# EFFECT OF ENZYMATIC HYDROLYSIS PRETREATMENT ON BATCH ANAEROBIC DIGESTION OF WASTEWATER GENERATED IN DESICCATED COCONUT PROCESSING PLANTS

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## Abstract

Enzymes are widely used to accelerate the biochemical reactions in biological wastewater treatment processes. Commercially developed enzymes such as amylases, proteases and lipases improve microbial biodegradation by accelerating the hydrolysis rate of carbohydrates, proteins and lipids. In this study, wastewater generated in desiccated coconut processing plants were pre-treated with lipase originated from porcine pancreas and then anaerobic digestion was performed to evaluate the effect of enzymatic hydrolysis pre-treatment. Hydrolysis pre-treatment was performed using three different concentrations of lipase i.e. 0% enzyme, 0.01% (w/v) enzyme and 0.1% (w/v) enzyme. Following hydrolysis pre-treatment, anaerobic batch digestion was performed in twenty-four 50 ml reactors under two scenarios i.e. scenario 1: twelve reactors under pH adjusted condition and Scenario 2: 12 were pH not adjusted. Under scenario 1, hydrolyzed pre-treated wastewater samples with three separate enzyme concentrations i.e. 0%, 0.01% and 0.1% were used as substrates and at each enzyme concentration four different inoculum to substrate ratio in volume basis of 1:4, 2:3, 3:2 and 4:1 were used. Similar procedure was followed under Scenario 2 as well. All anaerobic batch experiments were conducted under atmospheric temperature of 31±1°C and pressure of 0.997±0.002atm. Batch experiment was conducted for 60 days and during this period, samples were analyzed. The highest initial biogas production rate of 25.43 ml/day and highest average gas production rate during first 10 days of 7.16 ml/day were achieved for the sample with 0.1% lipase at inoculum to substrate ratio in volume basis of 2:3 under scenario 1. Following 60 days of complete degradation, for the same sample, experimental bio-methane yield of 42.75 mlCH4/gVS substrate added, cumulative biogas production of 95ml, cumulative methane production of 81.55ml, TS reduction of 51.77% and VS reduction of 67.68% were also achieved. The wastewater generated in desiccated coconut processing plants consists of high concentrations of medium chain saturated triglycerides. These triglycerides were hydrolyzed quickly when enzyme was added during enzymatic pre-treatment, resulting higher initial biogas production rate in the beginning as well as higher daily biogas production rate during first 10 days. The initial biogas production rate and daily biogas production rate during first 10 days of the initially pH-adjusted samples into pH 7.0 showed higher biogas production rate than pH not adjusted samples because it was the most favorable pH value for the methanogens for their optimal growth. The bio-methane potential increased when the inoculum to substrate ratio decreased because quantity of hydrolyzed triglycerides available for the anaerobic microorganisms to convert into methane gas was higher. The bio-methane yield of enzyme added samples were much higher than the enzyme

not added samples because enzymes accelerated the hydrolysis of lipids. According to this research study, it can be concluded that adding enzymes will improve the batch anaerobic digestion process of wastewater generated in desiccated coconut processing plants.

**Keywords:** Anaerobic digestion; enzymatic hydrolysis; lipase; desiccated coconut industry; lipid degradation

## DEDICATION

Dedicated with gratitude to my loving **PARENTS** for being the greatest pliers of my life.

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