Ming Yang Project: Treatment of Discharge Water From Starch Production Factory in People's Republic of China

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Experimental Site:
A national starch processing factory at Kwang si Chowang Administration Area in People's Repubic of China

General Background:
Ming Yang factory, selected as an experimental factory, is located in a poor south-western mountainous area of Republic of China. To facilitate economic development in this area, starch processing and sugar processing factories were introduced. They are now the leading industries in the area.
The factories in this area were started without assessing their environmental impact, and discharge water from over 200 factories currently in operation have polluted environment. More than half of the factories have received warning to dose down the factory operation. But dosing down, if enforced, would create major economic set-back for the area residents, leaving no receptor of the area farm products and increased unemployment.

Water Treatment in China
Generally speaking, discharge water is ether left without any treatment or pooled in a pond for natural oxidation in China. Since natural oxidation takes long time to purify water, ponds serve primarily as holding tanks in order net to spread pollution. When discharge water becomes large in quantity such as 10,000 ton per day as in the experimental factory, no pond can handle such volume. As a result, excess water is spilled to rivers and takes without being treated.
In the days when ponds received water discharged only from domestic households, pond water had been maintained in balance. Organic matters in such discharge water were just enough to feed pond fish. But, large amount of discharge water primarily from factories sets the balance off, generating four odor. In addition, discharge water from starch processing and sugar processing factories are rich enough to be processed again to produce alcohol. Discharge water from alcohol production sometimes measures up to 100,000ppm and is extremely difficult to purify. No report has been made yet that successfully treated discharge water from alcohol production, except EM treatment.
Active sludge method which is generally recognized as effective and stable, could not successfully treat discharge water from alcohol production. In this experiment, application of EM is expected to treat successfully water discharged from alcohol production and pooled in ponds.

Synopsis of the Experiment

In January 1995, with support of International Nature Farming Research Center, tow local residents who had been actively promoting EM launched on the experiment. They selected one (pond #1; then 50,000 ton and 25,000 ton now) of the oxidation ponds of the experimental factory because excess pond water is spilled out and polluted a dam which supplies drinking water to Nan Ning city. Another reason is that the experiment would serve as a demonstration to motivate more than 10,000 people who live in the former national farm where the factory is located.

The experimental application of EM eliminated foul odor and lowered BOD from 3,000ppm to 1,400ppm in the first three month period. Based on this result, EM Research Organization opened an office in China, and expanded the experiment to treat alt 10,000 ton per day discharge water with EM.

Condition Prior to the Experiment

The former national farm covers a large area; it takes 10 minutes by car from the entrance to its office and 15 more minutes from the office to the treatment ponds. When I first visited the factory, foul odor was detected far from the factory and so bad by the ponds that gave me a headache. In a 36,000 ton oxidation pond, the water was almost black and seeping out through its dike.

Three different types of discharge water (see Chart-1: Discharge Water From Processing) flows into the treatment ponds, and the mixture of the three measures BOD 9,000ppm, COD 40,000ppm, pH 4.0.

Extended EM and its Application

The water discharged from alcohol production is used as base material to extend EM, following an example in Brazil. Aeration is impossible because of high cost due to vastness and heavy pollution. The amount of EM applied is set a little over 1%, i.e., approximately 10.8 ton of extended EM to 10,000 ton of discharge water per day.

The extended EM of 10.8 ton is poured from 5 different places every day. The distance from the factory to the ponds is quite long, and the condition differ very much from one point to another. Therefore, the following factors were considered in selecting five points to place a tank for extending EM and pouring the extended EM into discharge water.

The water discharged from alcohol production is very hot. Even after it is mixed with ether types of discharge water, it is well over 60 Celsius. The first factor for selection is that the temperature is below 50 Celsius.

The second factor is that further the distance from the ponds is better. Because it gives EM time and place to work.

The third factor is strong foul odor. Stronger the odor, more active the putrescent bacteria are, and earlier treatment is required.

Chronology

Preparation started in the end of 1995, and the experiment started in January 1996. Three major developments were as follows:

Because the ponds are lined with soil, applied EM increase buffer function of soil lining and facilitate cleaning effects. The water discharged from alcohol production is highly polluted, but serves as good substrate for EM. In other words, based on the belief that discharge water is a good material to extend EM, the beet way to extend EM in the ponds was looked into.

In addition to application of EM, Bokashi was inoculated to the bottom of three ponds (15,000 ton each) established for oxidation and sedimentation, and coal crumbs were placed to serve as bed to cultivate EM (in place of ceramics).

Our trust in EM was net always firm when no changes were observed. The discharge water, although it was considered good for extending EM, took time to resolve protein. The discharge water from alcohol production was polluted beyond imagination, and pH of the discharge water stayed below pH5 which means that photosynthetic bacteria cannot be active.

Aeration was a tempting alternative to raise pH level, but it is too costly to be adopted as a standard procedure. A mixing screw and a pump were used as an alternative to aeration, but they made only a little difference.

In July 1996, we realized that Mr. Inatomi of EM Research Organization hit the head of the nail when he said that let the nature take care of it. A mixing screw and a pump were nothing next to the natural aeration of wind and rain. Nature has the power, and EM draws the best out of nature, and we only help EM. We discarded minor manipulation.

Around this time, #1 oxidation pond (25,000 ton) which had been under the experiment for two years, changed its color from creamy white to black, and bacteria became activated. In the black water, black coagulated material started floating and eventually sank to the bottom. The discharge water suddenly became clean, and BOD decreased down to 191 ppm in two month period. The largest pond which is the final deposit pond, started to be clean while the factory was in recess (2-3 month recess happens due to seasonal material supply). Although the factory resumed its operation in November 1996, both BOD and COD of the final deposit pond keep decreasing. (See Chart-III).

Current status

The sediment et the discharge water of alcohol production is used as fertilizer in orchard, and the water from the final deposit pond is used to make bricks which are to be baked soon. The dried bricks showed smoother surface and less cracks.

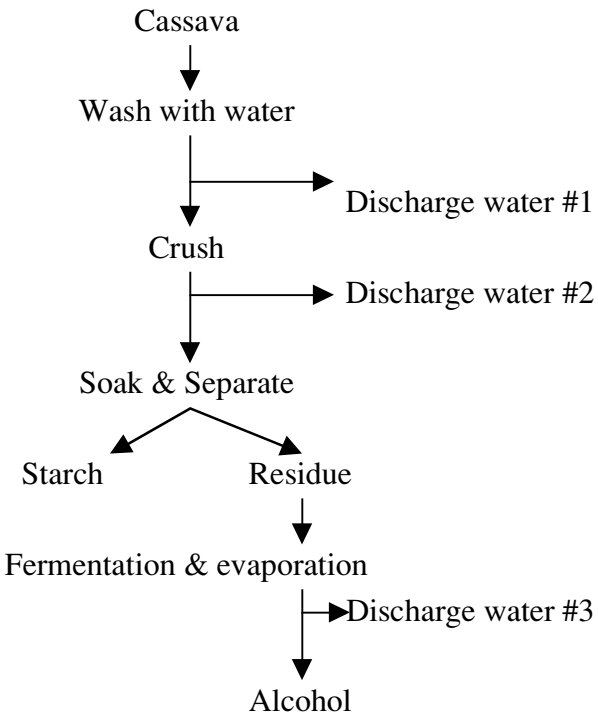
The Results

The 36,000 ton oxidation pond described in “Condition Prior to the Treatment” turned into a beautiful green grass field. This pond is located by 5 sedimentation ponds and was ordered by the area environmental office net to use. The factory brought in a machine to separate solid matters out of alcohol discharge water in this year. Until the last year, the solid matters accumulated in oxidation ponds and made the ponds shallow and useless; thereby, necessitating to remove the accumulated matters and dump to the said oxidation pond to its

full. Because of evaporation and restored natural power of the soil, the matters dried up and turned into good soil to nurture grass. The farmers in the area recognized the richness of the soil and took it all out to their farms.
In order to increase effectiveness, a pump was placed to feed #3 pond water back to the oxidation pond in January 1997. (See water flow chart-ll).

Other
The experiment is not completed, but has been successful to this point with cooperation of many who are concerned with the environment and the community.

Chart-1: Discharge From Processing



Discharge water #1
= Approximately 1,000 ton per day; includes hydro-cyanic add.
Discharge water #2
= Approximately 5,500 ton per day; includes large molecule protein and fiber; BOD 7,000ppm.
Discharge water #3
= Approximately 3,000 ton per day; BOD 40.000ppm, COD 80,000ppm.

Chart-II: Ming Yang Starch Processing Factory.

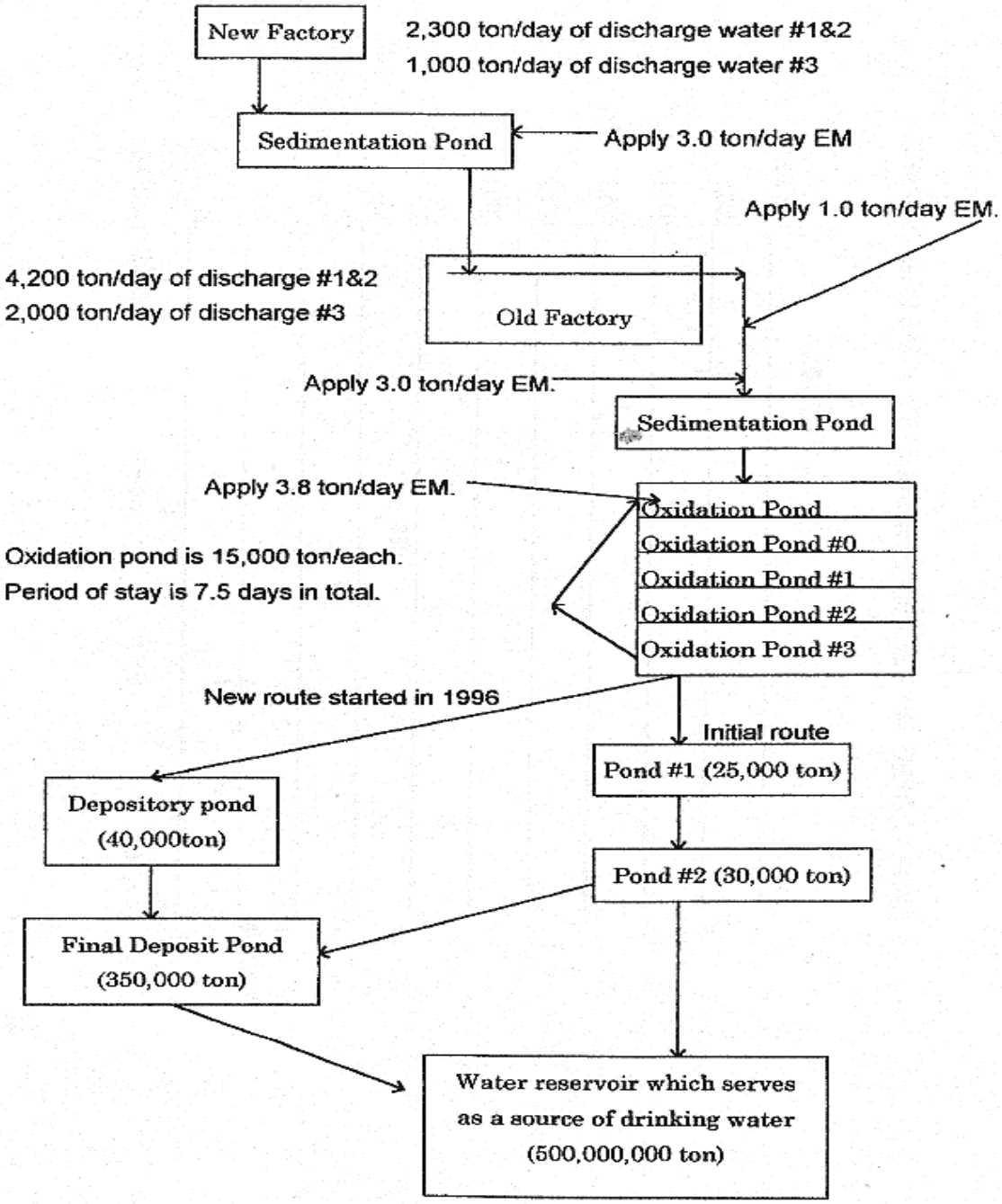


Chart-III: BOD & COD Measurement of the Final Deposit Pond.