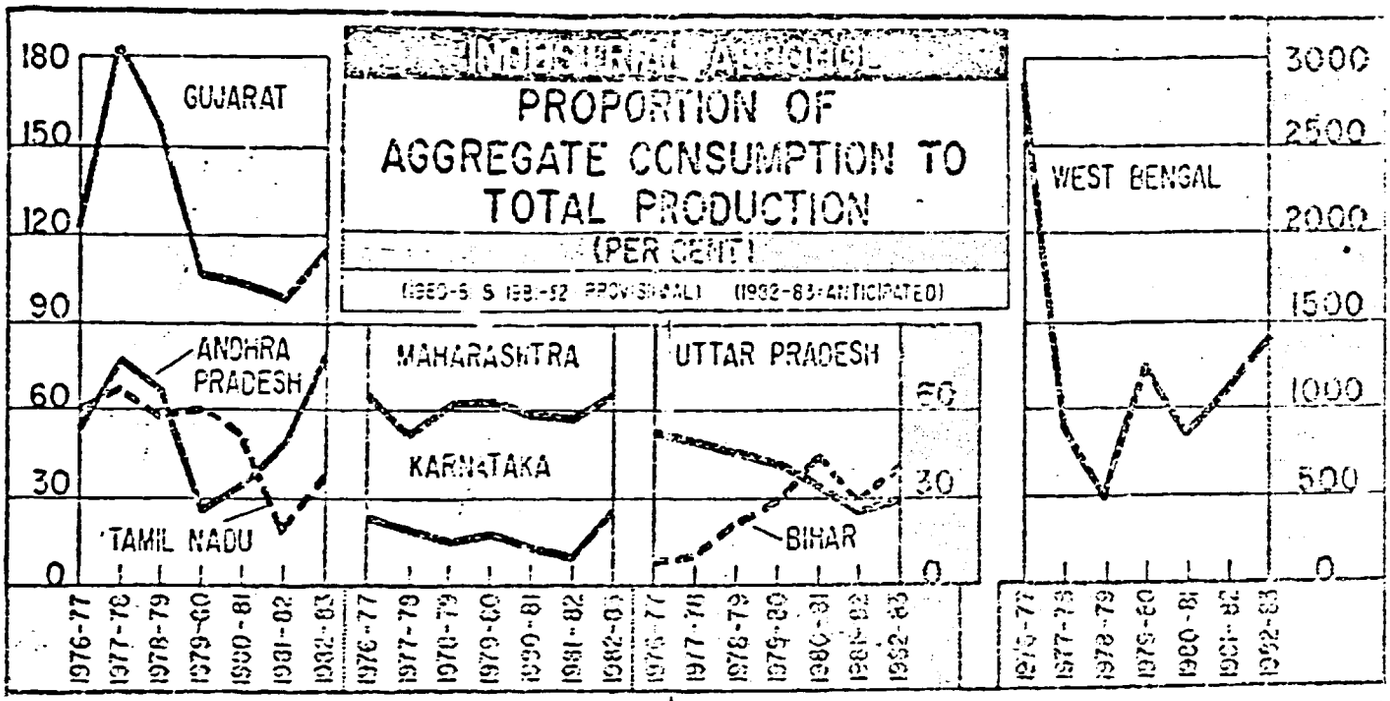


Multiple levies restrict off-take

By The Economic Times Bureau Research

The vast production potential of alcohol in the country notwithstanding, the recurring crisis in its timely availability at a reasonable price to the consuming industries in the deficit states has been causing serious concern. The uninterrupted movement of alcohol from the surplus states to the deficit states has been conspicuous by its absence.

The states of Maharashtra, Uttar Pradesh, Tamil Nadu, Andhra Pradesh and Karnataka are the leading producers of industrial alcohol in the country. Together they account for as much as 80 per cent of the total annual output. Maharashtra and Uttar Pradesh jointly produce nearly 50 per cent of the total production.



The consumption of industrial alcohol differ from state to state. The alcohol-based industries in the deficit states meet the shortfall in their total requirements through imports from the surplus states. Thus, West Bengal and Gujarat, the chronically deficit states in alcohol, meet the gap between availability and demand by importing it from the surplus states like Uttar Pradesh and Maharashtra.

Generally, the transport cost, apart from the multiple export duties, is given the major weightage by the consuming industries in the deficit states while arranging alcohol imports from the surplus states. For the lower incidence of transport cost helps the consuming industries to arrange their alcohol requirements at a reasonable cost. This, in turn, helps the consuming industries to keep the price of their end-products at a reasonable level.

However, the plethora of levies introduced by the surplus states on the alcohol meant for 'export' has reportedly turned the final price of 'imported' alcohol to the consuming industries in the deficit states prohibitive. In addition, because of sluggish demand, the market prices of several alcohol-based products have declined in recent months. Many of the alcohol-based industries have been forced to operate at uneconomic levels.

No wonder that during the alcohol year 1981-82, although adequate alcohol was available, off-take by the consuming industries fell to 215 million litres against normal off-take of 415 million litre. The performance during the alcohol year 1982-83 is also likely to be similar to the preceding year.

In the principal surplus alcohol producing states, the anticipated total consumption varied between 25.0 and 80.0 per cent of their estimated production during the alcohol year 1982-83. In Maharashtra, the leading industrial alcohol producing state, the total consumption was around 65 per cent of its products (Table 3). The anticipated consumption of industrial alcohol in Uttar Pradesh was just 25 per cent of its production during 1982-83.

However, Andhra Pradesh was expected to have consumed as high as 78.9 per cent of industrial alcohol produced in the state in 1982-83. In comparison, states like Bihar and Tamil Nadu consumed around 40 per cent of their respective production during the same year.

Among the deficit states, West Bengal mostly depends on the surplus states for its industrial alcohol requirements. As against its annual output of 4.0 million litres, the consumption has been at around 55.0 million litres.

Gujarat, too, imports industrial alcohol of 4 to 5 million litres to fulfil its domestic demand. But the state's dependence on the supply from the surplus states is about 15 to 25 per cent of its annual production.

On the whole, the average consumption of alcohol in the surplus states form just 50 per cent of their total production. Hence sufficient quantity of alcohol can be made available to the deficit states annually at a reasonable price. But the flow of alcohol to the deficit states from the surplus states has been subject to multiple levies, the sole purpose of them being apparently to garner more revenue. The adverse financial implications to the consuming industries in the deficit states has, however, been relegated to secondary importance.

The levies imposed by Maharashtra on alcohol consumed within the state, with effect from the beginning of January 1983, have been sales tax of 4 per cent and transport fee of Rs. 0.25 per bulk litre. On alcohol exported to other states, the commodity attracts excise duty of Rs. 0.55 per bulk litre.

The burden of various duties on industrial alcohol is slightly more in Uttar Pradesh. The duties imposed are graded so that high quantity of exports attract lower rate of duties. Thus, the state has a vend fee of Rs. 1.10 per bulk litre for less than 10 lakh litres of denatured spirit consumed within the state, while a lower rate of Rs. 0.30 to Rs. 0.20 per litre on consumption of more than 10 lakh litres of denatured spirit is levied. Besides, the commodity is also subject to administration charges and purchase tax (Table A).

Further, on denatured spirit exported to other states, an exise duty of Rs. 2.00 per bulk litre has been imposed on first 10 lakh litres and a lower of Rs. 1.20 per bulk litre on export quantity of 10 to 30 lakh litres has been imposed. For excess of 30 upto 65 lakh litres and above 65 lakh litres of alcohol exports, the rate of excise duty is still lower at Rs. 1.00 per bulk litre and Rs.0.60 per bulk litre respectively.

Two important facts need consideration in the light of the prevalent levies in the two leading industrial alcohol producing states on alcohol exports. First, they are of indicative nature on alcohol exports in the surplus states. For these rates have been steadily brought down from high levels by the major surplus states in recent times, because of accumulation of alcohol with the distilleries in the face of sluggish demand.

Second, despite the ruling lower levies on alcohol exports in the sur-

alcohol price spurts

By The Economic Times Research Bureau

The wholesale price of industrial alcohol has risen appreciably in recent years. The official wholesale price index number for the calender years 1981 and 1982 averaged 565.3 (base 1970-71 = 100) as compared to 447.9 in 1980. The average index had remained stagnant at 399.6 for four years 1976 to 1979. The index had averaged 176.9 in 1975.

The percentage increase in the index at 399.6 in 1976 over the previous year was a hefty 126 per cent. Byut the wholesale price index remained unchanged at that level during the following three years. The stabilised price index during this period was a welcome aspect for to the alcohol-based industries.

However, the sharp setback in industrial alcohol output witnessed during 1979-80 following sizable declines in sugarcane output during the years 1978-79 and 1979-80, led to its acute shortage. While the demand for industrial alcohol have been in kjeeing with the pace of growth in chemical industries, for which alcohol is the basic feedstock, the supply remained fluctuating during these years.

The situation culminated in a severe gap in industrial alcohol between demand and supply during 1979-80 and early part of 1980-81. It was during this period that the surplus alcohol producing states imposed several duties on its consumption both within and outside their states.

As a result, the wholesale price index for industrial alcohol went up by 20.7 per cent to 482.5 during September 1980. The monthly index till then had remained at 399.6 since 1976. The index increased further by 17.2 per cent to 565.3 in the month of October at which level it remained unchanged till 1982. (Table 7).

The average index for the year 1980, therefore, rose by 12.1 per cent to 447.9 from 399.6 in 1979. With the monthly index number for industrial alcohol during 1981 and 1982 remaining unchanged at 565.3, the index numbers for these years averaged at that level.

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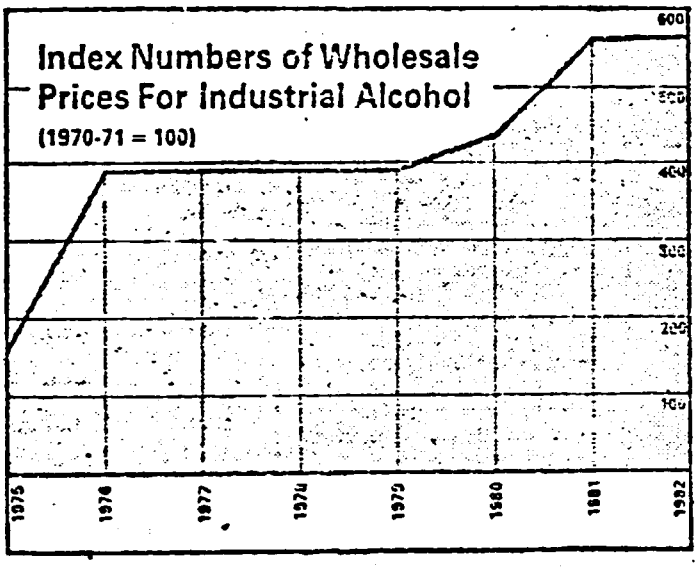
The average index number for 1982 at 565.3 over the level of 176.9 in 1975 showed a cumulative rise of about 220 per cent. The average annual rise worked out to 31.4 per cent. — S.S.



Compendium

A valuable publication has been brought out by All India Alcohol Based Industries Development Association (AABIDA) as a fitting tribute to its pioneering service to promote the interests of alcohol-based industries in the country during more than six years of its existence. Though the alcohol-based industries have been in existence for the last twenty-five years, it has been largely through the efforts of AABIDA that they have been able to put forward their points of view in the proper perspective in recent years.

The publication titled Alcohol Based Industries in India, 1977-1981 and priced at Rs. 75 per copy contains papers presented by eminent persons connected with alcohol-based industries at seminars organised by AABIDA during the above period.

This 169 pages volume cover such interesting topics as the emergence and growth of alcohol industry, planning for the alcohol-based industries in the eighties, their problems and prospects, its use as a renewable feedstock, etc.

In addition, a very useful part of the volume is devoted to statistics on alcohol.

— S. S.

Molasses export policy lacks direction

By The Economic Times Research Bureau

After much deliberations, the government has finally decided on the proposal to permit molasses export. Although, no firm target of molasses export during the financial year 1983-84 has been fixed, at least ten lakh tonnes of molasses are expected to be exported. In the previous year, the quantum of exports was over seven lakh tonnes.

There was no export of molasses during the fiscal 1981-82 owing to decline in its output. But about five lakh tonnes of molasses were exported during 1980-81.

Evidently, the decision to allow molasses export during the current year has been taken on the presumption that it provides the only alternative to the problem of mounting molasses and alcohol stocks with the distilleries. Apart from imposing financial burden on them, their accumulation can also become the source of severe pollution. Besides, the ruling steady prices of molasses in the international market has also been an added factor influencing the export decision.

The decision of the government in permitting molasses export during the current year has been received by the sugar industry with a sigh of relief. Two consecutive sugarcane harvests have saddled the industry with mounting stocks of sugar as well as the waste by-product, molasses.

Even assuming that there is exportable surplus of molasses, how is one to reconcile to the high export figure of as much as 5 million tonnes. The quantum of exports only underscores the failure in its use in stepping up the production of alcohol, the basic feedstock for several chemical industries. This, in turn, points to lack of policy direction on molasses export.

The total molasses output during the sugar season 1982-83 has been anticipated at 3.6 million tonnes as compared to 4.0 million tonnes in the preceding season. The output during 1981-82, 1980-81 and 1979-80 was of the order of 2.2 million tonnes, 1.6 million tonnes and 2.6 million tonnes, respectively (Table 1).

During the 1983-84 season, it is likely that production of molasses would be marginally lower, but availability is likely to be the same because of carry-over stocks from the previous season.

As indicated, the bumper output of molasses during 1981-82 and 1982-83 has been responsible for the large-size exports during 1983-84. If we allow nearly 15 per cent of the molasses production for seed, waste, cattle consumption, etc., yet sufficient quantity of about 3.5 million tonnes could be available for alcohol production. With the help of technological progress and optimum capacity-utilisation, higher alcohol output per tonne of molasses can be achieved.

On this basis, the annual molasses availability of about 3.50 million tonnes each during 1981-82 and 1982-83 (taking into account also the carry-over stocks), production potential of over 9.0 million litres of alcohol can be achieved, provided necessary installed capacity is available with the distilleries.

Industrial alcohol production has been just 500 to 600 million litres while the demand for it is much more. As has been discussed elsewhere, the potential demand for alcohol has been affected in recent years by sluggish demand for the products of alcohol-based industries. Consequently, the lifting of alcohol by these industries in the deficit states from the surplus states has considerably fallen short of allocations.

In the circumstances, therefore, the alcohol-based industries should not cavil at the proposed decision to export more molasses during the current year in view of the mounting stocks of alcohol and molasses with the distilleries. The lower off-take of alcohol by the consuming industries in the deficit states affected by the recessionary conditions has rightly forced the distilleries (and hence the sugar industry) to demand for molasses exports.

However, no less important in adversely affecting the consumption of alcohol by the alcohol-based industries is the high rates of levies on alcohol. It is perhaps possible that if the prevailing high rates of duties on the movement of alcohol (industrial) from state to state as also within the state has been lowered to more reasonable levels, the step would have provided a welcome relief to the consuming industries. While partly bringing down their escalating production costs, the lower rates of levies would have possibly helped to step up the demand for alcohol from the prevailing low levels.

No doubt, export has provided a temporary relief in regard to liquidate the mounting stocks of molasses and alcohol. However, if and when demand for the alcohol-based products resume, there will be pressure on the distilleries for increased supply of alcohol.

The present price of molasses is Rs. 60 per tonne, which is inclusive of a funding element of Rs. 20 per tonne to be used for storage purpose. This scheme has been in operation since 1975. Over the years, therefore, a sizeable amount should have been collected in this regard. If so, the resources so collected would be adequate enough to construct storage capacity sufficient to meet the need arising from abundant molasses supply as the present one.

But all indications are that storage of molasses leave much to be desired. While export of molasses in order just to relieve the distilleries of financial burden is a short-term remedy, a more suitable export policy should be considered from the long-term point of view. Once again, the attention inevitably leads to the need for having a co-ordinated national policy on molasses, alcohol and alcohol-based industries.

Acetic acid price declines

By The Economic Times Research Bureau

Even while the debate on the need for an integrated national policy on alcohol and related industries continues, some of the important alcohol-based industries have been faced with a serious dilemma. The high cost of their basic feed stock viz. alcohol, has made their operations unremunerative.

The addition of new capacities despite stagnant demand has pushed down the prices of the alcohol-based products. As the move in raising their prices to compensate increased production costs can only jeopardise even the existing demand, the alcohol-based industries have been forced to operate at uneconomic levels.

Take for instance the acetic acid industry for which alcohol is the basic feedstock. The manufacturers of this important alcohol-based item have been in a quandry in recent months over the likely official order in permitting a sharp hike in the price of alcohol.

On account of large addition to the existing capacity and prevailing sluggish demand, the producers of acetic acid have been unable to jack up the price of their products: instead, acetic acid prices after remaining steady till the middle of 1982, have fallen to uneconomic levels.

In the last seven years or so, capacity-utilisation in the acetic acid industry fluctuated between 60 and 85 per cent. Though fluctuations in capacity-utilisation in other alcohol-based industries have also been large due to one reason or other, that in acetic industry has wider implications.

From 85 per cent in 1976, the capacity utilisation in the acetic acid industry fell steadily to 67 per cent in 1978. After recovering to 72 per cent in 1979, the ratio fell to 62 per cent in the following year when shortage of alcohol turned acute. The utilisation of capacity recovered to 73 per cent in 1981 and the estimated utilisation was higher at 80 per cent in 1982 (Table 5).

But during 1983, the situation seems to have taken a turn for the worse because of sizable addition to the existing capacity in the face of prevailing inadequate demand. This has resulted in a cut-throat competition among the manufacturers of acetic acid.

Till about the middle of 1983, there were 17 producers of acetic acid accounting for a production capacity of 60 to 70 thousand tonnes. Even though a good proportion of annual acetic acid production is meant for captive consumption, the estimated demand for it during 1983 was placed just at 35 to 40 thousand tonnes.

In the event, prices of acetic acid have come down in recent months. From Rs. 7.75 per kg. in November 1982, the price fell gradually in 1983 in Bombay market.

The price of acetic acid was ruling strong between Rs. 8.00 and 9.00 per kg. around the middle of 1982. About the close of 1982, the price declined to Rs. 7.75 per kg. Contrary to hopes of a recovery, the price sluded to Rs. 7.50 per kg. during January 1983 and ruled steady at that level till the first week of August, 1983. In the following months, the price of acetic acid receded to Rs. 7.25 and touched Rs. 7.00 per kg. in October 1983. Indications are that the price weakened further. Of late, the fluctuated between Rs. 7.00 and 7.50 per kg.

Evidently, the sharp vicissitudes in

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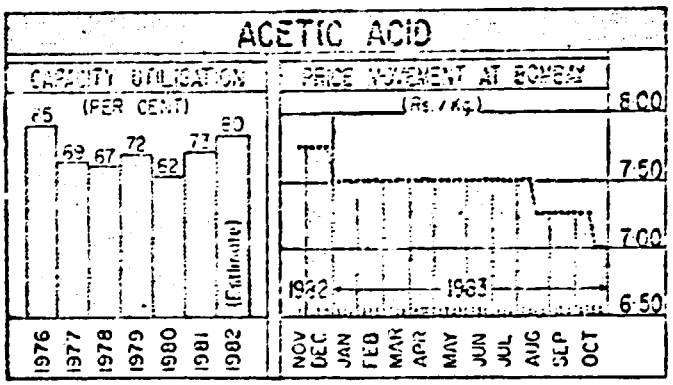

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in capacity-utilisation for acetic acid and the weakening trend in its market prices has been the direct result of the prevailing uncertainty on a viable policy on alcohol. The new addition to the existing capacity has further aggrevated the situation.

Of course, the addition of new capacity in the face of estimated growth in demand for the product during the current decade is to be welcomed. But its production can be sustained provided the manufacturers are assured of remunerative returns. This is possible only if the feedstock is made available at a reasonable level.

According to a Perspective Plan, the demand for acetic acid is expected to reach 55 thousand tonnes during 1985-86 and 80 thousand tonnes by 1990-91. The corresponding requirement of alcohol is also slated to go up to 77 thousand kilolitres and to 112 thousand kilolitres, respectively. The importance of maintaining a steady supply of alcohol to the consuming industries at a reasonable cost is, therefore, quite evident.

However, the alcohol-based industries have continuously been under suspension on the likely turn in alcohol prices. Any policy decision on alcohol should take into account the fact that alcohol is the basic feedstock for acetic acid industry and other such industries. Their rapid and healthy growth can be possible only if the basic feedstock is made available at a reasonable price. Then alone the economy of scale in production can be assured. Otherwise, the adverse repercussions would augur ill for all the inter-related industries.

— S. S.

Economic analysis of distillery industry

By Preeti Singh

The alcohol industry is an interesting process between an agricultural activity and an industrial use. Alcohol is prepared from molasses. Alcohol is a by-product in the process of manufacture of sugar. Out of the total production 30 per cent is for potable use and the major portion i.e. 70 per cent is used in preparing chemicals such as Acetone, Polyethylene, PVC, Alcohol provides a close nexus between the two priority sectors of the economy — agriculture and chemicals. This establishes not only the need of this industry but emphasises its importance in terms of the economic development and infrastructural planning requirements of the country.

Historically, alcohol industry can be linked with Government controls and policies of sugar industry in India. In the year 1932 sugar industry in the country was given protection resulting in increase of production and accumulation of molasses with no real market demand. The piling up of molasses led the States of U.P. and Bihar to plan a proposal of using molasses for producing alcohol for use in chemical industries.

To implement the use of alcohol Dr. Nagaraja Rao Committee was set up in 1955. The Committee recommended that the price of molasses should be kept to a minimum of Rs. 6.75 per tonne for molasses containing 5 per cent or more total reducing sugars present and prices to be fixed accordingly. The Committee also recommended adequate supply of molasses and enacting of legislation by the States. As a result of this recommendation the Central Government passed the Central Control Order on Molasses in 1961 for regulation of production, distribution and prices of molasses. The Central Control Order was not comprehensive and covered only sugar molasses.

In 1965 an amendment was made and the Central Molasses Control Order included the manufacture of khandsari within its purview. However, the Central Control Act did not include all the important sugar-growing areas because some of them were covered by State Molasses Control Order.

In 1973 the existing system of pricing and control of the industry was examined by the Bureau of Industrial Costs and Prices (BICP). There was a considerable problem in the distribution and supply of molasses and at the existing price of Rs. 10 per tonne of Grade I molasses was found uneconomic for industrial use and was being diverted towards open market selling and use for potable liquor.

The BICP Report suggested three alternatives: (a) complete decontrol (b) comprehensive control including khandsari molasses and (c) partial decontrol where certain quantity of molasses could be available to distilleries at controlled prices to be converted into industrial uses allowing the balance to be used for free sale at market prices. With the recommendation of the BICP the price of molasses was revised and increased for every grade of molasses on 31st October 1975. The new price increase was 500 per cent more than the prices prevailing for different grades (Table I). An increase of every rupee in the price has the effect of increase of Rs. 2 per litre in the price of alcohol.

TABLE 1

Grade of Molasses	Price as on 31-10-1975	Price effective from 1-11-1975
	Rs. Rate per Ton	Rs. Tax
Grade 1	10	60
Grade 2	8	48
Grade 3	6	36

Subsequently Dr. Bimal Jalan Committee was set up in 1976 to suggest measures in bringing about uniformity in rates of levies on alcohol and molasses. The Jalan Committee recommended a single levy by the States on alcohol used for industrial purposes, levy of sales tax on alcohol at the same rate as for industrial raw materials and abolition of all levies on alcohol exported to other States and of duties imposed by alcohol importing States. These recommendations were unanimously adopted by Central Molasses Board and recommended to the States for implementation.

In 1977 and in 1980 the Swaminathan Committee and the Bhattacharya Committee respectively further examined the problems of the alcohol industry. The Swaminathan Committee was of the opinion that there should be a uniformity in taxes in different States and alcohol should be considered as a basic feed-stock material like naptha and should be available at a uniform price all over the country. The Bhattacharya Committee emphasised the need to reduce levies on alcohol and recommended improvement in the technology for fermentation and the treatment of effluents.

It is against the background of these legislations, particularly the Bhattacharya Committee and in consonance with the future long term planning of the industry that this paper proposes to discuss some issues faced by the industry in the present context.

The distilleries are treading a critical path. There is a serious issue of modernization of plants through effluent treatment under the Prevention and Control of Pollution Act 1981. The industry is faced with the problem of mobilization of resources under pressures of penalties, rising costs, excessive inter-State levies, underutilized capacity, high transportation costs, erratic supply of molasses, and the paucity of funds. Attention should be focussed on each of these issues so that resources can be energised and the industry can be treated before it is declared economically unviable. Some of the issues are elaborated here to show the constraints of the industry.

The major external determinant of distilleries is the regular supply of molasses from sugar mills. The availability of molasses is on an average about 65 per cent of the total requirement of the industry. The short supply of molasses leads to low capacity utilization of the industry.

Another problem associated with molasses is its deterioration cost during storage and its transportation costs to the distilleries. These costs coupled with erratic supply creates a gap and the industry is not able to project its future demands.

The alcohol industry is hit by the mopping away of its resources through the levy of central sales tax, central excise, administrative charges, licence fee, transport fee, seed fee, special fee, cultivage fee, cess fee, permit fee on inter-State movement of molasses. These taxes have inter-State variations. In actual terms taxes vary from 7 to 8 per cent in Haryana to 25 per cent in Tamil Nadu and Andhra Pradesh. Most of these levies were imposed when the price of molasses was very low i.e. Rs. 10 per tonne. Price of molasses now multiplies from Rs. 6.70 per tonne to Rs. 10 to an increase of Rs. 60 with effect from 1-11-1975.

There is an urgent need for revision of these rates and uniformity in inter-State levies. Moreover, the actual price of alcohol varies to a great extent from the notified price in all the States. This ranges from Rs. 1.59 per litre in Karnataka to Rs. 3.65 per litre in Tamil Nadu. The actual price of industrial alcohol within the States ranges from Rs. 1.75 per litre in Karnataka to Rs. 4.95 per litre in Gujarat. In addition to levies and price variations, U.P. and Maharashtra also charge export pass fees which also varies from year to year. In U.P. the export pass fees increased from 50 paise per litre in 1980 to Rs. 2/- per litre. The consuming industries located outside State found it uneconomic to lift their quota. Also in Maharashtra export pass fee was Rs. 2.25 from 4.11.81. The distilleries had to reduce their production as their storage tanks were full and they faced the problem of idle capacity.

The distilleries have had a constant problem of inadequate and irregular supply of coal. This has led to the closure of units many a time. The quality of coal available to the industry has also been deteriorating. The coal contains low thermal value and high ash content. The industry does not have any option and must accept whatever coal is available or else allow the production to suffer. The distilleries which are not attached to sugar mills generate steam through coal. The consumption of steam varies from 2.46 to 5.75 KL of alcocol. The basic rate of coal paid by the units varies from Rs. 160/- to Rs. 203/- per tonne, average being Rs. 181/- per tonne. 5 tonnes of steam per MT of coal is the standard generated steam from coal. The cost of coal and its transportation as well as its quality needs to be given attention for reducing the costs of the distilleries.

One factor which creates a major disturbance in production is technological obsolescence. The distilleries have shown a complete lack of interest in repairing and maintaining machines or in investing funds for new machines. The main reason for this has been the high rising costs, and huge resources required for working capital. The industry could not pay attention to their capital intensive new projects. At present the industry is really re-

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better efficiency in producing energy and the treatment of effluents due to Water (Prevention and Control of Pollution) Act in 1974 followed by Air Prevention and Control of Pollution Act 1981. The installation of new types of machinery and technology requires a huge resource of funds.

An important question is that where will the distilleries plough these funds from? Being at the critical juncture as they are with no profit or retained earnings what sources can they be funded from? While government has passed an Act for Control of Pollution has it provided the industry with any concessions? The financial institutions have not so far any directions for giving aid to the sick distillery industries as this industry does not come under any developmental plan of the country.

The industry as it is will not be able to afford the high rate of interest charged by the commercial banks. This problem will become of cyclical nature as the industry will not be able to withstand any more pressures and will fail. Some suggestions for improvement in their position is discussed below.

The distillery industry has many problems. The first major interest is the investment of capital for improvement in the existing pattern of work. Investment requires a huge outlay of funds. It is clearly established that the industry cannot plough its own sources. It is contemplated that due to the colossal amount of total revenue to the government through the industry, the Central government should take steps to rectify the situation in the industry.

Perhaps, what is required is a National Alcohol Plan on the lines given in the case study of Energy and Development of Brazil. In Brazil, Government launched a programme in 1975. The programme favoured large scale planters and industrialists who wish to get rid of idle production capacity. The Brazilian Government finances on highly concessional terms the building of new distilleries. 80 to 90 per cent of total investment is financed to industrialists at negative interest rates. The Brazilian plan was based on environmental assessment, on economic, social and ecological grounds.

Government in India should distinguish the potable industry from the alcohol industry exclusively for the purpose of industrial use. The alcohol industry should then be given protection with a development rebate for the next 10 years. As an industry useful for priority sector industries it should be entitled for soft loans from the development banks like the IDBI, IFC and ICICI as well as the financial institutions like the LIC and UTI. At the State level the State Financial Corporation (which have earlier not initiated loans due to Pollution Act) should fix a development quota and give the industry soft loans for improvement of technology. A higher rate of depreciation may also be considered during the developmental phase.

Also, the IDBI has a Development assistance fund. It is used for sanctioning assistance in cases where banking or other financial institutions are not likely to grant such loans or advances in the ordinary course of business. Before granting assistance from Development assistance fund, IDBI has to obtain the prior approval of the Government. If the distilleries are given priority from the Govt looking into the Brazilian Plan, this fund would be a good answer for capital investment improvements towards technological changes and better yields.

The distilleries would go a long way in improving technology and create a more useful place for themselves lying as they are between the two strategic areas of agriculture and chemicals.

The technological improvements relating to steam involve a low cost outlay of about Rs. 10,000 only. The IDBI may consider financing these schemes through the refinancing of Bill discounting scheme. The Bill re-discounting scheme was introduced in 1965 to help the use of indigenous machinery particularly in the context of the recession that prevailed then and was originally applicable to six industries only viz., cotton, jute, silk, cement, sugar, pape, and machinery. Sugar is an allied industry of alcohol.

Within the perview of this scheme, it is suggested that the alcohol industry is also considered. The period of deferred payment, normally ranges for a period between six months and 7 years. The minimum amount of transaction under this scheme has been fixed at Rs. 10,000. This would be useful to make improvements relating to steam.

TABLE 1: TREND IN ALCOHOL AND MOLASSES OUTPUT

	Production (in million (tonnes) of			
	Sugarcane	Sugar	Molasses	Alcohol (Million litres)
1971-72 ..	113.6	3.11	1.21	260.0
	(—10.1)	(—16.8)	(—25.3)	(—)
1972-73 ..	124.9	3.87	1.67	340.0
	(9.9)	(24.4)	(38.0)	(30.8)
1973-74 ..	140.8	3.95	1.82	357.0
	(12.7)	(2.1)	(9.0)	(5.0)
1974-75 ..	144.3	4.80	2.01	400.6
	(2.5)	(21.5)	(10.4)	(12.2)
1975-76 ..	140.6	4.26	1.70	408.2
	(—2.6)	(—11.2)	(—15.4)	(1.9)
1976-77 ..	154.0	4.84	2.06	449.2
	(9.5)	(13.6)	(21.2)	(9.1)
1977-78 ..	177.0	6.46	2.97	500.7
	(14.9)	(33.5)	(44.2)	(11.5)
1978-79 ..	151.7	5.83	2.56	435.0
	(—14.3)	(—9.0)	(—13.8)	(—12.5)
1979-80 ..	128.8	3.86	1.58	385.9
	(—15.1)	(—34.3)	(—38.3)	(—11.9)
1980-81* ..	150.5	5.43	2.19	450.7
	(16.9)	(40.7)	(38.6)	(11.6)
1981-82* ..	153.6	8.43	3.99	515.4
	(22.0)	(55.3)	(82.2)	(19.7)
1982-83 E) ..	177.4	8.27	3.59	576.2
	(—3.4)	(—1.9)	(—10.0)	(11.8)

Notes: * Provisional; (E) Estimated Anticipated.

TABLE A: LEVIES ON ALCOHOL IN MAJOR PRODUCING AND IMPORTING STATES
(As on 1-1-1983)

State	On Alcohol consumed within the state		On Alcohol exported to other states	
	Levy	Rate (Rs.)	Levy	Rate (Rs.)
Andhra Pradesh	Excise Duty	1.00 B.L. on Rectified spirit	Export Permit Fee	0.15 B.L. on Rectified spirit
	Privilege Fee	0.20 B.L. on Denatured spirit	Export Pass Fee	1.00 B.L. on Denatured spirit
	Sales Tax	7%		
Bihar	Literage Fee	1.50 B.L. on Denatured spirit 0.15 B.L. (For IDPL)	Export Pass Fee	Rs. 2.- L.P.L. (Rectified spirit) Rs. 1.50 B.L. (Ordinary denatured spirit)
Gujarat	Excise Duty	15.50 B.L. (Rectified spirit)	Transport Fee	0.22 B.L. (Rectified spirit) 0.22 B.L. (Denatured spirit) 0.05 B.L. (Special Denatured spirit)
	Sales Tax	10% + 15% Surcharge		
			Special Fee	0.42 L.P.L. (Rectified spirit)
Haryana	State Sales tax	7%	Export Fee	Rs. 2/- B.L. (Rectified spirit)
	Excise Duty	Rs. 3.50 B.L. (Rectified spirit)		Rs. 1.- B.L. (Denatured spirit)
Karnataka	Excise Duty	0.20 B.L. (Rectified spirit)	Excise Duty	0.20 B.L.
Madhya Pradesh	Permit Fee	2.50 B.L. (Denatured spirit) 10.25 B.L. (For manufacture of basic drugs)		
Maharashtra	Sales Tax	4%	Excise Duty	0.55 B.L.
	Transport Fee	0.25 B.L.		
Punjab	Permit Fee	0.60 B.L. (Denatured spirit)	Export Fee	1.00 B.L.
Rajasthan	Excise Duty	Rs. 22.- L.P.L. (Rectified spirit) Rs. 1.40 Litre (Denatured spirit)		
Tamil Nadu	Excise Duty	0.75 B.L. * (Rectified spirit)	Excise Duty	0.50 B.L. (Rectified spirit)
	Vend Fee	0.25 B.L. (Rectified spirit) 1.00 B.L. ***		1.00 B.L. (Rectified spirit) 0.10 B.L. (Rectified spirit) 0.25 B.L. (Denatured spirit)
Uttar Pradesh	Vend Fee	1.10 B.L. for less than 10 lakh litres of Denatured spirit. From 0.30 to 0.20 B.L. for more than 10 lakhs of Denatured spirit.	Excise Duty on Denatured spirit	2.00 B.L. on first 10 lakh litres 1.20 B.L. for 10-30 lakh litres 1.00 B.L. for excess of 30 upto 65 lakh litres
	Administrative charges	Rs. 7.50 K.L. (For Synthetic Chemicals & Somaiya Organics)		0.60 B.L. for excess of 65 lakh litres
	Purchase Tax	0.30 B.L. (upto 10 lakhs litres) 0.20 B.L. (for 10 lakhs litres & above)		
Kerala	Excise Duty	15.50 P.L. (Rectified spirit)		
	Gallonage Fee	2.50 B.L. (Rectified spirit)		
	Vend Fee	0.50 B.L. (Denatured spirit)		
West Bengal	Export Pass Fee	3.75 L.P. Ltr. (for medicinal & toilet preparations) 5.00 L.L. (For scientific & research purposes) Rs. 20 L.P.L. (for other purposes)	Pass Fee	0.30 to 0.95 B.L. depending on purpose for which used.
	Pass Fee	0.95 B.L. 0.13 B.L.	Depending on the purpose for which denatured spirit is used.	(For consumers consuming more than 65 lakh litres on 1-4-82, pass fee will be 5 paise per litre. Upto 65 lakh litres 13 paise
	Octroi	Nil (Denatured spirit) £ 0.12 B.L. (Rectified spirit)		Only for Calcutta

Notes: * Reduced to Rs. 0.25 from 15-4-1983; *** Reduced to Re. 0.10 from 15-4-1983.
£ 0.5 B.L. from 17-3-1983. Specific rates are per bulk litre. Source: AABIDA.

TABLE 2: STATEWISE PRODUCTION AND CONSUMPTION OF INDUSTRIAL ALCOHOL

(Million litres)

State	1976-77		1979-80		1980-81		1981-82*		1982-83*	
	P	C	P	C	P	C	P	C	P	C
Andhra Pradesh	46.5	24.9	33.9	8.4	45.2	15.5	56.0	26.6	57.8	45.6
	(10.4)	(6.6)	(8.8)	(4.1)	(10.5)	(8.1)	(10.8)	(11.9)	(10.0)	(13.7)
Bihar	16.0	1.3	13.7	4.0	16.2	7.1	21.2	5.8	23.0	9.0
	(3.6)	(0.4)	(3.6)	(2.0)	(3.8)	(3.7)	(4.1)	(2.6)	(4.0)	(2.7)
Gujarat	12.1	14.9	14.4	15.2	18.3	18.9	22.6	22.2	35.0	40.0
	(2.7)	(4.0)	(3.7)	(7.5)	(4.3)	(9.9)	(4.4)	(10.0)	(6.1)	(12.0)
Karnataka	27.6	6.3	28.9	5.2	31.0	3.7	37.7	3.4	56.1	14.4
	(6.1)	(1.7)	(7.5)	(2.6)	(7.2)	(1.9)	(7.3)	(1.5)	(9.7)	(4.3)
Maharashtra	112.2	73.8	112.4	70.0	119.4	69.1	121.6	69.4	145.0	93.6
	(25.0)	(19.7)	(29.1)	(34.4)	(27.7)	(36.2)	(23.6)	(31.1)	(25.2)	(28.2)
Tamil Nadu	44.5	26.8	42.7	25.7	37.9	19.5	46.7	8.5	66.7	25.0
	(9.9)	(7.1)	(11.1)	(12.6)	(8.5)	(10.2)	(9.1)	(3.8)	(11.6)	(7.5)
Uttar Pradesh	140.0	73.0	101.2	41.2	125.0	42.5	158.5	40.0	138.5	40.0
	(31.2)	(19.4)	(26.2)	(20.2)	(29.0)	(22.3)	(30.7)	(18.0)	(24.0)	(12.0)
West Bengal	5.1	144.0	2.5	30.9	1.5	12.4	3.8	41.4	4.0	55.0
	(1.1)	(38.3)	(0.7)	(15.2)	(0.3)	(6.5)	(0.7)	(18.6)	(0.7)	(16.6)
Other States	45.1	10.6	36.2	3.0	36.2	2.2	47.3	5.6	50.1	9.9
	(10.0)	(2.8)	(9.3)	(1.4)	(8.4)	(1.2)	(9.2)	(2.5)	(8.7)	(3.0)
Total	449.2	375.6	385.9	203.6	430.7	190.9	515.4	222.9	576.2	332.5
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)

Notes : Figures in bracket are percentages to total; P — production; C — consumption. * Provisional. Source : Source : AABIDA.

TABLE 3: STATEWISE PROPORTION OF INDUSTRIAL ALCOHOL CONSUMPTION TO PRODUCTION

(per cent)

State	Proportion of aggregate consumption to production				
	1976-77	1979-80	1980-81	1981-82	1982-83*
Andhra Pradesh	53.4	24.8	34.3	47.5	78.9
Bihar	8.1	29.2	43.8	27.4	39.1
Gujarat	123.1	105.6	103.3	98.2	114.3
Karnataka	22.8	18.0	11.9	9.0	25.7
Maharashtra	65.8	62.3	57.9	57.1	64.6
Tamil Nadu	60.2	60.2	51.5	18.2	37.5
Uttar Pradesh	52.1	40.7	34.0	25.2	28.8
West Bengal	2823.5	1236.0	826.7	1089.5	1375.0
Other States	23.5	8.3	6.1	11.8	19.8
Total	83.6	52.8	44.3	43.3	57.7

Note : Excess over 100.0 per cent indicate, broadly, the extent to which the concerned state imported alcohol from other states to meet its requirements.
* Provisional
As West Bengal requirements of alcohol are met largely through imports from other states, the percentage of consumption to production is very large.

TABLE 4: DISTILLATION CAPACITY IN DIFFERENT STATES
as in September 1982

States	Number of distilleries	annual installed capacity (000's litres)
Andhra Pradesh	19	71,562
	(13.5)	(7.9)
Bihar	8	43,760
	(5.7)	(4.8)
Gujarat	6	36,200
	(4.3)	(4.0)
Karnataka	15	85,235
	(10.6)	(9.4)
Madhya Pradesh	6	11,710
	(4.3)	(1.3)
Maharashtra	27	205,979
	(19.1)	(22.9)
Tamil Nadu	8	72,950
	(5.7)	(8.0)
Uttar Pradesh	25	309,216
	(17.7)	(34.6)
Other States	27	69,834
	(19.1)	(7.7)
Total	141	903,446
	(100.0)	(100.0)

Note : Figures in bracket are

TABLE 5: CAPACITY UTILISATION IN ALCOHOL-BASED CHEMICALS

(per cent)

	Item	1978	1979	1980	1981	1982*
1.	Acetic acid	67	72	62	73	80
2.	Acetic anhydride	62	64	60	55	59
3.	Butyl acetate	45	46	44	48	n.a.
4.	Ethyl acetate	46	77	94	97	n.a.
5.	Styrene	61	58	n.a.	n.a.	n.a.
6.	Polyethylene	90	79	79	35	n.a.

Note: * On the basis of estimated capacity production data for 1982-83.
n.a. = not available.

TABLE 6: PERSPECTIVE PLAN FOR ALCOHOL BASED CHEMICALS

Item	1985-86		1990-91	
	Estimated demand (Tonnes)	Requirement of alcohol (Kilo litres)	Estimated demand (Tonnes)	Requirement of alcohol (Kilo litres)
2-Ethyl Hexanol	37,000	122,100 (15.7)	67,000	221,100 (19.0)
Acetic acid	55,000	77,000 (9.9)	80,000	112,000 (9.6)
VAM	23,000	47,000 (6.1)	34,000	69,700 (6.0)
Acetone	88,000	98,000 (12.6)	36,000	145,600 (12.5)
N. Butanol	11,000	20,900 (2.7)	15,000	28,500 (2.5)
Ethylene Oxide	15,500	36,300 (4.7)	25,000	55,000 (4.7)
SBR	56,000	201,600 (26.0)	73,000	306,900 (26.4)
Styrene	62,000	57,000 (7.4)	90,000	82,500 (7.1)
Other items	—	115,600 (14.9)	—	141,600 (12.2)
Total alcohol	—	775,500 (100.0)	—	1163,200 (100.0)

Note: Figures in brackets are percentages to total
Source: Bhattacharya Committee

TABLE 7: INDEX NUMBERS OF WHOLESALE PRICES FOR INDUSTRIAL ALCOHOL

(1970-71 = 100)

Month	1978	1979	1980	1981	1982
January	399.6	399.6	399.6	565.3	565.3
February	399.6	399.6	399.6	565.3	565.3
March	399.6	399.6	399.6	565.3	565.3
April	399.6	399.6	399.6	565.3	565.3
May	399.6	399.6	399.6	565.3	565.3
June	399.6	399.6	399.6	565.3	565.3
July	399.6	399.6	399.6	565.3	565.3
August	399.6	399.6	399.6	565.3	565.3
September	399.6	399.6	462.5	565.3	565.3
October	399.6	399.6	565.3	565.3	565.3
November	399.6	399.6	565.3	565.3	565.3
December	399.6	399.6	565.3	565.3	565.3
Annual average	399.6	399.6	447.9	565.3	565.3

Alcohol—the renewable feedstock

By V. M. Merchant, E. Ekanbaram, O. P. Bhatia

In India, sugarcane molasses has become the most important source of ethanol by fermentation. Nearly 60-65 per cent of ethanol produced in the country is used for the chemical industry. Ethanol is a versatile product which can be converted to almost all the important organic chemical products ranging from acetaldehyde and acetic acid at the one end to the products such as synthetic rubber, poly-ethylene and P.V.C. at the other.

Besides sugarcane, one of the most abundant resources which is also renewable is the cellulosic wastes. N.S.I. Pune has undertaken research projects to develop indigenous capability for production of ethanol from cellulosic wastes and its conversion to chemicals by new processes.

Research on bioconversion of cellulose have given realistic hopes that this would be in fact achieved. Efforts are being made to make the whole process economical. Several microbial cultures have been isolated for production of enzymes for the hydrolysis of cellulose to simple sugars. Saccharification experiments on cellulose from bagasse have been conducted. Work on improving the productivity of the cellulose enzyme is in progress.

Besides sugarcane and cellulosic waste, there are a number of various other renewable sources such as sweet sorghum, maize, sweet potato, cassava (tapioca), mahua flower etc., which are capable of conversion to ethanol. Of all the alternative resources, cassava appears to be the most attractive.

Cassava is a source of high starch material. Next to sugarcane, cassava is a major biomass source for energy production in India. Extending the present 32 million hectares under sugarcane further has limitations, as land under cereal production cannot be converted to sugarcane.

Cassava, on the other hand, being more tolerant to adverse soil and climatic conditions, emerges as an excellent source of carbohydrates for alcohol production. With an assured offtake for alcohol production, cassava can be made available throughout the year. It can also be dried and stored for later use.

Cassava has higher percentage of fermentables than sugarcane and yield of alcohol per tonne is higher. The Central Tuber Crops Research Institute, Trivandrum has developed techniques for the fermentation of cassava for alcohol production. An yield of 2,490 litres of alcohol per hectare could be achieved and cost of alcohol produced is estimated at Rs. 1.66 per litre. Cassava as a raw material for alcohol production deserves consideration after utilising available sugarcane and molasses fully.

In a paper presented by Shri P. R. Mahalingam last year at the AABIDA Seminar, a pointed reference was made by him to recent advances in fermentation and bioconversion.

The second International Symposium on Bio-conversion and Bio Chemicals Engineering held recently from 3rd to 6th March, 1981 at I.I.T. New Delhi, highlighted recent developments in the field of bioconversion.

Research work on conversion of sugar solution to alcohol by passing through immobilised cell or enzyme system was noted to have good potential. Experimental work has shown that such a system was active and viable for periods longer than 75 days.

Another development has been the use of bacterial fermentation based on a culture of Zymomonas mobile for fermenting sugar to alcohol. This new concept shows good promise, advantages being :—

(i) rates of sugar uptake and ethanol production being 2 to 3 times faster than yeasts; (ii) higher ethanol yields than yeasts due to different carbohydrates metabolism; (iii) simpler growth condition as Zymomonas grows anaerobically and does not require addition of O2 or maintain viability at high cell concentrations; (iv) no appreciable heat evolution has been noticed and fermentation proceeded satisfactorily at around 40 degree C.

The favourable results reported have all been in glucose/sucrose medium. Some inhibiting factors in cane molasses have not permitted the same reproducibility in molasses medium. Genetic manipulation being simpler with bacteria such as Zymomonas, it is expected that a specific type of bacteria could be isolated to give satisfactory results in molasses media.

The inhibiting factors in the use of Zymomonas in molasses medium could also get identified and steps found for removal of the same to permit smooth and efficient fermentations.

C. Thermohydrosulfuricum — a thermophilic bacteria — operating at 60 degree C with faster multiplication but consuming less energy, has been found to ferment sucrose solutions satisfactorily.

Instead of single cultures, co-cultures have been used to give improved yields of ethanol. Such co-cultures can be used to ferment both pentoses and hexoses.

This development has a good possibility as pentose is one of the unfermentable sugars present in molasses and hence higher alcohol yield per tonne of molasses could be obtained.

Now let us turn our attention to sugarcane and deal with it in some depth.

"Breathes there a man who has not loved his country?" asked the Poet of yore. "Breathes there a crop, which is sweet and every bit of which is useful?" asks the modern agricultural scientist. And immediately, sugarcane comes first in his mind.

Sugarcane has been known and grown in India since the Vedic times. "Sharkara" finds place in India's cultural heritage and in a number of religious and holy ceremonies. But the tremendous potentialities of this wonder plant and its untapped applications remained latent for ages.

It was only in the beginning of the 20th Century that the kaleidoscopic spectrum of its usefulness began to unfold itself to the discerning mind.

At the last year's ISSCT Congress (of the International Society of Sugarcane Technologists) held in Manila, Phillipines, the theme that emerged was that sugarcane had arrived at a turning point.

Sugarcane has ceased to be merely a crop for sugar. It has entered a new era wherein the entire perspective is undergoing a basic change.

Cane is the most efficient instrument for conversion of solar energy. The growing of cane — not for sugar—but for energy, for power and for ethanol for a wide variety of chemicals has been the most exciting development in the recent past. It is a potential raw material for sugar, fuel, food, paper, board and feedstock for diverse chemicals and now for power.

It is superior to crude or naphtha as a feedstock, for it is renewable and ever replenishing. It is derived from an inexhaustible source — the sun for which in the tropics and the sub-tropics are fortunately located.

With the technology level of today, it would be more appropriate to say that sugarcane is no more for sugar alone. It is a raw material to meet all human requirements like sweetness, fuel, power, waxes, pulp, paper and particle boards, foods and feeds, alcohols and alcohol-based chemicals sucrose chemicals, surfactants, detergents, etc.,

There have been many recent developments in cane technology and separation of various constituents. Hawker Sidley group of Canada have reported development of process and equipment for the separation of high quality sugarcane fibre (COMRIND). The process separates sugarcane into rind, pith, and wax-bearing epidermis.

The rind which is 18 per cent to 20 per cent of the weight of cane stalk contained 46 per cent fibre on wet basis. The fibres are washed and used for high value by-products. Sugar-bearing juice can then be separately processed free of colour and impurities.

In the light of these developments, it appears that the future agro-complexes will have gone to the multipurpose use of sugarcane in the economy and not depend upon only the end products, sugar, as is the situation today.

The development of the byproduct industries based on sugarcane in the Cane Sugar World indicates that the numerous products like the few mentioned below are already in commercial production: 1) By-product power, 2) Alcohol and alcohol-based products from molasses, direct sugar cane juice, mixed raw materials and the sugar house products; 3) Motor fuel; 4) Cane wax; 5) Pulp paper, particle board and other fibre-based products from bagasse; 6) Cattle-feed: Pith and Molasses, etc., 7) Protein Foods, viz. molasses fermentation; 8) Xylitol from bagasse; 9) Furfurat from bagasse; 10) Liquid Co2 from fermentation; 11) Feed-grade SCP from distillation waste liquors; 12) Potash fertilizers; 13) Sucrose chemicals — detergents and surfactants.

Messrs Tata and Lyle of England have recently put up a 5,000 tonnes/year detergent plant based on sugar and a few more plants are reported licensed in Japan and Latin America.

Several protein food units are reportedly coming up with Swiss and French know-how for the manufacture of protein food yeast from cane molasses.

Chromatographic techniques have reportedly been developed for separation of sugar from molasses and the manufacture of the liquid sugars, syrups and foods.

With the diversified applications that the cane and its products have, cane plays a main role in the vegetable kingdom and it has potential for meeting the energy needs, with a short cycle reliable resource, making itself as the most important crop of national interest.

The most important and main by-products of white crystal sugar industry are: (1) Molasses/Alcohol; (2) Bagasse; (3) Press mud and (4) By-Product power.

The estimates of production of sugar in our country by 1982-83 are 7 million tonnes, which will give about 3 million tonnes of molasses. Allowing 10 per cent use of molasses for such miscellaneous uses as cattle feed, tobacco, foundries, etc., and storage and handling waste, approximately 27 lakh tonnes of molasses are expected to be available for the production of alcohol by 1982-83. On the existing efficiencies of 210/220 litres of alcohol per tonne of molasses, this would give a production of 600 million litres of alcohol.

As there is considerable scope for technological improvements and increase in efficiency, the molasses-alcohol efficiency could hopefully go upto a ratio of 250 litres/tonne of molasses. At this ratio the production of alcohol by 1982-83 should be of the order of 675 million litres.

We come to another fascinating subject of great interest, particularly in the current context of the energy crisis. The large process steam needed in sugar factories mostly at the low pressures of 1 to 1.5 kg/cm² and the higher generation pressures have the poten-

tial for the generation of power requirements for sugar processing.

With semi-electrification and modernisation of the equipment the power needs of sugar factories increased and to meet this demand the generation pressures of steam also increased.

The present standard pressure of steam generation in India is 21 kg/cm². In Hawaii where the non-factory needs for power increased for irrigation water pumping station, power exchange inter-connections with public utility networks as well as increased electric power loads within the factory, the power demands have been met by increasing the steam generation pressure to 63 kg/cm² and temperature of 450°C and super imposing topping turbo-generators on the existing steam and power steams.

This subject had already attracted the attention of our technologists. In 1975, various aspects of the by-product power potential in Indian sugar factories were discussed at an expert group meeting in Delhi organised by the Super Technologists Association of India. In the context of the increasing gap between the needs and availability of power in the country, it is necessary to take early steps as in Hawaii, to exploit this by-product power potential fully.

The Hawaiian sugar industry, as is known, has been utilizing by-product power from the sugar industry for quite some time now through the use of high pressure steam generation. With the low sugar prices and the energy crisis, the sugar industry of Hawaii has come up with revolutionary new thinking by planting a major shift towards energy development.

The cane researchers are now aiming at increased Bio-mass defined as use of plan life o create energy. In this programme, the improved sucrose production seems to have taken a back seat to energy.

With the increasing costs of oil and thus electricity, bagasse has now taken a new value. A few programmes recently implemented or taken up at the Hawaiian mills may be helpful in giving us a direction and food for thought :

(i) Honokaa Sugar Co has recently established a boiler and power generation to produce enough surplus electricity to supply about 14 per cent of the needs of the entire island of Hawaii.

(ii) Libve Plantation Co. is constructing a new power plant that will supply 20 per cent of the electricity requirements of the island of Kauai.

(iii) Waialua Sugar Co. has installed facility for reducing the moisture content of bagasse to 31 per cent. The dryer uses stack gases (i.e., flue) thereby increasing available heat and energy. In terms of additional fuel this moisture reduction is equivalent to 8 per cent additional bagasse.

(iv) Waialua Sugar Co. Cahu and Laupahoe Sugar Companies are successfully burning their trash.

(v) C. Brewer & Co. has launched a bio-mass energy programme.

(vi) The HSPA Research Programme now has the objective of maximum energy BTU acre month as against sugar/acre month.

(vii) Each Hawaiian island will have one alcohol plant and 40 per cent of the Hawaii's gasolene needs will be met from the 2,21,000 acres of land under sugar.

There is no royal road to modernisation or to adoption of newer technologies and to exploitation of by-products. The fascinating possibilities and potentialities are there for every one to see. What is required are the will to pursue the same on a time-bound programme and a healthy environment and a sympathetic administration interested in promoting such a programme.

(Courtesy : AABIDA).

EXPERT COMMITTEES ON ALCOHOL

As late as the thirties when the problem of disposal of molasses became acute, a Joint Committee was appointed by the then national government in the states of U.P. and Bihar, on the feasibility of establishing an alcohol industry. Though the specific purpose at that time was one of disposing the surplus molasses, the process set in motion the need for developing an digenous alcohol industry.

However the realisation of the pivotal role played by alcohol in the development of several chemical industries during the early fifties prompted the government to institute an expert committee for necessary policy recommendations. This was followed by three more committees to take stock of subsequent developments.

We give below the major conclusions and recomendations of those four committees:

I. Nagaraja Rao Committee (1956)

1. The power alcohol industry has been developed to its present stature on the basis of an ex-distillery price of 14 annas per gallon. It is essential that the basic price for alcohol should not be higher than this figure if its use as a raw material for industries is to be developed. The Committee considers this an essential pre-requisite for stimulating industrial development based on alcohol and also in view of the absence of many other organic raw materials for development of these important industries within the country.

The Committee recognises that while the basic price for alcohol may be fixed so as to provide a fair return to the producer, the incidence of price to the consumer may be governed by a system of graded taxation upon the purpose to which the alcohol is to be put.

2. As molasses have been and will continue to be the principal raw material for production of alcohol, control over its price and distribution is essential if the price of alcohol is to be maintained at a low level. An ex-sugar factory price of 4 annas per maund, for molasses containing not less than 50 per cent total sugars, is recommended. For molasses of lower sugar content, correspoodingly lower prices on the lines prescribed in the U.P., may be charged.

In spite of the many repreesntations demanding an increase in the price of molasses, the Committee is unable to recommend and any such increase because, while it will not contribute significantly to reducing the price of sugar to the consumer, such an increase would be detrimental to the development of alcohol and alcohol based industries.

In order to ensure uniformity in the control over price and distribution of molasses, it seems preferable that such control should be exercised by the Union Government under powers conferred by the Industries (Development & Regulation) Act.

3. A ceiling price for alcohol has been calculated after taking into account the cost of production in a unit of economic size as well as the actual average transport charges on molasses from sugar factories to the distilleries. It is recommended that a uniform ceiling price for alcohol ex-distillery should be:

Re. 0-12-9 for alcohol of strength 95.5% by volume.

Re. 0-12-5 for alcohol of strength 96% by volume.

Plus an amount corresponding to an additional charge upto a maximum of Re. 0-6-0 per gallon towards the actual average transport charges incurred on molasses.

The above price would be applicable to alcohol corresponding to the specifications of power alcohol and rectified spirit (industrial grade) respectively.

4. In the interest of developing alcohol based industries, it is essential that alcohol of all grades including power alcohol should be charged the same freight rates on Railways. It is recommended that one uniform rate should be charged under Class 16 for Railway Risk and under Class 8 for Owner Risk for all grades of alcohol.

5. There is no unanimity of opinion between the Union and State governments regarding their respective rights to tax alcohol. The Committee feels, however, that if efforts for promotion of a substantial increase in the consumption of alcohol for industrial purposes are to succeed, it is essential that a uniform taxation policy and procedure should be devised by agreement between the Union and State governments, as has been done already for power alcohol. Such taxation can be enforced more satisfactorily by the Union government.

Two members of the Committee belonging to the State governments feel however strongly that since excise duties on alcohol represent a major flexible source of revenue to State governments, even if it decided that the Union government alone has the power to levy a duty on industrial alcohol, the collection of such duties should be left to State agencies and the amounts realised retained by the concerned States.

6. It is recognised that for certain categories of uses a higher price of alcohol would not constitute a deterrent to its consumption, and therefore any margin between the ceilling price specified earlier and the higher price which such a user could afford to pay, may provide a source of revenue to Government. Variation in excise duties on alchol used for different purposes have been recommended in the light of this observation.

7. It is recommended that the incidence of permit or licence fees, and gallonage charge, etc., may be levied, if at all, a token figure and that such charges should not be levied as compensation to cover the costs incurred in the administration of Excise and prohibition Laws.

8. It is recommended that Excise Laws governing distilleries engaged in the production of alcohol be revised in consonance with the needs of modern design and practice. The lines on which existing State Regulations may be revised have been indicated in board detail.

9. Control over distribution of industrial alcohol should be exercised Under Section 18(G) of the Industries (Development and Regulation) Act so as to ensure proper correlation between its production and distribution and to guarantee adequate supplies of alcohol at reasonable prices to industries whose development is deserving of encouragement.

10. The cost of excise supervision should not be realised from distilleries, as it constitutes an appreciable addition to the cost of production of alcohol.

11. Sometimes difficulties arise because of dual control over alcohol products exercised by the Union and state government departments. It is recommended that a system may be devised under which one single officer, either of the Union or the State government concerned, will be in sole charge of a distillery or a factory.

II. JALAN COMMITTEE (1976)

On Molasses:

(i) There should be uniform levies for usage within the states;

(ii) in inter-state movement levies on molasses should be given up.

On Alcohol:

(i) Present structure of levies and charges is complicated and cumbersome. The Committee recommends that the States should levy a single uniform levy at a reasonable level.

(ii) Levy on industrial Icohol should be that as for other industrial raw materials, i.e., for inter-state movement in line with Central Sales Tax for consumption within the State in line with Sales Tax on other industrial raw material.

(iii) Levy on inter-state movement of industrial alcohol should be no more than that for consumption within the State. Units located away from the surplus states already are

at a freight disadvantage and there is little justification for putting them at an additional disadvantage.

(iv) Deficit States importing from surplus states may also do away with the entry tax or countervailing fees levies charged by them.

The Committee emphasised the need for a realistic and viable pricing policy for molasses and alcohol which would provide a reasonable price to the manufacturers at the same time safeguarding the interests of the industrial consumer, ensuring fuller utilisation of capacity and smooth movement of alcohol and molasses within the country.

III. SWAMINATHAN COMMITTEE (1977)

1. In view of the multiplicity of taxes and levies, control by State and Central governments on movement and allocation of molasses and alcohol, low efficiencies in the fermentation process and inadequate growth of alcohol based chemical industries and inadequate interest taken by entrepreneurs to improve efficiencies, it is recommended that a high powered body with wide ranging powers be formed to monitor the progress of the industry to have a 10 per cent annual growth rates and administer funds for research and development work covering immediate needs and long range needs.

2. The amount of Rs. 20 per tonne of molasses provided for at present for the construction of storage tanks for molasses should be discontinued from the price of molasses. Instead a cess of Re. 0.03 (3 paise) per litre should be charged on the price of alcohol to provide funds for research and development work both in the distillery industry as well as the alcohol based chemical industry. The Committee recommends an incentive scheme to be drawn up by the controlling body for progressively increasing the efficiency of the distilleries to a yield of 260 litres of alcohol per tonne of molasses gradually over a period of 3 years. The efficient units producing above 240 litres per tonne of molasses through out the season may be allowed to export upto 5 per cent of the alcohol produced. The units that would show improvement in technical efficiency may be given liberal and timely allocation of molasses.

3. There is urgent need to improve the technical efficiencies of the distilleries and make maximum alcohol available from the present supply of molasses. For this purpose, it is necessary to employ adequate number of technically qualified people in the industries. A course of bio-chemical engineering available with the HBT Institute of Kanpur is most suitable.

4. AIDA and AABIDA should form technical cells for adopting modern techniques in industries.

5. There is justification in reducing the price of molasses.

6. The price of alcohol as delivered to the alcohol based industries should be about Re. 1.00 per litre.

7. While licensing new industries based on alcohol, preference should be given for the manufacture of chemicals where acetaldehyde is the building-block and lower preference where ethylene is building-block. However, the present ethylene based industry should be allowed to grow at the rate of 3 to 4 per cent per year. In remote areas where petrobased ethylene is not available, alcohol based ethylene units may be permitted.

8. The use of molasses based alcohol for the potable purposes should be restricted in order to maximise the availablity of alcohol for industrial use.

9. There is going to be a wide gap between the alcohol available and the requirements of alcohol based industries. Immediate steps must be taken to develop processes to produce alcohol from alternative source since this will have to be a long range development project. For immediate relief, Khandsari molasses could be brought under control for additional production of alcohol. This has already been done in some States.

10. It is possible to develop indigenous technology for the alcohol based industries provided a planned effort is made.

11. Some states are contemplating diversion of alcohol for motive power and for fuel purposes. This should be considered after meeting the full requirements of the chemical industry.

12. Research & Development work must be undertaken in the new avenues of fermentation technology in selective fermentation processes using a revolutionary new technique of immobilised enzymes. The low energy technology is much more appreciable to India than the utilisation of conventional technologies which require high energy inputs.

13. Minimum economic size of new distilleries is recommended as 10-12 thousand kilolitres per year. Preference should be given to the existing distilleries below the economic size to expand their capacity.

IV. BHATTACHARYA COMMITTEE (1980)

1. Sugar factories and distilleries should be compelled to provide adequate pucca covered storages for molasses, at least to store four months production at the sugar factory end and to hold four months consumption at the distillery end.

2. To increase the production of alcohol, it is essential to take the following steps:

(a) Alcohol industry should be given a priority status.

(b) Control price of alcohol should be revised and built-in the price formula to keep it remunerative.

(c) Investment and other fiscal incentives should be given for the distilleries to enable add new equipment and machinery and to permit induction of new technology to improve efficiency of production. In case the new technology has to be imported, it should be done on a centralised basis.

(d) Khandsari molasses should also be diverted in all States for alcohol production to augment the total availability of molasses for meeting increasing needs of alcohol.

3. Alcohol should preferentially be diverted in all states for making high value added chemical products and its use as an automotive fuel should not be considered.

4. Raw materials other than molasses being more expensive for production of alcohol should be considered only if adequate quantity of molasses are not available.

5. Detailed economic evaluation of the various effluent treatment methods by a competent engineering firm is suggested. The fixed and variable costs of effluent treatment should be taken into account while fixing the revised price of alcohol.

6. The suggested perspective plan for the production of alcoholbased chemicals over the next ten-year period calls for an increase in alcohol production from the present level to 900 million litres by 1985-86 and 1400 million litres by 1990-91. This can be achieved only by drawing out a time-bound national alcohol programme laying down long-term policies, priorities and incentives needed to execute it.

Source: Report of the Working Group on levies on molasses and alcohol.