

Wastewater Treatment and Biogas Production Technology For Food Industrial Factory

Currently, Thailand has about 10,000 food-industrial plants. Not only consuming resources, such as electricity and fuel oil, but they also generate tons of wastes from raw materials and water utilization, which require the appropriate treatment. Tapioca starch industry plays an important role in Thailand's economy. Sixty starch factories produce 1.7 million tons of tapioca starch, which is used in country and for export, worth 22,000 million Baht. Moreover the starch factories support human labor and employ as much 10 million people. In one ton of tapioca starch production, the resources consumption in starch processing was as follows: 40 L/ton of heavy fuel oil for starch drying, 165 KWh/ton of electricity and wastewater 15 m³, including several organic substances.

Wastewater is generally treated in opened pond system which covers land at least 4 Rais (about 1.6 Acres). There are some disadvantages of the opened ponds system, including low efficiency, bad odor and environment unfriendliness, due to the chemicals used for treatment. Cost of chemicals used for wastewater treatment is expensive, 200,000 Baht/month or higher. Chemicals contamination, usually through the release into the natural water resources, is a claim used in international trade disputation.

The National Center for Genetic Engineering and Biotechnology (BIOTEC) supports the research project **"Treating and Utilization of wastewater from Food Industry"** by **King Mongkut's University of Technology Thonburi**. The researchers developed high-rate, anaerobic fixed-film reactor, which are suitable for the treatment of wastewater from agro-industry. Because of its closed-system nature, there is no problem of smell. Due to the high effectiveness, only half of area used and less amount of the chemical used in the system. In addition, the by-product from the reactor is biogas, mainly methane that can be used for electricity generation or heavy fuel oil substitution. One cubic meter of biogas is equivalent to 0.45 L of heavy fuel oil, therefore if the fuel price of 14 Baht, then the value of biogas is 6.3 Baht.

The technology of water treatment and energy generation is usefully demonstrated in the industrial plant. A rice starch factory, located in Nakorn-Pathom province, constructed a 5,200 m³ of water treatment system. The system has 80-90% efficiency of organic removal. The construction area is reduced to be approximately one-third. Unsatisfied odor that disturb the people who live surround the factory is reduced. In addition, more than 80% of chemicals used in opened pond system are decreased. This technology has been processed since 2000. The



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system produces biogas 2,500 m³/day which substitutes heavy fuel oil for starch drying process about 1,250 L/day or 2,000-2,400 KWh/day of electricity.

Under investment supporting from **the Energy Policy and Planning Office, National Science and Technology Development Agency (NSTDA)** and the technology transfer from BIOTEC, another 4 tapioca starch industries are now under construction. From the process design, biogas will be produced about 11.52 million m³/year or higher or around 172.8 million m³ over 15 years total running-time of the system. **Those amounts of biogas could be substituted heavy fuel oil for production line equal to 5.4 million L/year or 81 million L/15 years (the total running-time). The substitution energy from biogas worth 1,134 million Baht in total, calculated at the heavy fuel oil price 14 Baht/L.**



Starch factory in Nakorn Pathom Province

As described above, the technology can be superbly employed in tapioca starch industry. If this technology has been used nationwide, the waste would be reduced by 50 million m³ per annum. This also helps decrease the use of heavy fuel oil, equivalent to more than 2,400 million Baht/year. Therefore, this might enhance the competitiveness of Thailand's tapioca starch industry in the world market.