

PERANCANGAN INSTALASI PENGOLAHAN AIR LIMBAH DOMESTIK (IPALD) DENGAN METODE BIOFILTER ANAEROB–AEROB PT PLN NUSANTARA POWER UP MUARA TAWAR PROVINSI JAWA BARAT

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INTISARI

Kegiatan operasional pembangkit listrik tenaga gas dan uap (PLTGU) menghasilkan air limbah yang bersumber dari aktivitas industri maupun domestik. Air limbah industri dikelola melalui *Wastewater Treatment Plant* (WWTP), namun pengolahan air limbah domestik masih dilakukan pengolahan setempat dengan lumpur hasil pengolahan dikelola bersama pihak ketiga dengan biaya yang besar. Oleh karena itu, dibutuhkan sistem pengolahan air limbah domestik yang lebih efisien dan berkelanjutan. Penelitian ini bertujuan untuk menganalisis karakteristik air limbah domestik; menganalisis kualitas air laut sebagai badan penerima air hasil olahan IPALD; membuat perancangan Instalasi Pengolahan Air Limbah Domestik (IPALD) dengan metode biofilter anaerob–aerob; dan membuat rancangan anggaran biaya yang dibutuhkan untuk membangun IPALD.

Metode pengumpulan data dilakukan melalui yaitu studi literatur, survei lapangan dan dokumentasi. Pengambilan sampel dilakukan dengan metode *grab sampling* pada beberapa titik diantaranya titik septik tank, bak pengumpul, saluran air dan air laut. Parameter analisis air limbah domestik mengacu pada PerMen LHK Nomor 68 Tahun 2016 tentang Air Limbah Domestik. Sementara itu, analisis kualitas air laut mengacu pada KepMen LHK Republik Indonesia No SK.321/Menlhk/Setjen/PKL.1/5/2019 tentang Izin Pembuangan Air Limbah ke Laut Atas Nama PT Pembangkit Jawa Bali Unit Pembangkit Muara Tawar. Analisis data dilakukan secara deskriptif.

Hasil penelitian menunjukkan bahwa kualitas air limbah domestik mengandung parameter yang perlu diolah lebih lanjut yaitu TSS, amonia dan total coliform dengan target efisiensi penurunan masing-masing sebesar 83,37%; 90%; 99,9%. Volume air limbah domestik yang dihasilkan mencapai 125,19 m³/hari. Kualitas air laut di lokasi pembuangan hasil olahan IPALD menunjukkan bahwa nilainya masih berada di bawah ambang baku mutu, sehingga pembuangan ke laut tidak menimbulkan risiko signifikan terhadap ekosistem laut. Berdasarkan hasil analisis tersebut, dirancang sistem IPALD dengan panjang 48,938 m lebar 2,5 m dan tinggi 2,2 m. Media biofilter yang digunakan adalah sarang tawon yang terdiri 1 bak ekualisasi, 2 dari bak pengendapan awal, 2 bak biofilter anaerob, 2 bak biofilter aerob, 1 bak pengendapan akhir, 1 bak desinfeksi dan 1 bak penampungan akhir. Estimasi anggaran biaya pembangunan IPALD dengan metode biofilter anaerob-aerob adalah sebesar Rp 2.626.025.000.00.

Kata Kunci: Air Limbah Domestik, IPAL Domestik, Biofilter Anaerob Aerob

**DESIGN OF DOMESTIC WASTEWATER TREATMENT PLANT (WWTP)
WITH ANAEROBIC–AEROBIC BIOFILTER METHOD PT PLN NUSANTARA
POWER UP MUARA TAWAR WEST JAVA**

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ABSTRACT

The operational activities of Gas and Steam Power Plants (PLTGU) generate wastewater originating from both industrial and domestic activities. While industrial wastewater is managed through a Wastewater Treatment Plant (WWTP), domestic wastewater is still treated locally, with the resulting sludge managed by third parties at a relatively high cost. Therefore, a more efficient and sustainable domestic wastewater treatment system is needed. This study aims to analyze the characteristics of domestic wastewater; assess the quality of seawater as the receiving body for the treated effluent from the Domestic Wastewater Treatment Plant (IPALD); design an IPALD system using the anaerobic–aerobic biofilter method; and develop a cost estimation for the construction of the IPALD system.

Data collection methods included literature review, field surveys, and documentation. Wastewater samples were collected using the grab sampling method from several points, including the septic tank, collection tank, drainage channel, and seawater. The parameters for domestic wastewater analysis refer to the Minister of Environment and Forestry Regulation (PerMen LHK) No. 68 of 2016 concerning Domestic Wastewater. Meanwhile, seawater quality analysis refers to the Decree of the Minister of Environment and Forestry of the Republic of Indonesia No. SK.321/Menlhk/Setjen/PKL.1/5/2019 regarding the Permit for Disposal of Wastewater into the Sea on behalf of PT Pembangkit Jawa Bali, Muara Tawar Power Plant Unit. Data were analyzed descriptively.

The results showed that domestic wastewater quality contained parameters that required further treatment, specifically Total Suspended Solids (TSS), ammonia, and total coliform, with targeted removal efficiencies of 83.37%, 90%, and 99.9%, respectively. The volume of domestic wastewater generated was 125.19 m³/day. The seawater quality at the IPALD discharge point remained below the threshold of environmental quality standards, indicating that the discharge would not significantly impact the marine ecosystem. Based on the analysis, an IPALD system was designed with dimensions of 48.938 meters in length, 2.5 meters in width, and 2.2 meters in height. The biofilter media used is honeycomb-shaped plastic media, consisting of one equalization tank, two primary sedimentation tanks, two anaerobic biofilter tanks, two aerobic biofilter tanks, one final sedimentation tank, one disinfection tank, and one final holding tank. The estimated construction cost for the IPALD system using the anaerobic-aerobic biofilter method is IDR 2,626,025,000.00.

Keywords: Domestic Wastewater, Domestic Wastewater Treatment Plant, Aerobic Anaerobic Biofilter