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Monitoring of Ammonia Content in Ambient Air of Industrial Area of Baddi (Himachal Pradesh) and Mohali (Punjab)

Attri PK*, Bhardwaj K, Kumari D and Kumar A

School of Environmental Sciences, DIS, Himachal Pradesh University, Summerhill, Shimla (HP), India

***Corresponding author:** Attri PK

E-mail: dr_pk@rediffmail.com

School of Environmental Sciences, DIS, Himachal Pradesh University, Summerhill, Shimla (HP). India.

Tel: 9418059991

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Abstract

Estimation of Ammonia content focus was made during February 2019 to June 2019 at industrial region Baddi and Mohali. The Ammonia concentration fixation indicated normal occasional varieties. The most noteworthy focuses happened during Feb. Also, March month the occasional patterns appeared to be generally ruled via air temperature. The impact of air temperature on the Ammonia content fixation was the hugest meteorological boundary. The alkali fixation influenced by the breeze speed and course the varieties in Ammonia content focus were emphatically subject to wind speed. At the point when compost urea and different pesticides utilized for crop creation convergence of alkali in the air additionally expanded. Alkali focus in six month to month time span in the industrial territory of Baddi fixation extend is 51.0 µg/m^3 and the base variety shows in the modern territory Mohali for example 16.1 µg/m^3. In Ammonia content, fixation scarcely changed more than a half years' time span and didn't show an unmistakable variety however a few increments were fundamentally seen in February and walk. In future due to spread of agribusiness, appearance of vehicle makes, it augments along these lines the party of smelling salts in air. The most extreme focus seemed to happen during month of February for example (39.31 µg/m^3 in the territory of Mohali) and (45.57 µg/m^3 in the region of Baddi) yet was marginally decreased in consistently. In month of June fixation diminish most extreme (19.34 µg/m^3 in Mohali and 19.51 µg/m^3 in Baddi). Fixation diminished steeply with expanded air temperature. The Ammonia content fixation diminished quickly in May and June, despite the fact that the temperature of May and June practically same. This might be because of littler NH_3 source in May and June. Despite the fact that more elevated levels were seen throughout the winter month of February 2019 (39.31 µg/m^3 Mohali and 45.57 µg/m^3 Baddi) to April 2019 (27.77 µg/m^3 Mohali and 33.80 µg/m^3 Baddi) and the lower level were seen during summer month May 2019 (21.96 µg/m^3 Mohali and 22.47 µg/m^3 Baddi) and June 2019 (19.34 µg/m^3 Mohali and 19.51 µg/m^3 Baddi). Ammonia content is favored nitrogen containing supplements for plant development. Ammonia content can be changed over to nitrite (NO_2) and nitrate (NO_3) by microbes and afterward utilized by plants. The most well-known utilization of smelling salts is the creation of manure. 83% of all alkali is utilized in manures.

Keywords: Ammonia; Ambient air; Industrial area; Mohali; Baddi

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Introduction

Ambient air is also known as atmospheric air not contaminated by air borne pollutants. Ambient air is typically 78% nitrogen, 21% oxygen and the extra 1% is made up of carbon, helium, methane, argon and hydrogen. Whereas Ammonia (NH_3) is a very important alkaline constituent in the atmosphere, plays an important role in atmospheric chemistry and is closely related to ecosystems. NH_3

has both direct and indirect impacts on critical environmental issues, including regional fine particles, acid rain, and eutrophication and acidification of ecosystems [1-7]. Ammonia exists naturally in the ambient air at levels between 1 and 5 parts in a billion parts of air (ppb). More recently, it has been shown that NH_3 plays a primary role in the formation of secondary particulate matter by reacting with the acidic species, e.g. SO_2, NO_x, to form ammonium-containing aerosols, which constitute the major fraction of PM 2.5 aerosols in the atmosphere [8,9]. Particulate ammonium species contribute to the degradation of air quality and visibility, as well as to the atmospheric radiative balance [10-12]. Anthropogenic ammonia emissions originate mainly from agriculture activities including soils, fertilizers and domesticated animals waste [13-15], although industrial and traffic emissions are also important ammonia sources in urban areas [16,17].

In addition, NH_3 is a key species for neutralising H_2SO_4 and HNO_3 in the atmosphere and forming $(NH_4)_2SO_4$, NH_4HSO_4, and NH_4NO_3 [18,19] which are major inorganic components of fine particulate matters. Global ammonia emission has more than doubled since preindustrial times, mainly because of agricultural intensification [20] to sustain such high agricultural productivity, chemical fertilizers have been intensively applied. Due to that global production of fertilizers is approximately 100 million metric tons of N year−1, compared to approximately one million metric tons only 40 years ago [21]. The world average fertilizer uses in 2005 was 96 kg/ha of agricultural land, ranging from 0.2 (Myanmar) to 2,656 kg/ ha in Kuwait (Earth Trends Data 2010). Ammonia (NH_3) plays a critical role in the global biogeochemical cycle of nitrogen as one of the key components of reactive nitrogen. Largely due to the widespread availability of industrially fixed nitrogen, atmospheric emissions of NH_3 are increasing steadily, with devastating effects on air quality, ecosystems and climate. Sources of atmospheric ammonia include animal waste, fertilizers, combustion (biomass burning, waste burning, transport), industry (production of chemicals, manufacturing processes), soils, plants and oceans.

Study areas

Industrial area Baddi (Himachal Pradesh): Baddi is an industrial town and a Nagar Parishad in the southwestern Solan district of Himachal Pradesh, India. It is home to multiple pharmaceutical companies which have established manufacturing plants and R&D hubs in the town. The town is Asia's biggest pharmaceutical hub and is home to some of the largest pharmaceutical companies such as Cipla, Dr, Reddy's laboratories, candela healthcare, Abbott laboratories, Ranbaxy laboratories etc. Baddi houses a total of 2,120 factories belonging to larding Pharma, FMCG and textile companies among other and which generate an annual turnover of Rs 60, 000 crore [22].

Industrial area Mohali (Punjab): Mohali, also known as Ajitgarh and officially known as Sahibzada Ajit Singh Nagar, is a city in the Mohali district in Punjab, India, which is a commercial hub lying south-west of the capital city of Chandigarh. it is developing rapidly as an IT Hub of the state. The city also has many international sporting venues consisting of a magnificent cricket stadium, hockey stadium, indoor stadiums, and golf course. It has Longitude of 30.78°N and Latitude of 76. 69°E. There are many companies in SAS Nagar, like Punjab Tractor Limited (PTL), ICI Paints, Punjab Communications Limited, IT companies, Environmental industries, Biotech industries etc. and many telecom service providers like Tata Communications and Vodafone and the Godrej Group. SAS Nagar's reputation as a home to large, multinational corporations is growing. Global tech giants like Quark and Philips have also followed suit [23-25].

Research Methodology

The study was taken on ammonia in ambient air. Readings and calculations done by practical's and using Indophenols method. It was taken under the supervision of air expertise's at ECO LAB Mohali. Sample was taken from preparing absorbing media. Standard Curve Plot the absorbance as the ordinate (Y axis) versus concentration as the abscissa (X axis). Draw a line of best fit and determine the slope. Here showing the monthly standardization curve by monthly graphs.

Calculation

$C\ [NH_3\ (\mu g/m^3)] = (As - Ab) \times CF \times Vs / VA \times VT$

Where,

$C\text{-}NH_3$= Concentration of Ammonia in $\mu g/m^3$.

As = Absorbance of sample.

A_b=Absorbance of reagent blank.

CF= Calibration factor.

V_A= Volume of air sampled in m^3

V_S = Final volume of the sample in ml

V_T = Volume of the aliquot taken for analysis, ml

Results

Study of ambient ammonia concentration in industrial area of Mohali and Baddi were studied from the month of February 2019 to June 2019. Focus perusing of NH_3 was begun in February 2019 and is accounted for here up to the furthest limit of June 2019. The consequences of the day by day fixation are appeared in **Figure 1.** This shows the enormous variation between days for both the territories. Month to month running methods for the day by day esteems are additionally appeared to watch the occasional patterns all the more plainly, while holding the significant transient structure in the information, while half year running methods are appeared to eliminate the effect of irregularity and picture the momentary patterns all the more obviously.

The outcomes show an unmistakable occasional cycle (February to June) for NH_3 with bigger fixations in winter than summer, as demonstrated **(Figure 1).** This might be incompletely because of agrarian movement and temperature which prompts NH_3 emanations. It was additionally seen by Bouwman AF et al. [26] that Vegetative Agriculture crop is the significant wellspring of ammonia in Denmark. While Asman WAH et al. [27] likewise examined ammonia fixation in environment all-inclusive and referenced that farming harvest is the one of the significant

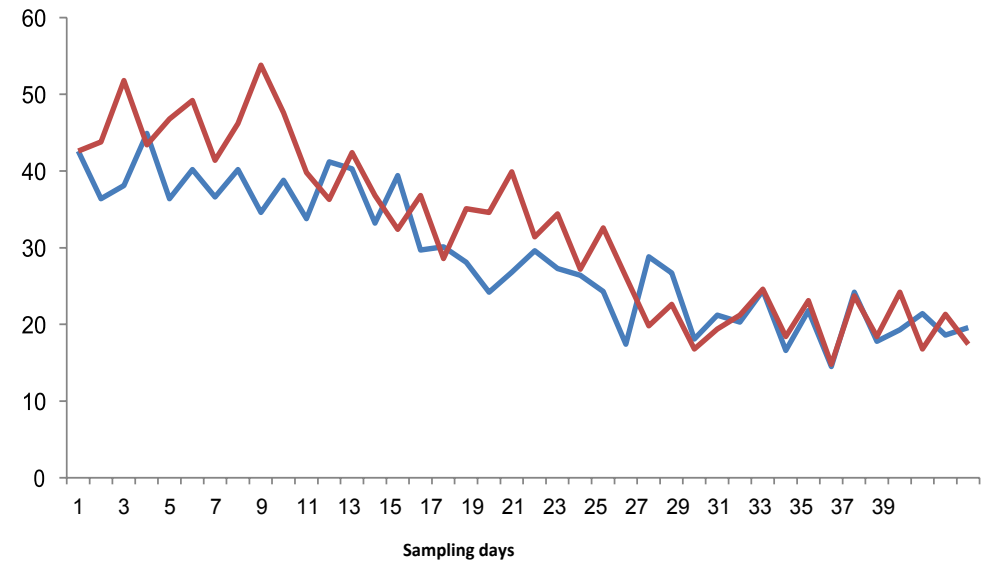

Figure 1 Day wise concentrations of NH_3 µg/m³ in Mohali and Baddi.

wellsprings of alkali. In winters time month of January and February we are utilized excrement, composts and urea for more farming creation which are delivered enormous measure of alkali in the climate. Significant wellsprings of ammonia outflows incorporate volatilization from creature waste and engineered manures, biomass consuming, misfortunes from soils under local vegetation and horticultural yields. Most inward ignition measures additionally produce alkali, despite the fact that the measure of ammonia created is normally little contrasted with different sources referenced previously.

It is also corresponding with other published work which has shown a temperature relationship with NH_3 air concentrations [28]. The results for NH_3 also show a seasonal cycle, with larger monthly and inter-annual variations. The concentrations of NH_3 are largest in the winter, with usually a mid-summer minimum. This may be explained in part by the temperature dependence of the NO_3- and Cl- equilibrium, forming more aerosols in the cooler winter time conditions. A further factor affecting NH_3 and concentrations may be increased emissions of SO_2 and concentrations of SO_2 and in winters, providing increased reaction of NH_3 to form ammonium sulphates. Both these effect are supported by other monitoring of aerosol and SO_2 concentrations made at this site [29,30]. Ammonia is the most gaseous base in the atmosphere. It fundamentally determines the overall acidity of cloud, precipitation and atmospheric aerosols [31]. An important role of ammonia in the atmosphere is neutralizing acidic compounds such as nitric and sulphuric acids to form ammonium nitrate and sulphate, which contribute significantly to fine particle mass [32]. In addition to its role as an important nutrient for plant growth, the deposition of atmospheric ammonia also results in the eutrophication of ecosystems and soil acidification by nitrification [33,34]. Ambient gaseous ammonia is emitted by a large number of sources.

Table 1 Monthly average concentration of ammonia in µg/m³.

Monthly average concentration of ammonia (µg/m³)		
Month	**Mohali**	**Baddi**
February	39.31	45.57
March	37.68	41.91
April	27.77	33.80
May	21.96	22.47
June	19.34	19.51

The ammonia concentration in the industrial zone of Baddi was commonly higher than that of the modern zone Mohali **(Table 1).** The commitments from modern and traffic source may likewise be there yet can't be additionally settled from our information. The high recurrence NH_3 spike watched normally during busy time periods were doubtlessly delivered by vehicles entering and leaving the parking garage on the administration street, close to testing site. This perception proposes that few out of every odd vehicle under on street driving condition transmit vaporous NH_3 into surrounding air. Notwithstanding, the past investigation performed by Huai T et al. [35] indicated that to certain degree, each of the 8 tried vehicles discharged NH_3. The surrounding alkali focus is utilized for relapse investigation contains commitment from traffic exhaust as well as other source, for example, warming framework. Other significant wellspring of NH_3 discharge is creature squander, alkali-based manures just as modern waste and soil emanations are emphatically reliant on surrounding temperature, regularly low during summer. It is very extraordinary at that area under midyear conditions.

The most extreme fixation seemed to happen during month of February for example (39.31 µg/m³ in the region of Mohali) and (45.57 µg/m³ in the zone of Baddi) however was marginally diminished in consistently **(Figure 2).** In month of June focus diminish most extreme (19.34 µg/m³ in Mohali and 19.51 µg/m³ in Baddi). Focus diminished steeply with expanded air temperature.

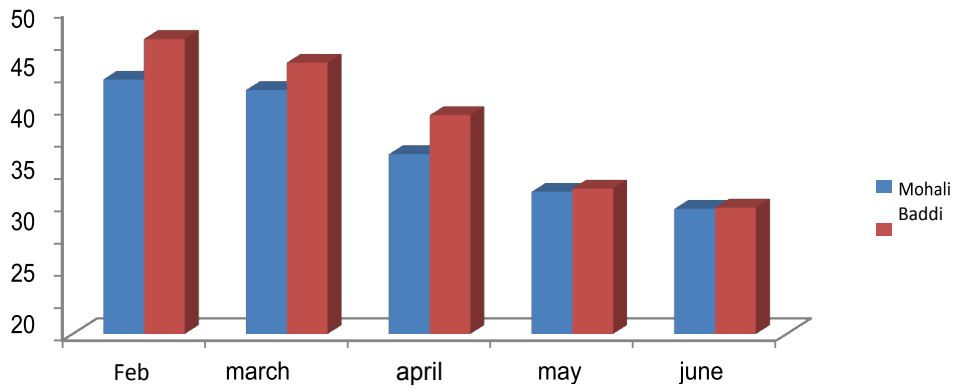

Figure 2 Concentrations of NH3 in µg/m3 in Mohali and Baddi.

The ammonia concentration fixation diminished quickly in May and June, despite the fact that the temperature of May and June practically same. This might be because of littler NH_3 source in May and June. despite the fact that more significant levels were seen throughout the winter month of February 2019 (39.31 µg/m^3 Mohali and 45.57 µg/m^3 Baddi) to April 2019 (27.77 µg/m^3 Mohali and 33.80 µg/m^3 Baddi) and the lower level were seen during summer month May 2019 (21.96 µg/m^3 Mohali and 22.47 µg/m^3 Baddi) and June 2019 (19.34 µg/m^3 Mohali and 19.51 µg/m^3 Baddi)

The month to month mean grouping of NH_3 alongside air temperature for a half year time frames are marginally unique in consistently **(Table 2).** The NH_3 focus demonstrated standard varieties with the higher fixation in Baddi and lower fixation in Mohali. The month to month implies NH_3 fixation expanded pointedly in the modern region of Baddi in the long stretch of April with expanding air temperature. At some point focus expanded in the region of Mohali. This is because of high modern emanation of alkali and ammonium particulate. Varieties appeared to be generally influenced via air temperature. On other hand, month to month mean grouping of alkali for the half year was in the scope of 16.3 to 51.0 µg/m^3. This is because of the impact of contrasting meteorological conditions.

Discussion

The NH_3 concentration increased sharply with increasing temperature and decreased rapidly with decreasing air temperature. A good correlation between NH_3 concentration and air temperature was obtained by linear regression analysis [36]. The results showed that the NH_3 concentration was highly variable due to temperature change in natural process/source, although a simple correlation between air temperature and relative humidity was not obtained, under lower temperature (5°C to 20°C); a linear correlation was obtained between NH_3 concentration and relative humidity. Atmospheric concentrations Of NH_3 are strongly dependent on wind direction and velocity. The frequencies of wind direction and wind velocity on the sampling day were summarized using the monthly weather report. The analysis of conc. relative to wind direction can be

Table 2 Weekly average concentration of NH_3 (µg/m^3) in studied areas.

Weekly average concentration of NH_3 (µg/m^3)										
Weeks	Mohali					Baddi				
	Feb	Mar	Apr	May	June	Feb	Mar	Apr	May	June
1st	39.5	34.1	29.2	20.8	19.3	43.2	51.0	32.7	29.4	19.2
2nd	41.5	37.4	26.1	27.7	18.5	47.6	43.7	34.8	21.2	21.3
3rd	38.3	40.7	28.2	19.86	20	48.1	39.3	35.6	19.13	19
4th	36.6	36.3	26.8	20.93	19.6	41.4	34.6	30.8	22.01	17.4

used to estimate regional apportionment. The seasonal, means frequency (%) of wind arising for each direction on sampling days. Wind blows mostly from north in winters and autumn, but it blows from south in summers. The effect of wind direction change on the ammonia concentration was not clearly observed. Sampling was made a site, 10 to 15 m above from the ground level at any industrial site which is located in Baddi and Mohali. Measurement of NH_3 was made in the day in the day time, 4/5 times a month between February 2019 to June 2019. As a short-term study, simultaneous measurement of ammonia was made 5 times a month. The concentration of ammonia was more in Baddi than Mohali in the month of February because of high industrial emission and low temperature in that area. Due to high industrial emission the area temperature slightly rises.

The NH_3 focus expanded pointedly with expanding temperature and diminished quickly with diminishing air temperature. A decent relationship between NH_3 fixation and air temperature was acquired by straight relapse examination [36]. The outcomes demonstrated that the NH_3 focus was profoundly factor because of temperature change in characteristic cycle/source, albeit a basic connection between's air temperature and relative mugginess was not gotten, under lower temperature (5°C to 20°C); a direct relationship was acquired between NH_3 fixation and relative dampness. Climatic centralizations Of NH_3 are unequivocally reliant on wind bearing and speed. The frequencies of wind heading and wind speed on the inspecting day were summed up utilizing the month to month climate forecast. The

examination of conc. Comparative with wind course can be utilized to gauge local division. The occasional, implies recurrence (%) of wind emerging for every heading on testing days. Wind blows generally from north in winters and pre-winter; however, it blows from south in summers. The impact of wind course change on the alkali fixation was not unmistakably watched. Inspecting was made a site, 10 to 15 m above from the beginning at any modern site which is situated in Baddi and Mohali. Estimation of NH_3 was made in the day in the day time, 4/5 times each month between February 2019 to June 2019. As a transient report, synchronous estimation of alkali was made 5 times each month. The centralization of alkali was more in Baddi than Mohali in the long stretch of February in view of high modern discharge and low temperature here. Because of high mechanical outflow the territory temperature marginally rises.

The most extreme fixation seemed to happen during third week in the Industrial territory Baddi for example (48.1 µg/m^3) and the base focus extend was 41.4 µg/m^3. In the event of industrial region Mohali, the greatest grouping of ammonia concentration is 41.5 µg/m^3 in the second seven day stretch of month February and the base range is 36.6 µg/m^3 show up in the fourth seven day stretch of this current month. Estimation of ammonia concentration focus was made during February 2019 to June 2019 at modern territory Baddi and Mohali. The all-out information was dissected to research fleeting varieties, meteorological impacts and unique attributes. The ammonia concentration fixation indicated ordinary occasional varieties. The most noteworthy focuses happened during Feb. Furthermore, March month the occasional patterns appeared to be generally commanded via air temperature. The impact of air temperature on the ammonia concentration focus was the hugest meteorological boundary. The alkali fixation influenced by the breeze speed and heading the varieties in ammonia concentration focus were unequivocally subject to wind speed. At the point when manure urea and different pesticides utilized for crop creation centralization of ammonia concentration in the environment likewise expanded. Ammonia concentration assume significant job in the environment is killing acidic compound, for example, nitric and sulphuric corrosive to frame ammonium nitrate and sulfate, which contribute fundamentally to fine molecule mass.

Air alkali shows exceptionally clear varieties in both the industrial zones. Grouping of Ammonia concentration in air is high because of farming harvests, modern emanation. Alkali fixation in six months to month timeframe in the industrial territory of Baddi focus extends is 51.0 µg/m^3 and the base variety shows in the modern zone Mohali for example 16.1 µg/m^3. In alkali fixation scarcely changed more than a half year's timeframe and didn't show a reasonable variety however a few increments were altogether seen in February and walk. In future on account of spread of agribusiness, appearance of vehicle makes, it expands in this manner the social gathering of Ammonia concentration in air.

Conclusion

The most extreme focus seemed to happen during month of February for example (39.31 µg/m^3 in the territory of Mohali) and (45.57 µg/m^3 in the region of Baddi) however was somewhat diminished inconsistently. In the month of June fixation decrease most extreme (19.34 µg/m^3 in Mohali and 19.51 µg/m^3 in Baddi). Fixation diminished steeply with expanded air temperature. The alkali focus diminished quickly in May and June, despite the fact that the temperature of May and June practically same. This might be because of little NH_3 source in May and June; despite the fact that more significant levels were seen throughout the winter month of February 2019 (39.31 µg/m^3 Mohali and 45.57 µg/m^3 Baddi) to April 2019 (27.77 µg/m^3 Mohali and 33.80 µg/m^3 Baddi) and the lower level were seen during summer month May 2019 (21.96 µg/m^3 Mohali and 22.47 µg/m^3 Baddi) and June 2019 (19.34 µg/m^3 Mohali and 19.51 µg/m^3 Baddi). Ammonia concentration is favored nitrogen containing supplements for plant development. Alkali can be changed over to nitrite (NO_2) and nitrate (NO_3) by microscopic organisms and afterwards utilized by plants. The most widely recognized utilization of Ammonia concentration is the creation of compost. 83% of all ammonia concentration is utilized in manures.

Conflict of Interest

Authors declare no conflict of interest.

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