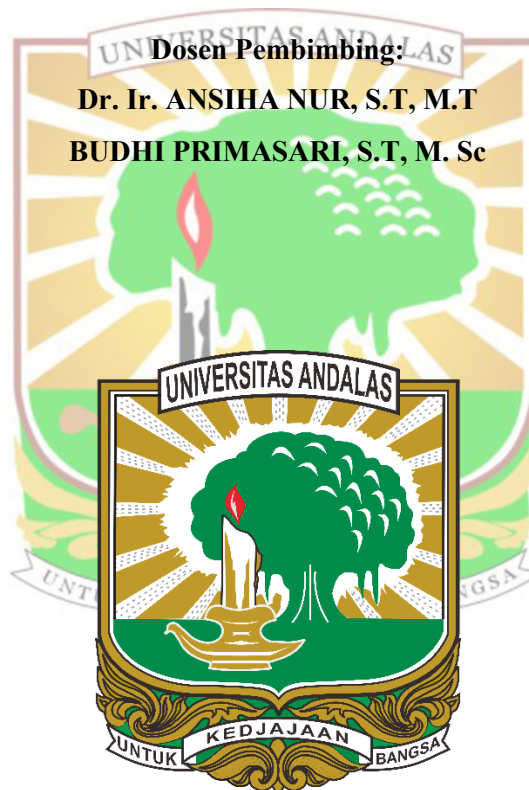


TUGAS AKHIR
DETAIL ENGINEERING DESIGN (DED) INSTALASI
PENGOLAHAN AIR LIMBAH (IPAL) FAKULTAS TEKNIK
UNIVERSITAS ANDALAS

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ABSTRAK

Tugas akhir ini bertujuan untuk merancang *Detail Engineering Design* (DED) Instalasi Pengolahan Air Limbah (IPAL) terpusat di Fakultas Teknik Universitas Andalas (FT-Unand) guna mengolah limbah domestik campuran dari lima departemen (Teknik Sipil, Mesin, Industri, Lingkungan, dan Elektro) serta dekanat. FT-Unand saat ini belum memiliki sistem IPAL terpusat, sehingga diperlukan perancangan untuk memastikan kualitas air limbah memenuhi baku mutu untuk dimanfaatkan kembali sebagai penyiraman tanaman. Metode yang digunakan meliputi studi literatur, pengumpulan data, analisis data, penyusunan alternatif desain, pemilihan desain terpilih, pembuatan detail desain, spesifikasi teknis, penyusunan rencana anggaran biaya, serta operasional dan pemeliharaan. Debit air limbah yang diolah sebesar 198,9 m³/hari dengan periode desain 15 tahun (2024–2039), melayani proyeksi 5.020 orang pada tahun 2039. Hasil perhitungan menunjukkan kebutuhan lahan untuk IPAL adalah 84,3 m², sementara lahan tersedia seluas 300 m². Hasil analisis karakteristik air limbah menunjukkan parameter kualitas air limbah melebihi baku mutu PerMenLHK No. 68/2016, di antaranya BOD 260,5 mg/L, COD 627,2 mg/L, TSS 189,1 mg/L, amonia 45 mg/L, minyak dan lemak 10 mg/L, dan total koliform 11.000 MPN/100 mL. Desain IPAL dirancang menggunakan teknologi biofilter anaerob-aerob dengan pertimbangan efektivitas pengolahan limbah organik, biaya operasional rendah, stabilitas proses, dan kesesuaian dengan lahan terbatas. Rancangan unit pengolahan meliputi, *bar screen*, *grit chamber*, bak pengendapan, biofilter anaerob-aerob, klorinasi, dan *sludge drying bed*. Hasil efluen yang dihasilkan memenuhi baku mutu (BOD 3,9 mg/L, COD 9,4 mg/L, TSS 1,9 mg/L, amoniak 4,5 mg/L, minyak dan lemak 0,5 mg/L, dan total koliform 110 MPN/100 mL). Estimasi biaya konstruksi sebesar Rp1.494.625.700,-.

Kata Kunci: *Limbah Domestik, Universitas Andalas, Detail Engineering Desain (DED), Sistem Anaerobik – Aerobik, Instalasi Pengolahan Air Limbah*



ABSTRACT

This study aims to design a Detailed Engineering Design (DED) for a centralized Wastewater Treatment Plant (WWTP) at the Faculty of Engineering, Universitas Andalas (FT-Unand) to treat mixed domestic wastewater from five departments (Civil, Mechanical, Industrial, Environmental, and Electrical Engineering) and the dean's office. Currently, FT-Unand does not have a centralized WWTP system, so this design is necessary to ensure the wastewater quality meets the required standards before being reused for plant watering. The methodology includes literature review, data collection, data analysis, alternative design formulation, optimal design selection, detailed design development, technical specifications, cost estimation, and operational & maintenance planning. The designed system treats 198.9 m³/day of wastewater with a 15-year design period (2024–2039), serving a projected population of 5,020 by 2039. Land requirement calculations indicate 84.3 m² is needed, while 300 m² is available. Wastewater characterization revealed exceedances of PerMenLHK No. 68/2016 standards, including BOD (260.5 mg/L), COD (627.2 mg/L), TSS (189.1 mg/L), ammonia (45 mg/L), oil & grease (10 mg/L), and total coliform (11,000 MPN/100 mL). The WWTP employs anaerobic-aerobic biofilter technology, selected for its organic removal efficiency, low operational costs, process stability, and compact footprint. The treatment units consist of a bar screen, grit chamber, settling tank, anaerobic-aerobic biofilter, chlorination, and sludge drying bed. The treated effluent complies with discharge standards (BOD 3.9 mg/L, COD 9.4 mg/L, TSS 1.9 mg/L, ammonia 4.5 mg/L, oil & grease 0.5 mg/L, and total coliform 110 MPN/100 mL). The estimated construction cost is IDR 1,494,625,700,-.

Keywords: Domestic wastewater, Universitas Andalas, Detail Engineering Desain (DED), Anaerobic-aerobic systems, Wastewater treatment plant

