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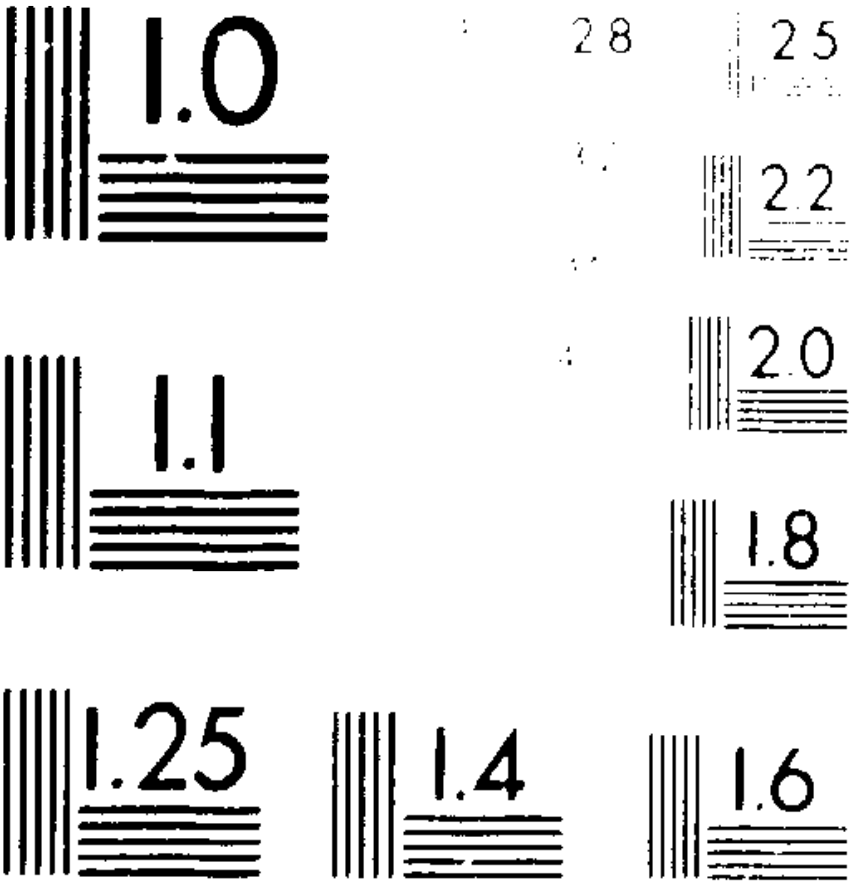

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4 June 1984
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INDUSTRIAL CHEMICALS FROM INDIGENOUS CARBOHYDRATE RAW MATERIALS (SUCRO-BASED CHEMICALS)

ST/PHI/81/001

PHILIPPINES

Technical Report* : Citric acid production

Follow-up to technical report

(20-24 March 1984)

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

Based on the work of Bjorn Kristiansen,
consultant in fermentation technology

United Nations Industrial Development Organization
Vienna

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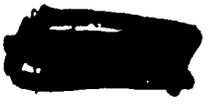

INTRODUCTION

This is a report on a one week visit made to the National Institute of Science and Technology (NIST) in Manila, Philippines, undertaken on behalf of UNIDO to evaluate the progress of the Industrial Chemicals from Indigenous Carbohydrate Raw Materials (Sucro-based Chemicals) Project. Special attention was to be given to the sub-project on citric acid production. Previously (October 1983) a one month visit had been undertaken to assist and direct this project. A report was presented, containing a research programme which the project was recommended to follow. The present report concerns the follow-up visit.

Included in the brief for this visit was an assessment of the plans for a pilot production facility and to which extent UNIDO assistance would be required.

PROGRAM OF ACTIVITIES

Sunday 19th March	Arrival Manila
Monday 20th March	UNIDO, Mr Pluhar
	NIST, Ms Palo and staff
Tuesday 21st March	NIST, Ms Palo and staff
	NSDA, Ms Tansinsin
Wednesday 22nd March	NIST, Citric acid staff
	NIST, Dr Hoson, coordinator "Integrated citric acid project"
Thursday 23rd March	NIST, Citric acid staff
Friday 24th March	NIST, Citric acid staff
	NIST, lecture to staff involved in "Integrated citric acid project"
	NSDA, Inspection of alcohol pilot plant
Saturday 25th March	Departure Manila.

OBSERVATIONS

In general, the group involved in the citric acid project had been reoorganised and were working according to the programme proposed during my earlier visit. It appeared that this had been implemented at the beginning of the year. There was still a tendency to carry out experiments on a week to week basis rather than relying on overall project planning. Provided careful control is exercised this should not lead to adverse results.

Two fermenters, one of 14 litres, the other of 2 litres capacity had been provided. It was not clear if this was to remain so, but the people involved were under the impression that at least the larger fermenter was now dedicated to the citric acid project. This fermenter had a temperature control system which relied on aides remembering to provide ice to a water bath. This had suffered a little but in general the temperature of fermentation was controlled.

The group was advised to concentrate on the larger fermenter as the 2 litres vessel was considered not suitable for the project. It could be used to provide technical training but was unlikely to provide meaningful data on the process.

It is hoped that another 14 litres fermenter can be provided to speed up the programme. It was indicated that one fermenter was on its way.

The large shaker, for which there is no temperature control facilities, is used extensively. Results obtained may often be meaningless, as pointed out previously. However, it is unlikely that the shaker can be placed in a constant temperature room and as long as the fermenters are running at constant temperature the work with the shaker should continue. This will provide information for the fermenter work. Extensive use of the smaller

shaker, which incorporated temperature control, is required. This has been pointed out to the workers concerned.

The work on recovery of citric acid is progressing faithfully, as detailed in the previous report. It is unlikely that significant progress will be made before a pilot plant is available. The group concerned with product recovery is very aware of their limitation and are working hard at mastering the theoretical and practical fundamentals of isolating citric acid crystals.

It can be concluded that the citric acid project was working according to the programme suggested by UNIDO and the staff demonstrated a process orientation which should lead to an eventual successful outcome of the project.

It was noted that the staff involved with the citric acid project has been subjected to certain administrative changes which should be noted. NIST has initiated an "Integrated citric acid project". The staff of the previous Sucro-based chemicals project on citric acid has been absorbed by NIST and the project has been expanded by additional staff members. The project has the same orientation and programme as before.

It appears that National Science and Technology Authority (NSTA) expects this move will accelerate the commercialisation of the citric acid process. The project director is Dr Uriarte, Head of NIST. Unfortunately he was unable to find the time to enlarge on his plans, in spite of numerous requests.

It may be necessary to exercise strict supervision to ensure the work on citric acid is progressing as planned.

There were, on this occasion as on the last, references given to support from local industry. No proof of its existence were given but it appears that efforts are being made to get industrial support for the project.

One of the groups involved in the "Integrated citric acid project" is working on the design and construction of a pilot plant. The plan is to have the pilot plant completed by the end of 1984. Presumably this means the design and not construction; the project has not yet demonstrated the need for a pilot plant.

It appears that the desire to build a pilot plant dominates all biotechnology projects, sometimes with scant regard to the scientific basis for its construction. Undoubtedly the citric acid project will require larger fermenters than at present and pilot facilities are required for product recovery studies. At the moment, however, the citric acid project has difficulties in procuring required chemicals.

Clearly it is not appreciated how expensive a pilot plant will be to run. Unless operating capital can be guaranteed for a number of years we will very likely find the plant idle shortly after commissioning.

The size of the pilot facility has yet to be fixed. If this is going to be constructed with only production of citric acid in mind it is important to determine whether it is to be considered as an R & D facility or intended for small scale production plant, as well as process development. The latter version is by far the more expensive and a final decision can only be taken

after consultation with financial importers, users and customers.

The team involved in the design of the pilot plant appears not to have the expertise and experience to design the plant. Hence assistance from outside will be required. To avoid any mistakes at this critical stage, the design of the pilot plant should be carried out by a firm deemed competent by UNIDO. It is essential, however, that this firm will work in close cooperation with the local expertise. This will allow the staff of the citric acid project to learn as much as possible about the plant and, what is also important, will make sure that its design is as adapted to the local conditions as possible. It is the intention of NIST (NSTA) to use as much locally fabricated equipment as possible in the plant. The extent to which this is feasible is not clear but it will keep the cost of the plant down, if feasible. This necessitates a very close liaison between local experts and the design firm which the latter must be made aware of.

The construction of the plant seems best left to a company with suitable experience. When it comes to construction, however, some of the project workers should have gained sufficient expertise to at least take part in the supervision of the construction.

The desire to include locally manufactured equipment is justified. Unfortunately, a fermentation plant put much more stringent demands on engineering skills and practices than chemical plants. With its limited experience, it may be unreasonable to expect that local industry will be able to manufacture to the high standard required. This was indeed indicated by examining a pilot plant for production of alcohol, situated at NSTA. Assurances that domestic stainless

steel equipment could stand comparison with foreign versions were made repeatedly. It may be that selected pieces of equipment can be manufactured locally, but it will be unrealistic to expect a significant contribution.

It must be admitted, however, that my knowledge of the industry is far from exhaustive. It may well be that one of the two major breweries can offer some contribution. The project should be encouraged to approach them with this in mind.

It must also be noted that the citric acid project does not, at present, have technicians with the required expertise to run a pilot plant. The company assigned to construct the plant should also undertake to provide training for plant operators.

RECOMMENDATIONS

The citric acid project is progressing according to the programme previously proposed. Administrative changes may necessitate a close control of the progress. These changes may speed up the project towards realisation of a pilot plant. It appears unrealistic, however, to expect the pilot facility to be finalised by the end of this year.

Considerable assistance must be offered in the design and construction of the pilot plant. It is recommended that this is put out to tender and the appointed company incorporates one, or more, selected workers from the citric acid project in its design team. The brief for the company should be to include as much locally manufactured equipment as possible. This must not lead to a lowering of design standard.

A final note which is not directly concerned with the citric acid project; but may be of benefit to all four sub-projects.

Recently, I had an opportunity to discuss the situation in the Philippines with Professor M Moo-Young, UNIDO consultant to sub-project Single Cell Production, who also noted the desire to build pilot plants in the Philippines.

Unless strict overall coordination of the whole programme is exercised, we could end up with a situation in which a number of priority projects were pushing for such a facility. If one project should get a pilot plant, it would be foolish not to realise that other projects would eventually require similar facilities. Hence, a multi-purpose pilot plant should be considered as early in the programme as possible. Luckily, the priority projects do not differ significantly in their fermentation characteristics so the concept of a multi-purpose plant is feasible.

The pooled activities in biotechnology in the Philippines can easily justify the need for one pilot plant.

It is recommended that the consultants involved in the sucro-based chemicals project, together with representatives from UNIDO get an opportunity to get together and discuss a common approach. With the ensuing approval from the relevant authorities in the Philippines significant assistance to their development of biotechnology will be provided.

Glasgow 19.3.84

B Kristiansen