

ABSTRACT

KINETICS OF ANAEROBIC CPO WASTE WATER TREATMENT IN PILOT SCALE

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CPO industrial waste water contains high concentration of organic pollutants and through anaerobic treatment potentially produce electricities. Design and operational of anaerobic bioreactor requires understanding of kinetics that were occurring in the bioreactor.

This study aims to determine kinetic parameters of growth and substrat utilization and to estimate production of methan gas using CIGAR bioreactor in pilot scale. Four m³ seed was collected from anaerobic pond of PTPN VII Bekri and introduced into 5 m³ CIGAR bioreactor. The kinetics of anaerobic degradation were held by fed the substrat semicontinuelly at a loading rate of 100 to 250 liter/day.

Results showed, Moser and first order reaction kinetics represented the microbial activities in the bioreactor. Moser biokinetic coefficients : maksimum growth rate, μ_{mak} and saturation constant, K_s were 0,0395 day⁻¹ and 22,2213 g/l. Maximum substrat utilization, k_s and biomass yield, $Y_{x/s}$ were 1,110 day⁻¹ and 0,036. The maximum efficiency of anaerobic degradation was 82,71% and maximum methan production was 0,32 m³CH₄/kg CODremoval.

Keywords : Kinetics, anaerobic dan bioreactor

ABSTRAK

KINETIKA PROSES PENGOLAHAN LIMBAH CAIR PABRIK MINYAK KELAPA SAWIT KASAR DALAM BIOREAKTOR ANAEROBIK SKALA PILOT

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Limbah cair industri CPO mengandung senyawa organik dengan konsentrasi tinggi dan melalui pengolahan anaerobik berpotensi menghasilkan energi listrik. Operasional dan design bioreaktor pengolahan limbah secara anaerobik membutuhkan pemahaman kinetika proses.

Penelitian ini bertujuan untuk menentukan parameter kinetika pertumbuhan mikroba dan pemanfaatan substrat pada proses degradasi anaerobik limbah cair pabrik minyak kelapa sawit dalam bioreaktor CIGAR serta mengestimasi gas metan yang dihasilkan. Biakan mikroba sebanyak 4 m³ yang berasal dari kolam anaerobik PTPN VII Bekri, diumpankan kedalam bioreaktor bervolume 5 m³. Penentuan kinetika proses anaerobik dilaksanakan dengan mengumpankan limbah cair segar secara bertahap sebanyak 100 liter/hari hingga 250 liter/hari.

Hasil penelitian menunjukkan kinetika Moser dan kinetika reaksi orde pertama mewakili penelitian ini. Diperoleh parameter kinetika laju pertumbuhan maksimum, $\mu_{\max} = 0,0395 \text{ hari}^{-1}$, laju pemanfaatan substrat maksimum, $k_s = 1,110 \text{ hari}^{-1}$, konstanta kejenuhan substrat $K = 22,2213 \text{ g/l}$ dan perolehan sel, $Y_{x/s} = 0,036$. Efisiensi maksimum proses anaerobik diperoleh 82,71% dengan perolehan gas metana $0,32 \text{ m}^3 \text{CH}_4/\text{kg COD}$.

Kata kunci : Kinetika, anaerobik dan bioreaktor