CHEM 32561

Environmental And Industrial Chemistry

Experiment No 03

Sampling of NOx ($NO + NO_2$) And Particulates

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Experiment Title **:** Sampling of NOx (NO + NO_2) And Particulates

Introduction:

Air pollution occurs when gases, dust particles, fumes or odors are introduced into the atmosphere, which has harmful or poisonous effects. The amount of nitrogen oxides emitted into the atmosphere as air pollution, from both man-made sources, can be quite significant. It's mainly produced by road traffic and energy production.

While NO_2 is a primary pollutant, it is also a contributing component for secondary pollutants formed from a chemical reaction. The most common is ozone. Photochemical smog, most common in sunny, dry locations, is created when NO_2 from gas combustion is exposed to sunlight, splits and releases an oxygen ion (O).

Matirial & chemical

chemicals	Glassware	others
Stock sodium nitrite solution(5.0 µg NO_2^- /mL)	Plastic syrings(60mL)	Cigarette holder
NOx indicator mixture	syrings(5mL)	Filter holder
Distilled water		Four membrane filters

Methods Sampling of cigarette smoke

Filter paper was weight accurately using a analytical balanceband handled it gently avoiding packing holes.Filter paper was placed inside the filter paper holder by holding it by the edge. Then carefully the filter paper holder was closed and taken exactly NOx indicator .Then empty syringe was connected to one end of the closed sealed cigarrete filter holder and a cigarette to the other end.Then smoke (3mL) was collected by pulling the handle.Then collected gas was up to 60mL level.The syringe was carefully disconnected and closed it with the cap and shaken well.

Sampling of automobile exhaust

The gas was collected as it was done with cigarette smoke using the apparatus.there indicator solution(15mL) was used

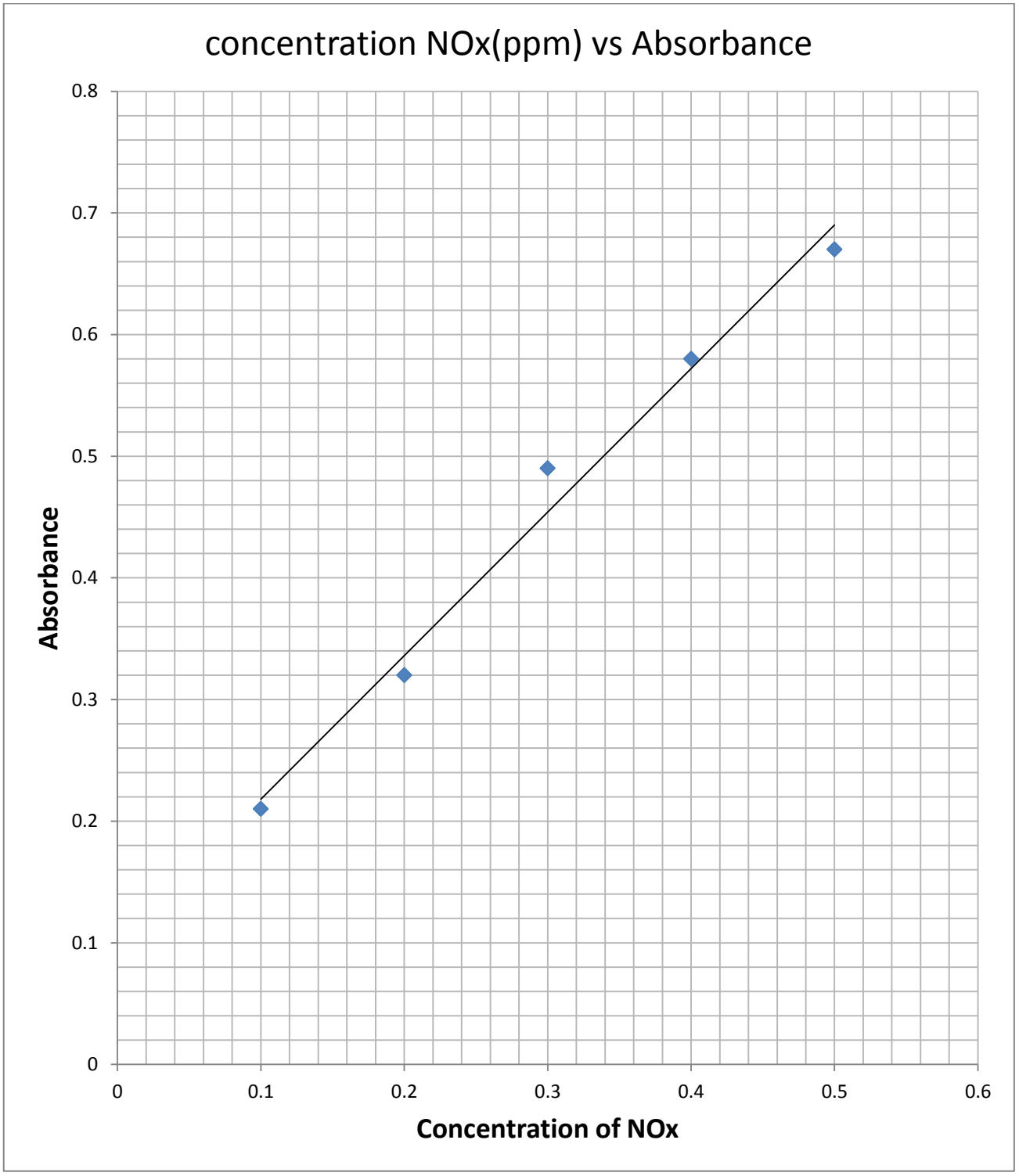
Absorbance measurement

After 30 minutes the absorbance was measured of the sample using the colorimeter.Here the NOx indicator was used as the blank solution and used filter 52as the relevant filter..

Results

Calibration curve (All solution bellow are diluted 1: 1 diluted factor)

Sample concentation	Stock solution(mL)	indicator(mL)	absorbance	Concentration After dilution
0.2	1	9	0.21	0.1
0.4	2	8	0.32	0.2
0.6	3	7	0.49	0.3
0.8	4	6	0.58	0.4
1.0	5	5	0.67	0.5


concentration NOx(ppm) vs Absorbance
Absorbance
Concentration of NOx
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0
0.1
0.2
0.3
0.4
0.5
0.6

Calculations.

For cigerrete smoke

mg/m^{-3} = mg particles / total ml sampled × 1000 ml/L × 1000 L/m3

= [(after – before)] / 35 ml × 1000 × 1000 = (0.0252 g – 0.0237 g) / 35 ml × 1000 × 1000

= 42.857 mg m^{-3}

Cigerrete smoke absorbance = 0.24

Cigerrete smoke Concentration = 0.12 µg / ml

mg NOx / m^3 = µg NOX / L = (µg N02-/ml) (Vi / Vg) (1.39) (1000 ml/L)

= 0.12 µg / ml × 25 ml / 35 ml × 1.39 × 1000 ml/L

= 119.14 mg m^{-3}

ppm NOX = µL NOx / L = [(µg NOx / L)/ 46] [RT/P]

= 119.14 mg m-3 / 46 g mol-1 × 0.082 L atm/K mole × 300 K / 1 atm

= 63.7 ppm

For vehicle smoke without acceleration,

mg/m^{-3} = mg particles / total ml sampled × 1000 ml/L × 1000 L/m3

= [(after – before)] / 35 ml × 1000 × 1000 = (0.0297 g – 0.0138 g) / 35 ml × 1000 × 1000

= 454.28 mg m-3

vehicle smoke absorbance = 0.26

vehicle smoke Concentration = 0.135 µg / ml

mg NOx / m3 = µg NOX / L = (µg N02-/ml) (Vi / Vg) (1.39) (1000 ml/L)

= 0.135 µg / ml × 25 ml / 35 ml × 1.39 × 1000 ml/L

= 134.04 mg m-3

ppm NOX = µL NOx / L = [(µg NOx / L)/ 46] [RT/P]

= 134.01 mg m-3 / 46 g mol-1 × 0.082 L atm/K mole × 300 K / 1 atm

= 71.7 ppm

For vehicle smoke with acceleration,

mg/m^{-3} = mg particles / total ml sampled × 1000 ml/L × 1000 L/m3

= [(after – before)] / 35 ml × 1000 × 1000 = (0.0497 g – 0.0258 g) / 35 ml × 1000 × 1000

= 682.86 mg m-3

vehicle smoke absorbance = 0.38

vehicle smoke Concentration = 0.24 µg / ml

mg NOx / m^3 = µg NOX / L = (µg $N0_2$-/ml) (Vi / Vg) (1.39) (1000 ml/L)

= 0.24 µg / ml × 25 ml / 35 ml × 1.39 × 1000 ml/L

= 238.28 mg m^{-3}

ppm NOX = µL NOx / L = [(µg NOx / L)/ 46] [RT/P]

= 238.28 mg m-3 / 46 g mol-1 × 0.082 L atm/K mole × 300 K / 1 atm

= 127.43 ppm

Discussion.

NOx pollution is emitted by automobiles, trucks and various non-road vehicles e.g., construction equipment, boats, etc .As well as industrial sources such as power plants, industrial boilers, cement kilns, and turbines. NOx often appears as a brownish gas. NOx emissions originate as products of combustion that accompany power generation and the processing of pulping chemicals.

High levels of nitrogen dioxide are also harmful to vegetation damaging foliage, decreasing growth or reducing crop yields. Nitrogen dioxide can fade and discolour furnishings and fabrics, reduce visibility, and react with surfaces .

NOx has direct and indirect effects on human health. It can cause breathing problems, headaches, chronically reduced lung function, eye irritation, loss of appetite and corroded teeth. Indirectly, it can affect humans by damaging the ecosystems they rely on in water and on land—harming animals and plants ..

The cigerrete smoke has NOx 63.7 ppm, the vehicle smoke without acceleration is 71.7 ppm and the vehicle smoke with acceleration is 27.43 ppm. More NOx is removed when the vehicle was accelerated. Vehicle remove NOx in without acceleration is higher than the NOx removed from the cigeratte smoke. Nitrogen oxides are produced from the reaction of nitrogen and oxygen gases in the air during combustion, especially at high temperatures. At normal temperatures, oxygen and nitrogen gases do not react together. Nitrogen oxides are produced naturally from a lightning strike.

In large cities, nitrogen oxides are produced from fuel combustion in mobile and stationary sources. The combustion of gasoline in automobiles emit nitrogen oxides into the atmosphere .In the experiment includes nitrogen oxides that containing in the cigerrete smoke and the vehicle smoke with and without acceleration.

Conclusions.

- The cigerrete smoke NOx m ay be 63.7 ppm
- The vehicle smoke without acceleration may be 71.7 ppm
- The vehicle smoke with acceleration may be 27.43 ppm.

References.

- https://www.aeroqual.com/blog/meet-the-nitrogen-oxide-family (2022.03.29)
- http://www.icopal.co.uk/#:~:text=The%20impact%20of%20nitrogen%20dioxide,to%20disease%20and%20frost%20damage. (2022.03.29