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RESEARCH ARTICLE

DECREASING OF NITROGEN OXIDES VERSES INCREASING OF AMMONIA IN AMBIENT AIR DUE TO SNCR SYSTEM INSTALLED AT HEIDELBERGCEMENT INDIA LIMITED, NARSINGARH, DAMOH

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ABSTRACT

Strictness of the Ministry of Environment, Forest & Climate Change (MoEFCC) against the non-compliance of the Emission norms Notified by MoEFCC in 2016 for Cement Industries was the major challenge for Cement Industries to achieve the emission norms. Nitrogen Oxides (NOx) emission reduction was the major challenge for Cement Industry therefore, some of the Cement Industries have installed global approved NOx reduction technology called as Selective Non Catalytic Reduction (SNCR). After installation of SNCR system in Cement Industries NOx emission through process stacks get reduced but the Ammonia (NH_3) gas has increased in process stacks because NH_3 gas is injecting in Pre-calciner of the cement Kiln at Temperature range between 870 to 1090^o Celcies and converting it into Nitrogen gas ((Production of Ammonium Nitrate, 2000) but some quantity of Ammonia approx 2 to 10 ppm (State and Territorial Air Pollution, 1994) get released from process stacks. Apart from this, some quantity of Ammonia gas also releasing during loading and unloading of Ammonia through tankers.

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INTRODUCTION

MoEFCC has notified NOx emission limits based on type of technologies installed for cement Manufacturing as 600/800/1000 mg/Nm^3 (MOEFCC Notification, 2016). Some of the Cement Industries have installed secondary NOx control equipment like Selective Non-Catalytic Reduction (SNCR) to achieve new emission norms. But in SNCR system ammonia is using for NOx emission reduction. In ambient air Ammonia releasing by spillage during loading & unloading and non-reacted Ammonia gas through Kiln stacks. On one hand, NOx is decreasing in Air on other hand Ammonia is increasing in Ambient Air.

Review of Literature: In atmospheric air, a whole spectrum of nitric oxides known as NOx is present. In which the two most often found in the highest concentrations are nitrogen monoxide and nitrogen dioxide (Krzeszowiak Jakub et al., 2016).

NOx reacts with water and other compounds to form various acidic compounds (Kukada Shreyash, 2018). When this acidic compound come in water body the acidification and chemical changes resulting difficulties in survival of fish and other aquatic species and acid rain can also harm forest Ecosystem by direct damaging plant tissues (Mishra Shraddha et al 2014). Acid rain is a complicated atmospheric process that has many direct & indirect public health impacts (Acid deposition, 2008). Ammonia is the main component for aerosol formation in the atmosphere causing a lots of air pollutions in Asia and adversely affect human health by infecting in cardiovascular systems, respiratory system and causing reduction in visibility and regional haze (Pinder et al., 2007 & Seinfeld et al., 1998). NH_3 induced other secondary inorganic aerosol during haze days in China (Fu et al., 2015). When ammonia increased in Atmosphere then excess ammonium (NH_4+) returned in Terrestrial & aquatic ecosystems and deposit in it and resulted in the distress of the global Nitogen and carbon cycles (Lü & Tian, 2007).

MATERIALS AND METHODOLOGY

Monitoring Location: HeidelbergCement India Limited (HCIL) situated at village of Narsingarh of district Damoh in state of Madhya Pradesh was selected for monitoring of Nitrogen Oxides (NOx) and Ammonia (NH_3) gas concentration in ambient air.

Fig. 1. HCIL, Narsingarh Plant on India Map with Plant Snap

We have selected three Ambient air sampling points each in Four direction of plant by taking Reference point as Line-I (Pre-heater) of HCIL, Narsingarh, first within 1 Km, second within 1 to 3 Km and third within 3 to 5 Km distance and Set a Controlled area at approx 10 Km far from Plant in upwind direction (West). Then the Total numbers of sampling points have become 13 numbers. I have coded these locations names as EE for East direction including EE-1 (1 Km), EE-2 (1 to 3 Km) and EE-3 (3 to 5 Km) EW for West direction including EW-1 (1 Km), EW-2 (1 to 3 Km) and EW-3 (3 to 5 Km), EN for North direction including EN-1 (1 Km), EN-2 (1 to 3 Km) and EN-3 (3 to 5 Km) and ES for South direction including ES-1 (1 Km), ES-2 (1 to 3 Km) and ES-3 (3 to 5 Km).

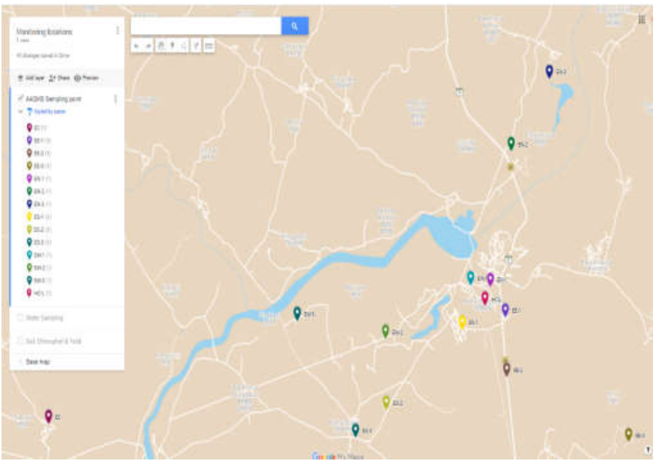

Fig. 2. Ambient Air Quality Monitoring Location near HCIL, Narsingarh

Ammonia sampling & analysis: We have followed CPCB-NAAQS Guidelines,2013 Manual Volume – 1 for sampling in which Fine Dust Sampler (FDS) with gaseous attachment is used to absorb Nitrogen Oxides (NOx) Ammonia (NH_3) in absorbing solutions in Impingers. We have done sample analysis by Modified Jacob and Hochheiser method (Na-Arsanite) for NOx and Indophenol Method (APHA-401) for Ammonia analysis.

RESULT AND DISCUSSION

NOx & NH_3 gas was monitored and analysed for all 12 locations during Winter, Summer and Rainy season of Year 2019-20 and Year 2020-21 in which year cycle was August to July.

The average mean of NOx in 2019-21 was 12.1 µg/M^3 which become 11.9 µg/M^3 in 2020-21 on other hand average mean of NH_3 in 2019-21 was 11.7 µg/M^3 which become 12.8 µg/M^3 in 2020-21. In percentage NOx reduction was 1.45% in ambient air but the NH_3 increased in ambient air was 9.26%.

Table 5.1. Ambient air quality monitoring data of Continues Ambient Air Quality Monitoring Station (CAAQMS) connected with CPCB for Year 2020

City Name	CAAQMS- Station Location	NO_2 (µg/M^3)	NH_3 (µg/M^3)
Jabalpur	Marhatal, Jabalpur - MPPCB	26.0	12.4
Bhopal	T T Nagar, Bhopal - MPPCB	17.1	15.5

(Source: CPCB, Central Control Room for Air Quality Management - All India for Year 2020)

In compare with the online data of the CPCB for nearest cities of Damoh it was find that NOx data of the HCIL, Narsingarh is lesser and for ammonia in Jabalpur it was lesser but in Bhopal it was higher.

Conclusion

As per the data analysis, it was find that there was reduction of NOx in ambient air was 1.45% on other hand Ammonia concentration was increased 9.26%. As per Ambient Air Quality Standard, 2009 the Ambient Air Quality Standard for NO_2 is 80 µg/M^3 for 24 Hr and 40 µg/M^3 for annual and standard for Ammonia is 400 µg/M^3 for 24 Hr and 100 µg/M^3 for annual. In compare with the National Ambient Air Quality Standards the NOx and NH_3 level in this area is within emission norms. In compare with other nearby cities area ambient NOx was lesser in HCIL, Narsingarh Plant.

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