Comparing concentration of nitrogen dioxide (NO_2) in urban Chiang Mai University using the passive sampling technique in 2024-2025

Vakulthip Charanaphong[1], Jaturawit Kabao[2], Nuttipon Yabueng[1,2]

[1]Environmental Science Program, Faculty of Science, Chiang Mai University, Thailad

[2]Environmental Science Research Center (ESRC), Faculty of Science, Chiang Mai University, Thailand

Abstract

One of the major pollutants that affects both human and environmental health is nitrogen dioxide (NO_2). It originates from automobiles and factories, particularly in metropolitan areas. Therefore, this study aims to evaluate and compare the levels of NO_2 in different areas around Chiang Mai University, including two roadside locations (RS1 and RS2), one parking lot (PL), and one garden (GD). In this study GD was used as the background site because it is far from traffic activity. NO_2 sampling were set up simultaneously three times at each site using the passive sampling technique. Different NO_2 levels were found; RS2 has the highest concentration value, followed by RS1 because these two places have quite a lot of traffic, meanwhile GD which normally has no cars at all, but the value is higher than PL because it happened to be during a graduation ceremony, causing heavy traffic. The lowest is PL which is close during the graduation ceremony, therefore the concentration value is low in the second half of the third period of sample collections. For Triplicate of sample collection, We found the first sample collection (1st date) had the lowest concentration because there were quite not activities, 2nd date, it was during the peak of graduation ceremony and other activities and in the last sample collection (3rd date) had the highest concentration because it was during graduation ceremony. In summary, areas near roads tend to have higher nitrogen dioxide concentrations compared to other locations. Non-background areas, which are unaffected by traffic, show lower levels, while background areas, despite being farther from traffic, may still have higher concentrations than PL due to increased vehicle activity during certain events.

Introduction

Nitrogen dioxide (NO_2) is a reddish-brown gas that forms from the oxidation of nitric oxide and is present naturally in the environment through sources like volcanic activity, lightning, and bacterial respiration. It's also a byproduct of combustion processes, especially from vehicles and gas stoves. NO_2 plays a crucial role in atmospheric chemistry and ozone formation but can also lead to pollution issues like acid rain and harm to vegetation and crops. Long-term exposure to NO_2 can cause respiratory problems, especially for workers in certain industries or those exposed to high levels.

Methodology

1) NO_2 collection

Prepared NO_2 test tubes (contains blank 3 tubes, sample 5 tubes)

Attach in shelters

Hang for 1 week at target sites

2.) NO_2 extraction

Extraction with DI water and forming color by using Saltz Man reagent.

The reaction of nitrite with Griess assay reagents forms an azo dye

Measured by Spectrophotometer at 540 nm

Results & Discussion

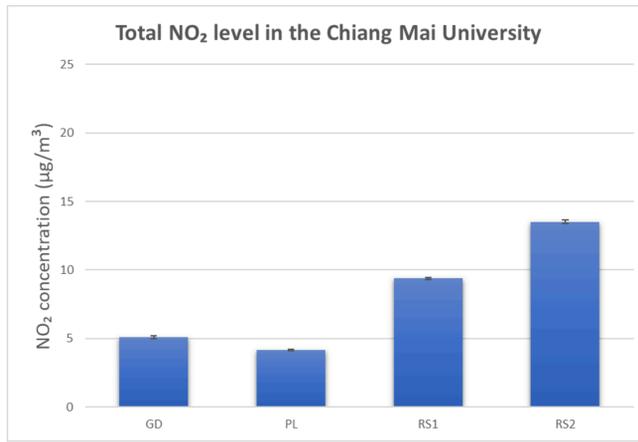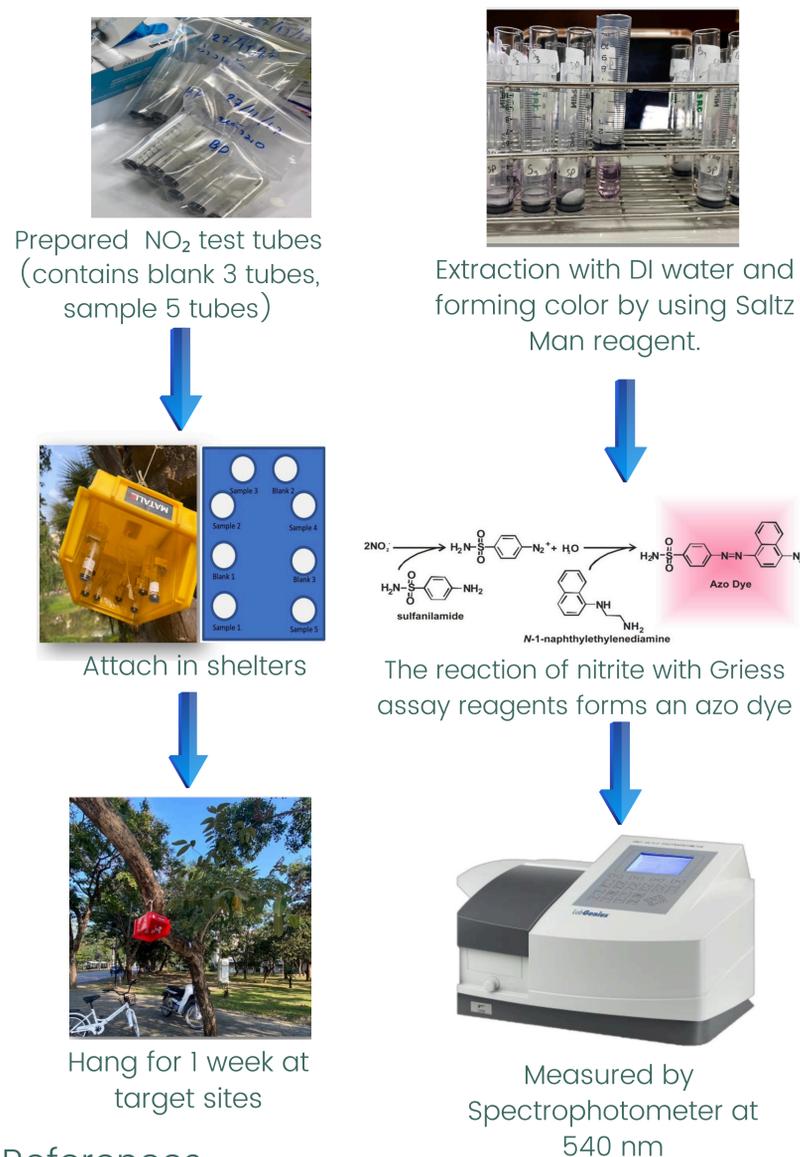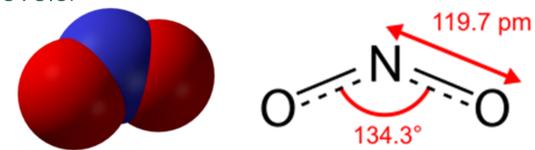Total NO2 level in the Chiang Mai University

Figure 1 compares the total NO_2 levels at each site. The figures were compared at the Garden (GD), Parking Lot (PL), and Road Sides 1 and 2 (RS1 and RS2).

NO2 Kit 19-25/Dec/2024

NO2 Kit 09-15/Jan/2025
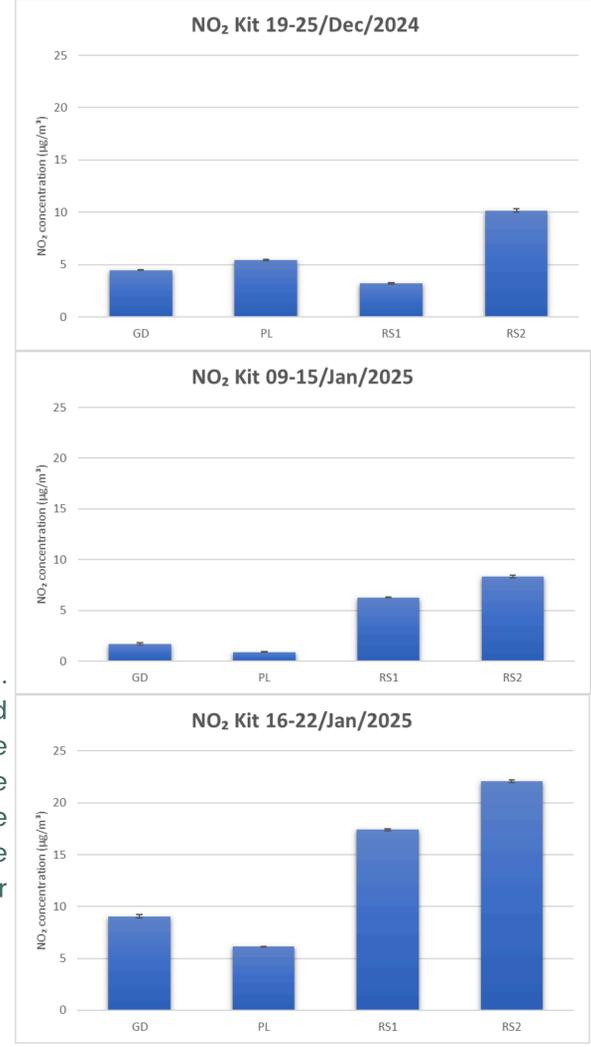

NO2 Kit 16-22/Jan/2025

Figure 2 compared the total concentration for the dates 19–25 December 2024, 9–15 January 2025, and 16–22 January 2025 at Garden (GD), Parking Lot (PL) and Road sides 1,2.

Conclusions

NO_2 concentration is dependent on site collection. High NO_2 concentrations are frequently detected close to emission sources. In conclusion, the distance between the sample collection location and the detected NO_2 emission source determines the change in concentration. According to this study, the primary source of the NO_2 amounts seen near Chiang Mai University is vehicular emissions.

Acknowledgment

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