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AIR POLLUTANTS AND THEIR ENVIRONMENTAL IMPACT: A REVIEW

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Abstract: *This paper focuses on air pollutants status in the ambient air also includes main criteria pollutants(SO_2,NO_x,PM_{10},$PM_{2.5}$,CO,O_3,NH_3,Pb,Ni,As,benzene and benzo-pyrene prescribed by central pollution control board (CPCB, 2009) their impact on environment.*

Key words: *Air pollutants, CPCB, Environment.*

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INTRODUCTION

Air pollution is one of the most critical environmental problems in developing countries. It is the outcome of economic development, rapid industrialization and the demand for energy. Apart from rapid industrialization, urbanization has resulted in the emergence of industrial centres without a corresponding growth in civic amenities and pollution control mechanisms. Increased awareness of health problems related to air pollution arising from urbanisation and industrialization has, especially during the last two centuries, gradually created a demand for more efficient emission controls, especially in the developed world, and thus there has been a notable decrease in both the emissions and ambient concentrations of many air pollutants. Air borne dust and several inorganic and organic minerals associated it with are responsible for severe impairments of human health and large scale damage to nature and buildings. The most conclusive evidence has been provided by cohort and time series studies that have linked elevated concentrations of PM to increased morbidity and mortality (Dockery et al. 1993, Pope et al. 1995, Samet et al. 2000)

AIR POLLUTANTS

The air pollutants can be classified as primary or secondary pollutants. The primary air pollutants are harmful chemicals which directly enter the air due to natural events of human activities**.** A secondary air pollutant is a harmful chemical produced in the air due to chemical reaction between two or more components. That is primary pollutant combines with some component of the atmosphere to produce a secondary pollutant (Naik S., 2005).

According to central pollution control board (CPCB, 2009) has notified 12 pollutants as criteria pollutant in ambient air. These are oxides of sulphur and nitrogen, carbon mono oxide, ozone,PM_{10} (≥10µm in diameter),$PM_{2.5}$ (≤2.5 µm of aerodynamic diameter), NH_3, Pb,Ni,As, benzene and benzo-pyrene. These are described as follows-

1. **Sulphur dioxide:** It is a colourless gas with a pungent and suffocating odour. The gas is produced by the combustion of fossil fuels (Naik S.,2005). Sources include industrial activities such as flaring at oil and gas facilities and diesel power generation, commercial and home heating and vehicle emissions. The amount of SO_2

emitted is directly related to the sulphur content of the fuel (Air Quality Monitoring Network, 2009).

2. **Nitrogen oxides (NOx):** NOx represents the sum of the various nitrogen gases found in the air, of which Nitric Oxide (NO) and Nitrogen Dioxide (NO_2) are the dominant forms. Theemission sources are varied but tend to result from high temperature combustion of fuel forindustrial activities, commercial and residential heating, and vehicle use. Forest fires can be alarge natural source of NOx (Air Quality Monitoring Network, 2009).
3. **PM_{10} and $PM_{2.5}$:** Particulate matter is a ubiquitous pollutant, reflecting the fact that it has both natural and anthropogenic sources. Natural sources of primary PM include windblown soil and mineral particles, volcanic dust, sea salt spray, biological material such as pollen, spores and bacteria and debris from forest fires (National Ambient Air Quality Objectives for Particulate matter, 1998).PM_{10} refers to particulate matter that is 10 µm or less in diameter. PM_{10} is generally sub divided into a fine fraction of particles 2.5 µm or less ($PM_{2.5}$), and a coarse fraction of particles larger than 2.5 µm (National Ambient Air Quality Objectives For Particulate matter, 1998).
4. **Carbon-mono-oxide (CO)**: Anthropogenic emissions of CO originate primarily from incomplete combustion of carbonaceous materials. The largest carbon monoxide emissions are produced as exhaust of internal combustion engines, especially of vehicles with petrol engines.CO is prevented blood capacity in oxygen transfer to body tissues such as heart and brain. The reactivity of CO with hemoglobin is 240 folds greater than oxygen (Harrop, 2002 and WHO, 1999). In the presence of CO, oxygen falls to combine with hemoglobin. Effects of COHb in blood are associated to long half-life, which is nearly 5 hours (Guest, 1995).
5. **Polycyclic aromatic Hydrocarbons(PAHs):** Polycyclic aromatic hydrocarbons (PAHs) represent a group of organic compounds consisting of two or more condensed aromatic rings that are widely geographically distributed and remain in the environment for a long time (Howsam, Jones, & Ineson, 2000). Coke oven, aluminium production, iron and steel foundries, coal gasification and coke production are the main industrial sources of PAHs and are released from emission

sources accompanying incomplete combustion, which include automobile exhaust gases, various combustion facilities, household heating, and so forth. PAHs are emitted into the atmosphere as particles or gases (Nikolaou *et al*., 1984; Behymer and Hites, 1985; Daisey *et al*., 1986; Sanders *et al*., 1993; O'Malley *et al*., 1994; Matsuzawa, 2000). Many PAHs are suspected carcinogens (Lee *et al*., 1981) or endocrine disruptors (Matsuzawa, 2000).. PAHs are listed by the Unites States Environmental Protection Agency and the European Commission as priority pollutants.The best known model compound from this group is highly carcinogenic benzo[a]pyrene (BaP), are carcinogenic and mutagenic (Du Four, Janssen, Brits, & Van Larebeke, 2005), and they are widely believed to make a substantial contribution to the overall burden of cancer in humans (Phillips, 1999). Due to these properties they are considered to be top of the list of the most hazardous substances. Harmful effects of PAHs on living organisms have been observed for years. DlP has been in the spotlight of scientific interest recently because toxicological investigations indicated that dibenzo[a,l]pyrene probably has a much stronger carcinogenic potential than benzo[a]pyrene (Higginbotham, Ramakrishna, Johansson, Rogan, & Cavalieri, 1993). DlP is detectable in environmental samples and has been characterized as the most potent carcinogenic species among all PAHs as yet tested in rodent bioassays (Schober et al., 2006).

6. **Ozone (O_3):** Ozone is a secondary pollutants ,which is not emitted directly into the air, but is created by a chemical reaction between oxides of nitrogen (NOx) and volatile organic compounds (VOC) in the presence of sunlight. Motor vehicle exhaust and industrial emissions, gasoline vapours and chemical solvents are some of the major sources of NOx and VOC, also known as ozone precursors. Strong sunlight and hot weather cause ground level ozone to form harmful concentrations in the air.
7. **Ammonia (NH_3)** Ammonia is a colourless, pungent, hazardous caustic gas composed of nitrogen and hydrogen. Ammonia emissions are also grouped as NHy which is a sum of NH3 and NH4. Ammonia is found in small quantities in the atmosphere, and is produced from the putrefaction of nitrogenous animal and vegetable matter. It is an important source of nitrogen which is needed by plants and animals. Exposure to high levels of ammonia in air may be irritating to skin, eyes, throat, and lungs and

cause coughing and burns. Lung damage and death may occur after exposure to very high concentrations of ammonia (CPCB, 2009www.cpcp.nic.in).

8. **Heavy metals (Pb, Ni and As)**:Heavy metals are naturally present in soils (Ojanuga,*et al.,*1996) but anthropogenic activities have resulted in high concentrations in the environment (He, *et al*., 2004). Industrial facilities, waste incinerating plants, and fossil fuel burning are considered the main sources of anthropogenic heavy metal emissions. Air in industrial and metropolitan areas is more heavily contaminated with heavy metals than air in rural areas (*1*). Metals such as As, Cd, Co, Ni, Pb, Sb, V, Zn, and the platinum group elements (PGEs) Pt, Pd, and Rh can be characterized as being road-specific heavy metals. The urban population is exposed to the airborne toxic metals that often are well above natural background levels (Hadad et al., 2003; Salam et al., 2003; Samura et al., 2003; Zereini et al., 2005; Shridhar et al.,2010). The European Union has set an air quality standard for Pb, setting an annual limit value of 0.5 µg/m^3, to be achieved by 2005. Also, the directive 2004/107/EC proposed as mean annual concentrations for Cd and Ni to be 5 ng/m3 and 20 ng/m3, respectively. It is well documented that the use of Pb-containing, anti-knocking gasoline additives had been playing a dominant role in the build up of atmospheric Pb levels (Dixit *et al.,* 2008). Since the lead content in fuels has been regulated during the past years, smelter processes, fuel burning activities and other industrial sources contribute in the ambient lead production (EC, 1997).Nickel is one of the metals used in the electroplating industry. Continuous and prolonged exposure to nickel can produce dermatitis and disorders in the respiratory system (Razos, P., 2010). Ni-bearing particles occur in the atmosphere as part of suspended particulate matter and, rarely, of mist aerosols. Ni is commonly associated with the fine particulate matter fraction of ambient air samples with diameters ranging from 0.6 to 10 µm.

ENVIRONMENTAL IMPACT OF AIR POLLUTANTS

There is good evidence that the health of 900 million people over the world is deteriorating daily because of high levels of ambient air pollutants(Ghose,2007) The toxicology of air pollution is exceedingly complex as there are different types of pollutants affecting individual differently(Yassi,2001). In urban area, genera ration of particulate and gaseous pollutants have several health impacts. Dieselization of vehicles is accelerating due to

relatively low prices of diesel, this is promoting its use further. Use of is diesel based vehicles worsen the air quality in coal mining area, bringing in its wake a number of related health problems. The new scientific information emerging from international studies indicates that the cancer-causing potential of diesel exhaust is very high. It has been reported that high levels of pollution affect mental and emotional health too. Exposure to heavy metals causes a range of human disorders and ecological damage. Recently epidemiological studies have pointed out that airborne particulates containing toxic components, such as heavy metals, are of special concern due to numerous health effects (Andersen et al., 2006; Sarnat et al., 2006; Liu et al., 2009; Mavroidis and Chaloulakou, 2010). Long-time exposure to toxic these (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) even at low concentrations can be deleterious to human health (Akoto *et al.,* 2008). Amongst the symptoms, feeling of Fatigue, exhaustion, low mood, nervousness, irritation of eyes and stomach aches have shown a significant association with air quality. Inhalation of fumes is associated with recurrent colds, chronic bronchitis and hyperactive airways (Smith, 1990).Environmentalists claim that living in an Indian heavily polluted is like smoking 10-20 cigarettes every day. More than40, 000 people die pre-maturely every year because of air pollution, says a World Bank report (David, 1994). The estimates of disease burden due to air pollution are based on the impact of air pollution on mortality. The impact of air pollution on morbidity could not be included in the calculations due to lack of reliable epidemiological data.

CONCLUSION

It can be concluded that air pollutants are coming out of anthropogenic activities; urbanization and industrialization have led to this process very rapid. There are 12 main air pollutants which should be taken into account seriously. They should be monitored at a regular interval and governmental organization has to keep t maintain these pollutants under permissible limit. So that impact on environment can be reduced or under control.

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