

Desain sewage treatment plant kapal penumpang menggunakan sistem moving bed biofilm reactor (MBBR) (studi kasus : kapal penumpang PT Peln di Pelabuhan Tanjung Priok = Passenger ship sewage treatment plant design with 9MBBR) technology (case study : PT Peln passenger ships in Tanjung Priok Harbour)

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Abstrak

Aktivitas pelayaran di Indonesia terus meningkat sehingga diperlukan tindakan pencegahan pencemaran laut melalui pengolahan air limbah secara on-site di setiap kapal penumpang. Penelitian ini bertujuan untuk mengetahui karakteristik air limbah domestik kapal penumpang dan waktu detensi optimum penyisihan konsentrasi COD dan TN yang akan dijadikan kriteria desain unit MBBR. MBBR merupakan unit pengolahan kombinasi pertumbuhan biomassa terlekat dan tersuspensi yang efisien untuk diterapkan di kapal penumpang karena membutuhkan ruang yang minim. Kinerja MBBR diketahui melalui eksperimental menggunakan sistem batch pada reaktor anoksik dan aerob dengan waktu detensi 2, 4, 6, dan 8 jam. Hasil penelitian memperoleh konsentrasi COD dan TN air limbah domestik kapal penumpang sebesar 550-760 mg/l dan 51-88 mg/l yang melebihi baku mutu MEPC 227.64 tahun 2012 masing-masing sebesar 125 mg/l dan 20 mg/l sehingga perlu diolah. Waktu metabolisme optimum sehingga menghasilkan efluen yang memenuhi baku mutu adalah 8 jam masing-masing reaktor dengan total efisiensi penyisihan COD sebesar 81,2% dan TN sebesar 87,3%. Perancangan STP MBBR memiliki volume sebesar 80,25 m³/unit yang menghemat ruang sebesar 107,0 m³; berat sebesar 118,3 ton/unit yang meningkatkan daya tampung KM Sinabung sebesar 92,4 DWT; dan energi sebesar 7,7 kW/unit yang menghemat penyediaan energi sebesar 21,2 kW.

Sailing's activities in Indonesia are increasing, hence on-site wastewater treatment at each passenger ship(s) is needed to avoid sea pollution. This study aims to determine the characteristics of domestic wastewater from the passenger ship(s) and optimum detention time of COD removal and TN concentrations that will be used as a design criterion of MBBR unit. MBBR is a combination of attached and suspended growth biomass treatment which is efficient for application in passenger ships, because it required minimal space. MBBR's performance was acknowledged through experimental process using batch system on anoxic and aerobic reactors with 2, 4, 6, and 8 hours detention time.

Results of this study showed COD and TN concentrations of domestic wastewater from passenger ship(s) of 550-760 mg/l and 51-88 mg/l respectively. These values exceeded the quality standard stated on 227.64 MEPC in 2012 which the standard COD and TN concentrations are 125 and 20 mg/l, so the wastewater needs to be treated. The optimum metabolisme time needed to produce effluent that meets the quality standard is 8 hours for each reactor with total COD removal efficiency of 81.2% and TN of 87.3%. The STP MBBR's design had volume of 80.25 m³/units which saved the space of 107.0 m³; weight of 118.3 tons/unit which increased the KM Sinabung's Death Weight Tonnage (DWT) of 92.4 DWT; and energy of 7.7 kW/unit which saved the energy supply of 21.2 kW.