

**ANALISIS VARIASI JARAK PENGUKURAN TERHADAP
KONSENTRASI PARTIKULAT AKIBAT INDUSTRI SEMEN
MENGUNAKAN ALAT AMBIENT NANO SAMPLER**

TUGAS AKHIR

Sebagai salah satu syarat untuk menyelesaikan

Program Strata-1

Departemen Teknik Lingkungan
Fakultas Teknik Universitas Andalas

Oleh:

HAFIZ ADLI ANANDA

2110943002

Dosen Pembimbing

Prof. Ir. Vera Surtia Bachtiar, S.T., M.Sc., Ph.D, IPU

Ir. Reri Afrianita, S.T., M.T



**PROGRAM STUDI SARJANA TEKNIK LINGKUNGAN
DEPARTEMEN TEKNIK LINGKUNGAN
FAKULTAS TEKNIK - UNIVERSITAS ANDALAS
PADANG
2025**

ABSTRAK

Penelitian ini menganalisis konsentrasi partikulat berdasarkan variasi jarak pengukuran terhadap industri semen di Kota Padang. Pengukuran dilakukan menggunakan alat ambient nano sampler di empat titik arah Barat dengan jarak 0 km, 0,5 km, 1 km, dan 1,5 km dari pusat aktivitas industri berdasarkan arah angin dominan, dimana setiap titik pengukuran dilakukan pengambilan sampel sebanyak tiga kali. Konsentrasi rata-rata TSP, PM_{10} , $PM_{2,5}$, PM_1 , dan $PM_{0,5}$ yang didapatkan pada setiap variasi jarak pengukuran didapatkan konsentrasi TSP secara berturut-turut ialah $187,38 \mu\text{g}/\text{m}^3$, $112,34 \mu\text{g}/\text{m}^3$, $78,00 \mu\text{g}/\text{m}^3$, $58,12 \mu\text{g}/\text{m}^3$. Konsentrasi PM_{10} $147,12 \mu\text{g}/\text{m}^3$, $87,61 \mu\text{g}/\text{m}^3$, $64,56 \mu\text{g}/\text{m}^3$, $47,28 \mu\text{g}/\text{m}^3$. Konsentrasi $PM_{2,5}$ $67,12 \mu\text{g}/\text{m}^3$, $46,65 \mu\text{g}/\text{m}^3$, $33,90 \mu\text{g}/\text{m}^3$, $24,52 \mu\text{g}/\text{m}^3$. Konsentrasi $PM_{1,0}$ $41,44 \mu\text{g}/\text{m}^3$, $30,94 \mu\text{g}/\text{m}^3$, $25,11 \mu\text{g}/\text{m}^3$, $18,27 \mu\text{g}/\text{m}^3$. Konsentrasi $PM_{0,5}$ $22,62 \mu\text{g}/\text{m}^3$, $17,20 \mu\text{g}/\text{m}^3$, $13,16 \mu\text{g}/\text{m}^3$, $8,76 \mu\text{g}/\text{m}^3$. Tren ini menunjukkan bahwa semakin jauh dari sumber emisi, konsentrasi partikulat semakin rendah. Analisis one-way ANOVA menunjukkan bahwa terdapat perbedaan konsentrasi partikulat yang signifikan berdasarkan variasi jarak pengukuran, sedangkan uji post hoc Bonferroni menunjukkan perbedaan signifikan antara titik 0 km dan 1,5 km untuk parameter TSP. Konsentrasi PM_{10} di titik 0 km dan 0,5 km melebihi baku mutu $75 \mu\text{g}/\text{m}^3$, serta $PM_{2,5}$ di titik 0 km melebihi baku mutu $55 \mu\text{g}/\text{m}^3$. Hasil penelitian ini menunjukkan bahwa area terdekat dengan industri memiliki risiko pencemaran udara yang tinggi dan dapat memicu gangguan sistem pernapasan. Upaya pengendalian yang disarankan ialah penanaman vegetasi sebagai penahan debu di sekitar permukiman.

Kata kunci: Ambient nano sampler, Industri semen, Jarak, One-way ANOVA, Partikulat.



ABSTRACT

This study analyzes particulate concentrations based on variations in measurement distance from the cement industry in Padang City. Measurements were taken using an ambient nano sampler at four points in the west at distances of 0 km, 0,5 km, 1 km, and 1,5 km from the center of industrial activity based on the prevailing wind direction, with three samples taken at each measurement point. The average concentrations of TSP, PM₁₀, PM_{2,5}, PM₁, and PM_{0,5} obtained at each measurement distance variation were as follows: TSP concentrations were 187.38 µg/m³, 112.34 µg/m³, 78.00 µg/m³, and 58.12 µg/m³, respectively. The PM₁₀ concentrations were 147.12 µg/m³, 87.61 µg/m³, 64.56 µg/m³, and 47.28 µg/m³. PM_{2,5} concentrations: 67.12 µg/m³, 46.65 µg/m³, 33.90 µg/m³, 24.52 µg/m³. PM₁ concentration: 41.44 µg/m³, 30.94 µg/m³, 25.11 µg/m³, 18.27 µg/m³. PM_{0,5} concentration: 22.62 µg/m³, 17.20 µg/m³, 13.16 µg/m³, 8.76 µg/m³. This trend indicates that particulate concentrations decrease as distance from the emission source increases. One-way ANOVA analysis shows that there are significant differences in particulate concentrations based on variations in measurement distance, while the Bonferroni post hoc test shows significant differences between the 0 km and 1,5 km points for the TSP parameter. PM₁₀ concentrations at the 0 km and 0.5 km points exceeded the quality standard of 75 µg/m³, and PM_{2,5} at the 0 km point exceeded the quality standard of 55 µg/m³. The results of this study indicate that areas closest to industry have a high risk of air pollution and can trigger respiratory system disorders. The recommended control measures include planting vegetation as a dust barrier around residential areas.

Key words: *Ambient nano sampler, Cement industry, Distance, One-way ANOVA, Particulates.*