COMBINED TOXICITY EFFECTS OF FREE FATTY ACIDS (FFAS) AND DETERGENT IN THE ANAEROBIC TREATMENT OF OLEOCHEMICAL INDUSTRIAL EFFLUENT (OCIE)

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ABSTRACT

The effect of combined toxicity of free fatty acid such as caproic acid (C6), caprylic acid (C8), capric acid (C10), lauric acid (C12) and detergent in anaerobic digestion was examined both in batch and continuous experiments. The objectives of the study were to determine the effect of combined toxicity effects of FFAs and detergent and also the optimum threshold inhibition concentration of FFAs and detergent.

Methanogenesis was inhibited more when FFAs and detergent were mixed together then the individual FFAs or detergent. In the batch experiment, mixtures of detergent and FFAs at concentrations 20 mg/l and 40 mg/l respectively resulted in significant inhibition of methanogenesis. On the other hand, individual concentration of FFA or detergent up to more than 100 mg/l was showed only slight inhibition.

The continuous experiment at HRT at 5.6 day, 4.0 day and 2.2 day with the concentration of detergent at 40 mg/l and original FFAs in the OCIE did not effect the reactor. The efficiency of TOC removal was about 90 to 95 %. However, the gas production was very low.

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CHAPTER 1

INTRODUCTION

Malaysia is the largest producer of palm oil and palm kernel oils in the world. Taking advantage of the readily available raw materials, the first oleochemicals industry was set up in Malaysia in 1979 producing fatty acids and glycerol from palm and palm kernel oils. In 1985, the oleochemicals industry was identified by the Industrial Master Plan of Malaysia (MIDA, 1985) as one of the potential growth sectors in palm oil industry. By 1997 there are 13 oleochemical plants operating with the capacity about 823,500 tonnes per year (PORLA, 1997). On an average, each factory discharges about 300 – 500 m^3 of OCIE per day. The organic loading is about 800-1400 kg/day, which has the population equivalent between 4736-7894 people. As a result, more attention should also be focused on the treatment of OCIE.

Currently the treatment methods employed at the factories are of an aerobic system, namely sequencing batch reactor (SBR) and aerated lagoon that require high energy and nutrient. However these systems also create problems such as high sludge production, moderate organic loading rate and the need of a large land area.

Anaerobic digestion has now become a more economically feasible treatment process for wastes having high-strength organic wastes, like palm oil mill effluent (POME) (Ma, 1991), which is a microbiologically controlled process. It occurs in several natural habitats and is now adopted as an effective means of waste treatment. The process can be divided into three phases namely hydrolysis,