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10 July 1989
ENGLISH

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INDUSTRRIAL BIOGAS TECHNOLOGY DEMONSTRATION PLANT AND EXPERIMENTAL STATION (PHASE II)

US/CPR/81/171/11-51

Beijing, CHINA

Technical Report: General Design of the Biogasplant for Daxing Distillery*

Prepared for the Government of The People's Republic of China
by the United Nations Industrial Development Organization,
acting as executing agnecy for the United Nations Development Programme

Based on the work of S. Kraemer
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Vienna

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Meeting in Wiesbaden the 15th and 16th of June.

The meeting was appointed to discuss the result and the actual state of the generel design of the biogasplant for Daxing distillery carried out in Wiesbaden in the period from May 23rd to June 20th by the staff of Dr. Loll and a Chinese team of 5 including 3 technicians.

The Chinese team arrived to Wiesbaden on Tuesday, the 23rd of May and stayed for 4 weeks untill Tuesday, the 20th of June.

State of the generel design.

In the time from May 23rd to June 15th I was in contact with Dr. Loll and the Chinese team several times to ensure that their coorperation was o.k. and that the progres of the work was not hindered by some old disagreements.

Before going to Wiesbaden I was informed by Dr. Loll of the defined basis for the design (telefax from Dr. Loll enclosed). All decisions of importance for the design referred in the telefax were made in unity, this I got confermed in Wiesbaden.

Briefly described the basis for the plant is:

- The substrate consist of wastewater from the distillery and water from washing the solid waste.
  After washing the solid waste the Chinese counterpart has decided to reuse the material in the distillery. For this reuse it is necessary with separation and drying to 85% of dry matter.
- As the substrate contain a rather high amount of suspended solid the digester used will be of the anaerobic contact sludge type, working at mesophilic temperature (35°c). the plant is equipped with two digesters working in serie.
- The loading rate is realatively low. But as there are big uncertainties in defining the amount of organic material from the wash of the solid waste, a low loading rate has to be accepted, as the basis for the design.
- The gasproduction is stated as a parameter of importance for the design. I draw Dr. Loll's attention to the piont that probably the reduction of COD is more

important as a design parameter, and also the garanty most likely will go on the COD-red.
- The COD-red. rate is planned to 0.75 as a minimum, and more likely it will reach 0.85.
- The biogas is used for steamproduction at the distillery, with the existing coal fired plant working in parallel. As the gasuse only takes place in 2-4 hours a day the boiler and the gasstorage is given a rather big dimension, compared to the total gas production.

There were prepared quite a lot of drawings by the to teams, which were working in the same house but separatly with Dr. Loll and Mrs.He as the interface.

It seemed to me that too much emphasis was put to detailed drawings, while there still was generel drawings and decisions to make. This situation was common for the two teams, which from my point of view means that the work has not been planned properly with the major aim to do the generel design.

One major problem was still to solved namely the separation and drying of the the solid waste from the factory. Dr. Loll claimed that he could not design this system without knowing more exact what demand the factory makes for reusing the material in the shape of structure and form, and furthermore that separation and drying of solid waste is not a part of his contract he with UNIDO.

Dr. Loll is right in both this points, but as the Chinese team on the other hand would not accept the generel design as completed before the problem was solved, I made the following suggestion, which was accepted by both part:

> As a part of the generel design Dr. Loll carries out a description of the technical and economical feasibilities for washing, separating and drying the solid waste for a reuse in the distillery. Dr. Loll makes it very clear what the charachter of the end product is for each of the possibilities described, in such a way that the management of the factory is able to decide, which solution to choose.
>
> Also Dr. Loll describes the equipment to be used for separation and drying, i.e. by use of brochures from suppliers of the equipment, in such a way that the technicians of the Chinese counterpart can evaluate the possibilities and decide, which one to employ in the project.
>
> Whether the equipment can be included in the project or not, have to be decided by UNIDO after having the generel design and thereby the estimation of the cost of equipment for the project.

After having the actual state of the work I put up a description of what was still missing in relation to what UNIDO would accept as a proper generel design. This paper was given to

both teams in handwriting.

"THE PAPER".

The generel design must define the project in such a way that the detailed design of the plant can be carried out by the two parties independently.

To complete the generel design the following must be worked out by the two parties in coorperation:

1. Deside all main dimensions for the project such as flowrates, retention time, volumens, pressures and capacities.
   The figures should be listed as a part of the generel design reported to UNIDO for approval.
2. For the Chinese authorities and UNIDO to approve the generel design of the project the following drawings should be completed:
   - Site plan.
   - Plan of the plant, 1:100.
   - Sectional views.
   - Connecting pipelines and all other interfaces to the factory.
   - Flow diagram(s).
   - Mass flow diagram.
3. Overall description of the control system for the plant giving information of what is going to be controlled, and how it is controlled.
4. A description of technical and economical feasibilities for pretreatment and the following separation and drying of solid waste from the distillery.
5. A list of drawings to be completed during DETAILED DESIGN telling the subject of the drawing, the scale and whom of the two parties is going to do it.
6. A description of standards for the drawings to be completed during detailed design.
7. A list of equipment to be imported to China.
8. An estimation of the total cost of the project, and an estimation of the cost of the equipment to be imported including and specifying the equipment for washing, separating and drying the solid waste.

<u>The coorperation.</u>

Working together in Wiesbaden the two teams, as far as I perceived it, had divided the work in such a way that the Chinese team prepared drawings of the plant rather detailed, and the German team made the more generel papers, drawings and descriptions.

This way of work is probably very effective seen in relation to the the number of drawings completed, but as the Chinese team should learn how to plan and design the actual plant, I am quite sure, that doing the work more mutual by putting up two teams consisting of both Chinese and German technicians would have been a more effective way.

As I already have mentioned there was still a lot of generel work to do at the time where there was only a few days left of the stay. In the same time the Chinese team had prepared several detailed drawings, which are not a part of the detailed design. These facts means to me that the planning of the work has not been carried out properly by Dr. Loll.

At a meeting with the Chinese team, they appointed that they did not believe in being able to complete the generel design till their scheduled departure from Wiesbaden on Tuesday 20th. And especially they were concerned of Dr. Loll's attitude to the problem of solid waste treatment.

Friday morning I therefore ashed the two parties to put up a list of the work, which had to be carried out before Tuesday the 20th.

The necessary time for the work on the list was evaluated, and it was aggreed that difficulties by completing the work probably would occur.

But as Dr. Loll could not accept an extention of the stay, it was agreed that Dr. Loll after the departure of the Chinese team should complete, what was not already completed.

The work in shape of descriptions and drawings Dr. Loll carries out after june the 20th, the chinese team must have the opportunity to comment on before it is reported to UNIDO and the Chinese authorities for approval.

Time schedule and reporting.

The progres report including the detailed design for UNIDO's approval will be completed and given to UNIDO in July.

During the end of June and July the two teams will start the work on detailed design. Therefore it is of importance that the evaluation of the generel design is carried out immediately after UNIDO's reception of the report.

DR.-ING. ULRICH LOLL

ABWASSER – ABFALL – AQUATECHNIK

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FAX TO MR. KRAEMER C/O CARL BRO a/s (2 PAGES)

DEAR MR. KRAEMER,

AS WE HAVE DISRUSSED BY TELEPHONE, WE SEND YOU THE ACIUAL DATA AND PLANNING DECISIONS FOR THE BIOGAS PLANT IN DAXING:

1.) SUBSTRATE

a) QUALITY: COD 31 – 52 g/l ANALIZED BY THE CHINESE EXPERT.

DS: 2,7 ÷ 3,5 %
ø 3,1 %

VS: ~ 80% OF DS

PLANNING DATA:
NORMAL ø 40 g COD/l
MAXIMUM 50 g COD/l

b) QUANTITY: NORMAL 60 m^3/day
MAXIMUM 100 m^3/day

c) COD – LOAD: NORMAL 2400 kg COD/day
MAXIMUM 4.000 kg COD/day

2.) GASPRODUCTION

a) EXPECTED GAS YIELD: 0,4 – 0,45 m^3 BIOGAS/kg COD_{RE}

b) EXPECTED GAS QUANTITY: 700 ÷ 1.350 m^3 BIOGAS/day

c) GAS QUALITY: ~ 60 – 65% METHANE

d) GAS STORAGE VOLUME: 300 – 1000 m^3

3.) DIGESTER SYSTEM

a) ANAEROBIC CONTACT PROCESS

→ BECAUSE OF HIGH CONTENT OF DRY SOLIDS

b) MAIN DIMENSIONS

2 REACTORS WITH 400 m^3 EACH

1 SEDIMENTATION TANK WITH BIOMASS RECYCLING

c) CONSTRUCTION

CONCRETE CONSTRUCTION WITH INSOLATION

ZYCINDER FORM

INTERNAL HEAT EXCHANGER

INTERNAL SUBSTRATE ~~AGITATION~~ (MIXING)

4.) GAS USE

- ONLY FOR STEAM PRODUCTION WITH A CHINESE STANDARD BOILER SYSTEM
- STEAMPRODUCTION/GAS USE OVER 2-4 h/day (THEREFOR RELATIVLY LARGE STORAGE VOLUME)

5.) OPERATION DATA

COD LOADING RATES: NORMAL 3,0 kg COD/m^3·day

MAXIMUM 5,0 kg COD/m^3·day

PARALLEL OPERATION OF THE TWO REACTORS

REACTOR OPERATION IN SERIE:

1. REACTOR: 6 – 10 kg COD/m^3

2. REACTOR: ≈ 1,5 – 3 kg COD/m^3