

CHAPTER I

INTRODUCTION



1.1 General Background

Tapioca production industry is one of the most important industries. It acquires the income to the nation for many thousand million bahts a year. By now, Thailand is the most exporter of tapioca production in the world. Tapioca production is divided into 3 kinds: tapioca chips, tapioca pellets and tapioca starch. The first two kinds are used for animal food whereas tapioca starch is used for human consumption as well as various industries. The producing processes of tapioca chips and tapioca pellets are not so complicated as that of the tapioca starch since the first doesn't need any water consumption in the process. Therefore it causes no problem of wastewater, so the wastewater problem only occurs especially in the tapioca starch factories.

Tapioca starch factories are classified into 2 categories: the first grade factory and the second grade factory. Both of these factories discharge a large amount of concentrated wastewater. Normally, the first grade factory has an average capacity of process production 60 ton-starch per day while the second grade factory has only 6 ton-starch per day. Each ton of tapioca root yields approximately 200 kgs of starch depending on the percentage which varies from 16-25 per cent of starch per the roots. First grade factory discharges 30-50 m³ of wastewater per a ton of starch and containing 4,000-6,000 mg/l BOD₅. Therefore, the 60 tons capacity

will discharge 2,400 m³/day of wastewater or 12,000 kg/day in term of BOD₅ loading. This loading is equivalent to the amount of wastewater generated by 180,000 persons. Second grade factory discharges lower volume of 20-40 m³ of wastewater per a ton of starch, so 6 tons capacity discharges only 180 m³/day or 1,500 kg-BOD₅/day, equivalent to 14,000 persons.

There are 145 tapioca starch factories which are located mostly in the north-eastern and the south-eastern part of Thailand especially in Nakornratchasima, Rayong and Chonburi Province. McGARRY et al. (1972) their surveying showed that in Chonburi Province, over 97% of the total wastewater pollution came from tapioca starch factories and discharged into the coastal area. PATTAYA TOURISM DEVELOPMENT (1978) indicated that Pattaya City in Chonburi Province is being developed into tourism area. Obviously, the tapioca wastewater treatment problems are important to be concerned until now.

Presently, almost of the tapioca starch factories have their own wastewater treatment plants. Some of them are under construction or improving their treatments efficiency. Over 85% of the treatment plants are waste stabilization ponds, because of the simplicity in operation and their locations in rural areas where there is not much problem of the land cost. Nevertheless, the area of waste stabilization ponds for the first grade tapioca starch factory, capacity 60 tons/day requires about 80-100 rais (1 rai = 1,600 m²) and second grade factory, capacity 6 tons/day requires about 6-10 rais to meet the standard effluent. The following problems have occurred where the factories are located in urban area and have inadequate area to construct these treatment plants and the more rapid en-

largement of the urban area it is the more increasing of the land cost it has. These problems causing some of the treatment plants were constructed as 1,000 m far from their own factories, for these cases, the treatment processes of high efficiency in smaller area should be considered.

1.2 Purposes of Research

According to some of previous studies which showed that primary treatment of tapioca wastewater by anaerobic processes was effective and more economical than aerobic conventional processes. A purpose of this research is to introduce the contact stabilization process after some of anaerobic processes for instance, anaerobic ponds or anaerobic filter as the reason to reduce their treatment plant areas mentioned above.

Consequently, the research is considered as the following purpose;

- To study and collect the information of tapioca starch manufacturing processes, characteristics of wastewaters and their previous treatment research.
- To study a treatability of tapioca wastewater employing a laboratory-scale contact stabilization process.
- To investigate the effects of such factors as sludge age, organic loading, contact time, nutrient, trace elements, etc.; relate to the performance of the process.
- To evaluate the kinetic parameters for instance, the growth yield coefficient and microorganisms decay coefficient.

- To establish and recommend the design parameters of contact stabilization process.

1.3 Scope of Investigation

This research has studied and has collected the information of tapioca starch manufacturing processes, characteristics of tapioca wastewaters, their previous treatment research including the literature reviews and practical aspect of contact stabilization process.

Then, a laboratory-scale contact stabilization model was established, started up and used in continuous treatment of tapioca wastewater sampling from anaerobic waste stabilization ponds for a period of 400 consecutive days, starting from November 24, 1978 to December 28, 1979. The treatment process was studied by means of variations of some parameters for instance, sludge age, contact time in two operating conditions of nutrient controlled condition and both of nutrient and trace element controlled condition. The flow rate, recycle ratio, stabilization time were kept on constant throughout the experiments. The wastewater entering the system was preserved in the refrigerated storage tank. The temperature surrounding contact and stabilization tanks were controlled, the characteristics of the influent and effluent, contact as well as stabilization tank were determined in laboratory. The obtained data were analysed, therefore all of the factors required for the purposes of the research were evaluated and finally concluded.