Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

Shefali Kesarwani
Department of Environmental Science and NRM, SHUATS, Allahabad, Uttar Pradesh, India

Abhishek James
Department of Environmental Science and NRM, SHUATS, Allahabad, Uttar Pradesh, India

Effect of air pollution on human health problems residents living around the cement plant, Chandrapur, Maharashtra, India

Shefali Kesarwani and Abhishek James

Abstract
Cement industry is the backbone of India's economy and one of the leaders in detrioating the environment and health of the human. The emmisions from cement plant like particulate matter (respirable and nonrespirable) and gaseous pollutant (SOx, NOx,CO₂). Cement dust not only deterioate the quality of air but also human health, animal health and vegetation. The effect of cement dust mostly seen between 2-4 km radius. Data for human health was collected through questionnaire. About 35 people from each site have been surveyed for prevalence of air pollution oriented diseases among the people. Results indicated higher incidence of respiratory diseases among the affected people followed by eye irritation and other diseases among the affected people residing around the cement plant. The effect on human health is due to long period exposure of air generated in the study area.

Keywords: air pollution, human health problems, cement plant

1. Introduction

Cement industry is responsible for contributing a variety of pollutants to atmosphere such as Particulate matter (PM2.5 & PM10), Sulfur oxide (SO_2), Nitrogen oxide (NO_2) (Worrell *et al.*, 2001; Quiros and Webb, 2005) [29, 17]. PM_{10} is particulate matter with an aerodynamic diameter up to 10µm, i.e., fine and coarse fraction combined. The diameter of dust particles of PM_{10} is larger than PM $_{2.5}$ i.e. fine dust particles. Globally cement industry contributes almost 5% of total carbon dioxide to atmosphere, which enhanced global warming (Qudais, 2011; Lei *et al.*, 2011) [16, 8].

210 large cement plants account for a cumulative installed capacity of over 350 million tonnes, while over 350 mini cement plants have an estimated production capacity of nearly 11.10 million tonnes, as of 2016. Every industry has both positive and negative impact on environment and living beings associated with it positive, in terms of socio-economic development and negative in terms of associated harmful emissions (Ggeorghe and Ion, 2011; Srivastava and Singh, 2012; Yousefi, 2013) [6, 23, 30].

WHO estimates that worldwide, at least two million people every year die prematurely due to health effects caused by lack of clean air around them. Air is the basic element necessary for human life but the quality of air is deteriorating day by day and it is being constantly polluted from different sources of pollution. One of the major sources of air pollution is industries and automobiles, as per estimation 20- 30% of air are contaminated by different industries in India (Sivasamy and Srinivasan, 1997) [22].

Different activities in industries deterioate various environmental components like air, soil, water and vegetation (Dolgner *et al.*, 1983; Sai *et al.*, 1987; Mishra, 1991; Murugesan *et al.*, 2004; Kumar *et al.*, 2008) [5, 19, 12, 13, 2]. According to Central Pollution Control Board of India cement industry is one of the 17 most polluting industry. Cement dust contains heavy metals like chromium, nickel, cobalt, lead and mercury which is hazardous to the environment with impact on living beings. (Baby *et al.*, 2008) [2].

Exposure to cement dust can cause serious health problems through contact with skin, eyes, or breathing passages and might result in hospitalization (Anderson *et al.*, 2003; Ballester *et al.*, 2001) [1, 3].

The emissions from cement industry degrade the air quality in areas within 3-4 km radius periphery of the factory. Such emissions can contribute to a wide range of health effects, especially respiratory diseases, brain damage, lung cancer, heart diseases, skin irritations, fatigue, headache, and nausea (*World Development Indicators,* 2004) [28]. Failing eyesight due fumes is also common in the different working processes of cement area of the factory.

Correspondence
Shefali Kesarwani
Department of Environmental Science and NRM, SHUATS, Allahabad, Uttar Pradesh, India

According to the World Health Organization (WHO), long-term exposure to the above emissions can result in many diseases in human beings.

Several studies result showed that these emissions from cement industrtry are adversely affecting human health in many ways, like itchy eyes, respiratory diseases like tuberculosis, chest discomfort, chronic bronchitis, asthma attacks, cardio-vascular diseases and even premature death. (Pollution Prevention and Abatement Handbook 1998, Mehraj, Bhat and Balkhi; 2013) [11].

Materials and Methods
Chandrapur district is located in the eastern edge of Maharashtra in Nagpur division. It is located between 19.30'N and 20.45'N latitude and 78.46'E longitude. The district is known for its Super Thermal Power Plant, one of the biggest in Asia, and its vast reserves of coal in Wardha Valley Coalfied and Large reservoirs of limestone supply many cement factories also known as a geological museum because a multitude of rocks and fossils found here. Chandrapur is known for its hot and dry climate Humidity is very low in this region. Temperature starts decreasing in october with December being the coldest month, with a minimum average temperature of 9 ºC and maximum of 23.2 ºC. Temperature begins to rise in February. May is the hottest month, with a mean maximum temperature of 43 ºC and minimum of 28.2 ºC.

For the present study four villages have been selected namely Awarpur, Palgaon, Nanda and Naokari which are located around the cement plant within 5 km radius. Awarpur is a village which is situated at 19.78'N and 79.13'E which is 1.9km away from cement plant. Palgaon is a village which is situated at 19.78'N and 79.15'E which is 300m away from cement plant. Nanda is a village which is situated at 19.77'N and 79.12'E which is 3.9km away from cement plant. Naokari is a village which is situated at 19.79'N and 79.14'E which is 850m away from cement plant.

Study of Health Status was carried out by selecting 35 people from each sampling site. Their background information was collected through personal interview. Criteria for selection participant was based on random selection at the site those aged from 20 and 45. Care should be taken that the person having exposure to that area at least from 5 years. Questionnaires were based on analysis of various standard organizations such as Department of Health And Ageing and Health Council (2002) [4], WHO (1999) [25], etc. and according to the literature (Maureen *et al*., 1860; Lesliam *et al*., 2005; Winston *et al*., 2005; Sengupta, 2006; UNEP, 2008) [24, 21, 27, 9, 10].

Results and Discussions
Human health diseases: The most common route for pollutants to enter the human body is by inhalation, the most common effect of air pollution is damage to the respiratory system. Exposure to air pollutants can cause headache, eye irritation, skin allergies, chest pain, respiratory problems (such as, asthma, shortness of breath, allergic reaction that interference with breathing, cough and wheezing) and lung problems (such as, chronic bronchitis, emphysema, tuberculosis and pneumonia) when the air is polluted. Study of Health Status was carried out by selecting 35 people from each sampling site. Their background information was collected through personal interview. Criteria for selection participant was based on random selection at the site those aged from 20 and 45. Care should be taken that the person

having exposure to that area at least from 5 years.

From figure no.1 it was concluded that
14.3% people having headache, chest pain and respiratory problems 11.4% people having eye irritation, 8.6% people having skin allergies and lung problems at Awarpur.
20.0% people having respiratory problems, 17.1% people having eye irritation and chest pain, 8.6% people having headache and skin allergies, 5.7% people having lung problems at Palgaon.
20.0% people having respiratory problems, 14.3% people having eye irritation, 11.4% people having headache and skin allergies, and 5.7% people having chest pain lung problems at Nanda.
22.9% people having eye irritation, 17.1% people having respiratory problems, 11.4% people having headache and lung problems and 8.6% people having skin allergies and chest pain at Naokari. Similar results was also reported by Rai P., Mishra R.M. and Parihar S. 2013 [13].
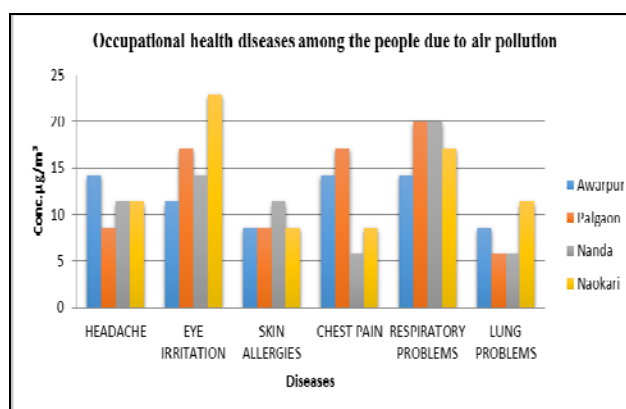

Fig 1: Occupational health diseases among the people due to air pollution of sampling sites Table No. 5: Percentage of air pollution oriented diseases among the people of four sampling sites

Table 1: Percentage of air pollution oriented diseases among the people of four sampling sites

Sl. No.	Diseases	Sampling sites			
		Awarpur	Palgaon	Nanda	Naokari
1.	Headache	14.3	8.6	11.4	11.4
2.	Eye irritation	11.4	17.1	14.3	22.9
3.	Skin allergies	8.6	8.6	11.4	8.6
4.	Chest pain	14.3	17.1	5.7	8.6
5.	Respiratory problems	14.3	20.0	20.0	17.1
6.	Lung Problems	8.6	5.7	5.7	11.4

Table 2: Average percentage of air pollution oriented diseases among the people of all four sites

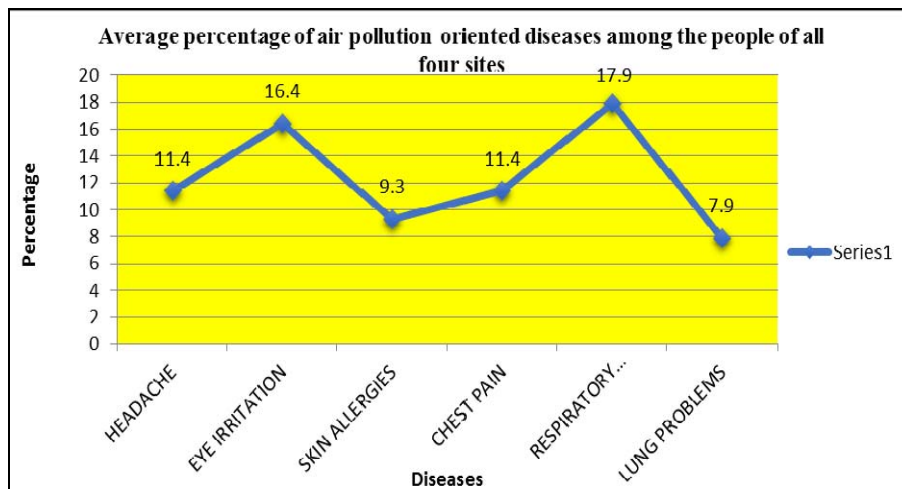| Sl. No.	Diseases	Average percentage of air pollution oriented diseases among the people of all four sites
1.	Headache	11.4
2.	Eye irritation	16.4
3.	Skin allergies	9.3
4.	Chest pain	11.4
5.	Respiratory problems	17.9
6.	Lung Problems	7.6

Fig 2: Average percentage of air pollution oriented diseases among the people of all four site
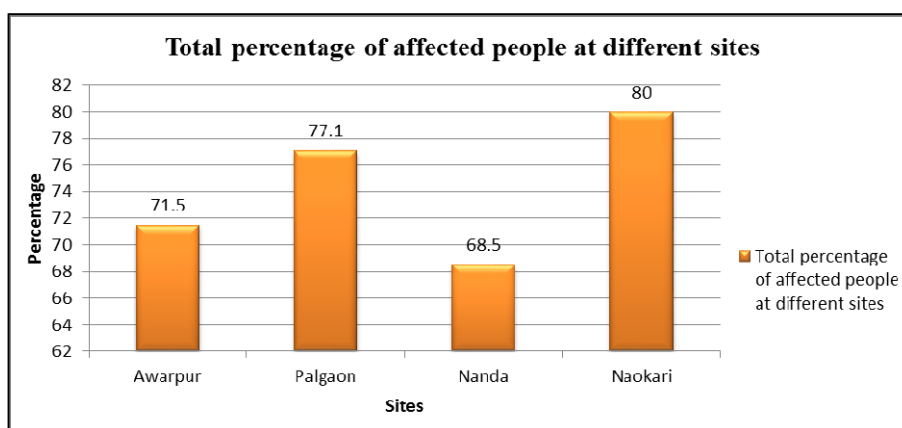

Fig 3: Total percentage of affected people at different site

After completing the cohort health sampling it was concluded that most of the people having problem related to headache, eye irritation, skin allergies, chest pain, respiratory problems (like asthma, shortness of breath, cough, wheezing, allergic reaction that interference in breathing) and lung problems (like bronchitis infection, pneumonia, tuberculosis, emphysema).

Site 1(Awarpur) total 71.5% persons are affected at site1 due to air pollutants.
Site 2(Palgaon) total 77.1% persons are affected at site 2 due to air pollutants.
Site 3(Nanda) total 68.5% persons are affected at site 3 due to air pollutants.
Site 4(Naokari) total 80.0% persons are affected at site 4 due to air pollutants.
Site 4 > Site 2 > Site 1 > Site 3

Association between air pollution and lung function parameters has already been well documented (Schwela 2000; pope 2000a; WHO 2000b) [26, 15]. Under long term exposure, there is correlation between particle concentrations and mortality from lung disease (WHO 2000a) [26]. Particulate matter in the ambient air have been found to cause acute effects such as increased daily mortality, increase rate of hospital admissions for exacerbation of respiratory disease etc. (WHO 2000a, 2000b) [26]. However, health effects of SPM in humans depend on particle site, concentrations and exposure time.

Conclusion
As per human health status at site 3(Nanda) shows less affected number of people with 68.5% as compared to Site 4 (Naokari) shows highly affected number of People with 80.0%. The problems which are found in people is due to long exposure of dust generated in the study area.

References
1. Anderson HR, RW Atkinson, SA Bremner, L Marston. Particulate air pollution and hospital admissions for cardio respiratory diseases: Are the elderly at greater risk? Eur. Respir. J, 2003; 21:39-46.
2. Baby S, Singh NA, Shrivastava P, Nath SR, Kumar SS, Singh D, Vivek K. Impact of dust emission on plant vegetation of vicinity of cement plant. Environ. Eng. Manage. J. 2008; 7(1).
3. Ballester F, JM Tenías, S Pérez-Hoyos. Air pollution and emergency hospital admissions for cardiovascular diseases in Valencia, Spain. J. Epidemiol. Commun. H., 2001; 55:57-65.
4. Department of health and ageing and enHealth council Environmental health risk assessment- guidelines for assessing human health risks from environmental hazards, 2002.
5. Dolgner R, Brockhaus A, Ewers U, Weigand H, Majewski F Soddemann H. Repeated surveillance of exposure to thallium in a population living in the vicinity of a cement plant emitting dust containing thallium. Int. Arch. Occup. Environ. Health, 1983; (52):79-94.

6. Ggeorghe IF, Ion B. The effect of air pollution on vegetation and the role of vegetation in reducing atmospheric pollution www.intechopen.com, 2011, 241-280.
7. Kumar SS, Singh NA, Kumar V, Sunisha B, Preeti S, Deepali S, Nath SR *et al*. Impact of dust emission on plant vegetation in the vicinity of cement plant. Environ. Eng. Manage. J. 2008; 7(1):31-35.
8. Lei Y, Zhang Q, Nielsen C, He K. An Inventory of Primary Air Pollutants & CO2 Emissions from Cement Production in China 1990-2020. Atmospheric Environment, 2011; 45:147-154.
9. Lesliam QMS, Awelka GW. Assessment of cement dust concentrations and noise levels in a cement plant in Nicaragua. 2005.
10. Maureen LC, Nathalie BS, Anna A, Sharma PK. The health effects of air pollution in Delhi, India, 1860.
11. Mehraj SS, Bhat GA, Balkhi HM, Gul T. Health risks for population living in the neighborhood of a cement factory. African Journal of Environmental Science and Technology, 2013; 7(12):1044-1052.
12. Mishra GP. Impact of industrial pollution from a cement factory on water quality parameters at Kymore. Environ. Ecol. 1991; 9(4):876-880.
13. Murugesan M, Sivakumar A, Jayanthi N, Manonmani K Effect of cement dust pollution o physiological and biochemical activities of certain plants. Pollut. Res. 2004; 23(2):375-378.
14. Pollution Prevention and Abatement Handbook 1998 toward Cleaner Production, World Bank Group, International Finance Corporation, Washington D.C, 1999.
15. Pope III CA. Epidemiology of fine particulate air pollution and human health: Biologic mechanisms and who's at risk? Environmental Health Perspectives, 2000; 108:713-723.
16. Qudais HA, Abu-Allaban M. Impact Assessment of Ambient Air Quality by Cement industry: A Case Study in Jordan. Taiwan Association for Aerosol Research, 2011, 802-810.
17. Quiros L, Webb GA. Assessment of Cement Dust Concentration and Noise Level in a Cement Plant in Nicaragua.Center for occupational and environmental health student project Award, 2005.
18. Rai P, Mishra RM, Parihar S. Quantifying the Cement Air Pollution related Human Health diseases in Maihar city, MP, India. Research Journal of Recent Sciences, 2013; 2.
19. Sai VS, Mishra MP, Mishra GP. Effect of cement dust pollution on trees and agricultural crops. Asian Environ. 1987; 9(1):11-14.
20. Schewela DH. Air pollution and health in urban areas. Reviews on Environmental Health, 2000; 15:13-42.
21. Sengupta B. Design of air quality monitoring systems to enable health impact studies, Central Pollution Control Board Ministry of Environment and Forests New Delhi, 2006.
22. Sivasamy N, Srinvasan V. Environment pollution and its control by tree employment news New Delhi. 1997; (52):1-2.
23. Srivastava KP, Singh VK. Impact of Air-Pollution on pH of soil of Saran, Bihar, India, Res.J.Recent Sci., 2012; 1(4):9- 13.
24. UNEP. Environmental pollution and impacts on public health by united nations environment programme, 2008.
25. WHO. Monitoring ambient air quality for health impact assessment WHO Regional Publications, European Series, No. 85 World Health Organization Regional Office for Europe Copenhagen, 1999.
26. WHO. Guidelines for Air Quality. WHO/SDE/OEH/00.02. World Health Organization, Geneva, Switzerland, Internet Address: http://www.who. Int/peh, 2000.
27. Winston HH, Joan D. A guide to health risk assessment California Environmental protection agency office of environmental health hazard assessment, 2005.
28. World Development Indicators World Bank, Washington, DC, USA, 2004.
29. Worrell E, Price L, Martin N, Hendriks, C Meida, OL. Carbon Dioxide, 2001.
30. Yousefi KD, Darvishi G, Haghighi F. Estimation of Air Pollution in Urban Streets by Modeling of PM10, O3 and CO Pollutants according to Regression Method (Case study-Yadegar and Azadi streets intersection, Tehran, IRAN), Res. J. Recent Sci., 2013; 2(4):36-45.