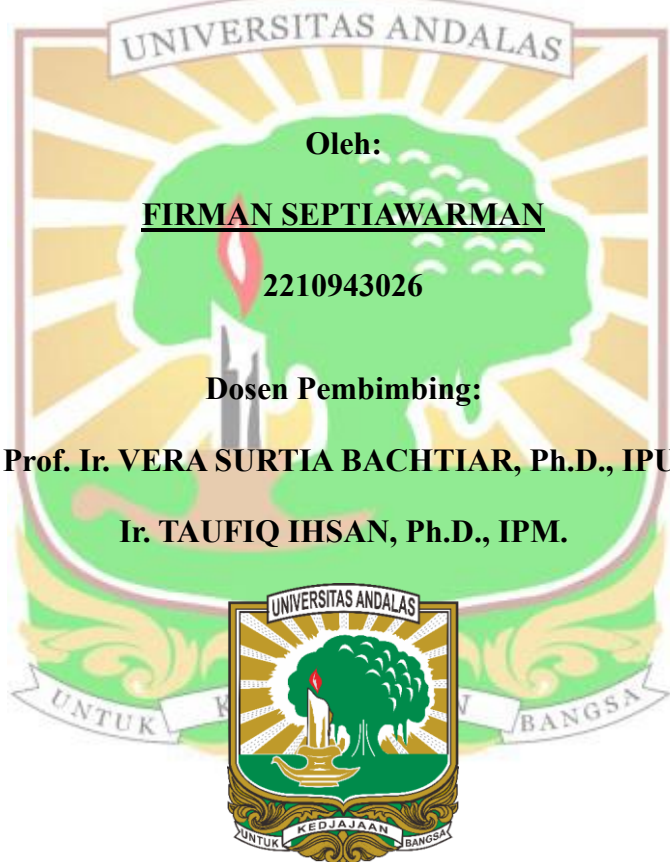


**ANALISIS PERBANDINGAN KONSENTRASI (CO₂ DAN
TVOC) PADA RUANGAN KELAS BER-AC DAN NON-AC DI
UNIVERSITAS ANDALAS MENGGUNAKAN
LOW-COST SENSOR**

Sebagai salah satu syarat untuk menyelesaikan
Program Strata-1 pada
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Fakultas Teknik- Universitas Andalas

TUGAS AKHIR



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ABSTRAK

Kualitas udara dalam ruangan (*Indoor Air Quality/IAQ*) di fasilitas pendidikan merupakan faktor krusial yang memengaruhi kesehatan, kenyamanan, dan konsentrasi belajar mahasiswa. Penelitian ini bertujuan menganalisis dan membandingkan konsentrasi Karbon Dioksida (CO₂) dan *Total Volatile Organic Compounds* (TVOC) pada ruang kelas ber-AC dan non-AC di Universitas Andalas, mengevaluasi kesesuaiannya dengan baku mutu Permenkes RI No. 2 Tahun 2023, mengidentifikasi potensi sumber pencemar, serta menganalisis korelasinya terhadap suhu, kelembapan, dan kepadatan penghuni. Pengukuran dilakukan secara kontinu selama 24 jam penuh sepanjang lima hari kerja pada enam ruang kelas sampel, yaitu empat ruang ber-AC (RSTA 2, RSTA 3 Split Wall), (RSTA 4, RSTA 5 Sentral) dan dua ruang non-AC (G1.5, G1.11), menggunakan *Low-Cost Sensor* berbasis IoT (*Wi-Fi Environmental Sensor* RS-WFVS2). Data dianalisis menggunakan statistik deskriptif, uji normalitas Kolmogorov-Smirnov, uji Kruskal-Wallis, korelasi Spearman Rank, serta analisis pola temporal harian. Hasil menunjukkan rata-rata harian CO₂ berkisar 447,00-873,08 ppm dan TVOC 228,33 - 944,68 ppb, masih memenuhi baku mutu secara rerata harian. Namun, pada jam aktif perkuliahan, ruang ber-AC mengalami akumulasi CO₂ yang melampaui ambang batas, dengan puncak tertinggi 3.053 ppm di RSTA 5 dan 2.762 ppm di RSTA 4, sementara ruang non-AC tetap aman dengan maksimum 770 ppm. Uji Kruskal-Wallis membuktikan perbedaan signifikan ($p < 0,05$) CO₂ dan TVOC antara kedua tipe ruangan. Sumber emisi CO₂ bersifat biogenik dari respirasi penghuni, sedangkan TVOC dipicu aktivitas antropogenik seperti produk perawatan pribadi dan perlengkapan perkuliahan. Kepadatan penghuni terbukti menjadi determinan utama kenaikan CO₂. Direkomendasikan penerapan *purging* berkala, penambahan *exhaust fan*, evaluasi kapasitas penghuni, dan penggunaan material rendah emisi.

Kata Kunci: Kualitas Udara Dalam Ruangan, CO₂, TVOC, *Low-Cost Sensor*, Ruang Kelas



ABSTRACT

Indoor Air Quality (IAQ) in educational facilities is a critical factor affecting student health, comfort, and learning concentration. This study analyzes and compares Carbon Dioxide (CO₂) and Total Volatile Organic Compounds (TVOC) concentrations in air-conditioned (AC) and non-air-conditioned (non-AC) classrooms at Universitas Andalas, evaluates compliance with Indonesian Ministry of Health Regulation No. 2 of 2023, identifies potential pollutant sources, and examines correlations with temperature, humidity, and occupant density. Measurements were conducted continuously for 24 hours across five working days in six sample classrooms: four AC rooms (RSTA 2, RSTA 3 Split Wal), (RSTA 4, RSTA 5 Sentral) and two non-AC rooms (G1.5, G1.11), using an IoT-based Low-Cost Sensor (Wi-Fi Environmental Sensor RS-WFVS2). Data were analyzed using descriptive statistics, the Kolmogorov-Smirnov normality test, non-parametric Kruskal-Wallis tests, Spearman Rank correlation, and daily temporal pattern analysis. Results show daily average CO₂ ranged 447.00 - 873.08 ppm and TVOC 228,33 - 944,68 ppb, within the daily-average standard. However, during active lecture hours, AC classrooms experienced CO₂ accumulation exceeding the threshold, peaking at 3,053 ppm in RSTA 5 and 2,762 ppm in RSTA 4, while non-AC rooms stayed safe at a maximum of 770 ppm due to effective cross-ventilation. The Kruskal-Wallis test confirmed a statistically significant difference ($p < 0.05$) in CO₂ and TVOC between room types. CO₂ emissions were predominantly biogenic, from occupant respiration, while TVOC emissions were driven by anthropogenic activities such as personal care products and lecture equipment. Occupant density proved the primary determinant of CO₂ increase. Periodic purging, additional exhaust fans, occupant capacity evaluation, and low-emission materials are recommended.

Keywords: Indoor Air Quality, CO₂, TVOC, Low-Cost Sensor, Classroom

