

**UNIVERSITI TEKNOLOGI MARA**

**OPTIMIZATION OF METHANE  
PRODUCTION FROM VEGETABLE  
AND FRUIT PEEL FOOD WASTE  
USING RESPONSE SURFACE  
METHODOLOGY**

**NURUL SHAHIDA BINTI OSMAN**

**MSc**

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## ABSTRACT

The main objective of this research was to optimize pH and substrate concentration parameters which may affect the methane production by using response surface methodology (RSM) analysis. In this study, food waste (FW) was used as the substrate for methane production. They consisted of fruit peel and vegetables part. The anaerobic sludge (AS) were used as inoculum. The characterization analysis based on physicochemical and microbial properties were done to determine the composition of anaerobic sludge and food waste sample. High amounts of sugar contents and high amount of C/N ratio of FW make FW a potential feedstock for methane production. The bacterial was found as *Bacteroides* and it is found that this gram-negative bacterium is belong to hydrolytic bacteria group which contributed in methane production during anaerobic digestion. This specialized microbial population of hydrolytic bacteria is responsible for depolymerization of complex organic polymers to simpler organic compound. Screening on the effects of inocula sizes, substrate concentration, and pH of incubation by using a Two-Level Factorial Design (TL-FD) were conducted under mesophilic condition (37°C) using a serum bottles (160 ml). The experimental results from TL-FD showed that pH and substrate concentration were significantly affected methane yield ( $P_s$ ) and methane production rate ( $R_m$ ). Optimizations of the specific methane yield ( $P_s$ ) and methane production rate ( $R_m$ ) were achieved by using a central composite design (CCD). The maximum  $P_s$  of 289.90 mL was obtained under optimum conditions of pH 7.67 and substrate concentration of 80 g/L. The maximum  $R_m$  of 109.917 mL/hr was calculated under optimum conditions of pH 7.66 and substrate concentration of 80 g/L. The optimized conditions obtained were subjected to confirmation run and it showed reproducible data with a  $P_s$  of 289.93 mL and  $R_m$  of 109.91 mL/hr. The main effects of parameters were recorded and it was found that main effects of pH were higher than that of substrate concentration.

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