Influence of Meteorological Factors A Case Study of Bangkok and Chiang Mai Thailand

Thepthiporn Saiuparad, Naphat Phowan, Naruephat Tangmankongworakoon, Supika Vanitchung, Patarapong Kroeksakul, *Kun Silprasit
Department of Environment and Resources, Faculty of Environmental Culture and Ecotourism, Srinakharinwirot University, Bangkok, Thailand
Corresponding Author Email: kun@g.swu.ac.th

Abstract

The severe PM2.5 crisis in Thailand is driven by diverse environmental factors. This research aims to compare average PM2.5 concentrations, investigate the relationship between meteorological factors and PM2.5 levels, and develop predictive models for Bangkok and Chiang Mai. Six independent variables were analyzed: temperature, relative humidity, wind speed, wind direction, rainfall, and air pressure. Data from 2020–2024 were sourced from the Thai Meteorological Department and the Pollution Control Department, analyzed using descriptive statistics, Pearson's correlation, and Multiple Regression Analysis combined with Principal Component Analysis. Results reveal that Chiang Mai experiences higher average PM2.5 concentrations than Bangkok (26.53 µg/m³ vs. 22.35 µg/m³), with critical peaks reaching 106.00 µg/m³ in Chiang Mai. In both regions, relative humidity and rainfall showed significant negative correlations with PM2.5. Notably, Bangkok exhibited a strong positive correlation with air pressure (r=.801), while Chiang Mai was highly sensitive to air dryness (r=−.864). Multiple Regression Analysis indicated that the "Humidity and Rainfall" group had the most significant influence on reducing dust levels in both areas (β=−.696 for Bangkok and β=−.744 for Chiang Mai). Additionally, wind direction significantly influenced dust accumulation in Chiang Mai, reflecting the impact of its basin-like topography. These findings suggest that PM2.5 management strategies must be site-specific, considering local meteorological conditions and geography, such as urban green space planning and localized pollution control zones, to maximize mitigation efficiency.

Keyword: PM2.5, Meteorology, Bangkok and Chiang Mai, Multiple Regression Analysis