

**PERFORMANCE OF REVERSE MEMBRANE BIOREACTOR IN THE  
PRESENCE OF IMPURITIES FROM GASIFICATION OF  
AGRICULTURAL WASTE IN BATCH ANAEROBIC DIGESTION**

**ABSTRACT**

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Agricultural waste is a potential source for producing biogas. In order to be used for producing biogas, agricultural waste need to pass the pre-treatment method which are gasification, to convert the waste into fermentable gases. However, the presence of toluene and naphthalene as impurities in gasification products might effect the anaerobic digestion system. Reverse-membrane bioreactor is a technique for encasing the cells inside bioreactor using PVDF membrane, and it was evaluated in this work in batch digestion system. The study was conducted in 118 ml working volume for 30 days under 55°C condition. Toluene, naphthalene, and combination of both added in different concentration to evaluate the minimum inhibiting concentration in rMBR reactors. The results showed addition 0.05, 0.1, 0.5, 1.0 g/L of toluene, 0.01, 0.02, 0.1, 0.2 g/L of naphthalene, and 0.05 + 0.01, 0.1 + 0.02, 0.5 + 0.1, 1.0 + 0.2 of toluene + naphthalene increased methane production in free cell reactors 3-31%, 5-25%, and 18-25%, and did not inhibit the methane production. Biogas composition in all reactors achieved methane percentage 59-69%. The highest VFA concentration achieved in addition 0.2 g/L of naphthalene in rMBR reactor, 13.115 g/L. The pH value of all reactors reached 8.3-8.4. Minimum inhibiting concentration of toluene and naphthalene can not be determined from this work. The effect of using rMBR configuration also can not be determined in this work.

**Keywords:** reverse membrane bioreactor, batch, anaerobic digestion, toluene, naphthalene

**PERFORMA REVERSE MEMBRANE BIOREACTOR TERHADAP HASIL  
SAMPING DARI PROSES GASIFIKASI LIMBAH PERTANIAN  
MENGUNAKAN BATCH ANAEROBIC DIGESTION**

**ABSTRAK**

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Limbah pertanian merupakan sumber potensial untuk memproduksi biogas, dan gasifikasi diperlukan sebagai metode *pre-treatment*. Namun, adanya toluena dan naftalena sebagai hasil samping dalam proses gasifikasi dapat menghambat produksi biogas. *Reverse membrane bioreactor* adalah teknik membungkus inoculum dengan menggunakan membran PVDF dan dievaluasi dalam penelitian ini untuk mencegah penghambatan produksi biogas dalam sistem *batch*. Penelitian dilakukan menggunakan reactor bervolume 118 ml selama 30 hari pada suhu 55°C. Toluena, naftalena, dan kombinasi keduanya ditambahkan dalam konsentrasi yang berbeda untuk mengevaluasi konsentrasi penghambatan minimal dalam reaktor rMBR. Hasil penelitian menunjukkan penambahan 0,05, 0,1, 0,5, 1,0 g / L toluena, 0,1, 0,02, 0,1, 0,2 g / L naftalena, dan 0,05 + 0,01, 0,1 + 0,02, 0,5 + 0,1, 1,0 + 0,2 toluena + naftalena meningkatkan produksi metana dalam reaktor *free cell* 3-31%, 5-25%, dan 18-25% dan tidak menghambat produksi metana. Komposisi biogas di semua reaktor mencapai persentase metana 59-69%. Konsentrasi VFA tertinggi dicapai di samping 0,2 g / L naftalena dalam reaktor rMBR, 13,115 g / L. Nilai pH semua reaktor mencapai 8,3-8,4.

Kata kunci: membran, batch, proses anaerobik, toluena, naftalena