POLLUTION DUE TO CEMENT DUST

Laxmi Suthar
Department of Civil Engineering
JIET Universe (co-ed campus),
NH-65, Pali Road, Mogra,
Jodhpur (Rajasthan), INDIA
laxmi.suthar1995@gmail.com

Pawan Kansara
Department of Civil Engineering
JIET Universe (co-ed campus),
NH-65, Pali Road, Mogra,
Jodhpur (Rajasthan), INDIA
pawankansara007@gmail.com

Rishi Gupta
Department of Civil Engineering
JIET Universe (co-ed campus),
NH-65, Pali Road, Mogra,
Jodhpur (Rajasthan), INDIA
grishi025@gmail.com

Dr. Garima Goswami
Ass. Prof. (Chem.), Department of Applied Sciences
JIET Universe (co-ed campus),
NH-65, Pali Road, Mogra,
Jodhpur (Rajasthan), INDIA
garima.goswami@jietjodhpur.com

Abstract— Now a days, cement industry is causing many environmental pollution problems. The pollutants of the cement industry produce the adverse impacts on Air, Water And Land. Cement industry is one of the17 most polluting industries listed by Central Pollution Control Board in India. During the last decades, the emission of dust from cement factories has been increasing alarmingly due to expansion of more cement plants to meet the growing requirement of cement materials for construction of buildings. In view of gaseous air pollutants, many of which are readily recognized as being the cause of injure to various types of vegetation. Relatively little is known and limited studies have been carried out on the effect of cement dust pollution on the growth of plants. The limestone mining and different stages of cement manufacture cause hazardous environ mental impacts on air, water, soil, land and vegetation. Geoenvironmental Impact Assessment was carried out in the areas around cement plants in Sirohi, Pali, Nagaur and Chittaurgarh district, Rajasthan. Landscape has totally been degraded due to dumping of overburden material, dust pollution and unreclaimed mine pits. There has been increase in the number of quicklime manufacturing units, limestone and sandstone quarries in the area thereby increasing dust pollution. Unreclaimed mine pits have changed the aesthetic view of the area and degraded the land as well.

Keywords: cement industry, dust pollution, gaseous air pollutants,

I. An Introduction

In this article, dust effects on workers, environment and main sources of dust production in construction sites are explained and presented. The prevailing source of dust pollution in construction site is of dusty facilities. Dust pollution is the introduction of chemicals, particulate matter, or biological materials that cause harm or discomfort to humans or other living organisms, or cause damage to the natural environment.

Thus, dealing this problem is really considerable. It is clear from findings that the most important causes of dust production in a construction site are cement silos and dusty roads. Simply recognizable routes without any formal construction or maintenance make dust in many ways. Modern roads, which are normally smoothed and paved can be a solution for dust controlling as they do not impart dust to environment. Dust is also introduced from cement factories. Everyday huge amount of dust in form of cement enters into the environment. They adeversely affects living organisms. Increased concentration of cement dust pollutants causes invisible injuries like progressive decline in the physiological process such as photosynthetic ability and respiration rate of leaves. Visible injuries such as closure leaf stomata, a marked reduction in growth and productivity can be observed due to cement dust. Farmer (1992) reported that cement dust pollutants block the stomata which lead to reduction in yield of number of annual crops. Sato et al., (1993) also reported that due to cement dust, the productivity and concentration of chlorophyll in a number of crops decreased. Some of the initial studies have shown that the incremental individual risk due to emissions of the cement dust is very high not only with regard to health effects but also in relation to toxicological and cancer risks produced by pollutants emitted by the cement kiln .Surprisingly, the conclusion has been challenged. Similarly, earlier conclusion that long-term exposure to cement dust does not lead to higher morbidity of severe respiratory disease than other types of blue collar has also been challenged. In order to minimize the human health risk due to cement dust

exposure the factory managers are necessarily required to put in place the latest technology, management systems and continuous online monitoring, and routinely implement the activities that facilitate adherence to the emission norms prescribed under the pollution control legislation. In addition to implementing the technological and managerial measures to control dust and other emissions, it is also necessary to provide adequate personal respiratory protective equipment for the chronically exposed people. It is necessary because observations from experiments have shown that cement contains many harmful elements which are hazardous when exposed for use to user and its sorroundings.

Cement contains 3-8% aluminium oxide, 0.5-0.6% iron-oxide, 60-70% calcium oxide, 17-25% silicon oxide, 0.1-4% magnesium oxide and 1-3% sulphur trioxide (Ade-Ademilua and Umebese, 2007). It influences quality of soil also.The pH of the cement-polluted soils was alkaline but that of the polluted soil was more alkaline. Similar studies on cement dust pollution show elevated levels of soil pH (Adamson et al., 1994; Mandre, 1997; Mandreetal., 1998). Cement dust is a mixture of Ca, K, Si and Na which often include heavy metals like As, Al, Cd, Pb, Zn, Fe, and Cr. Majority of these elements in excess amounts are potentially harmful to the biotic and abiotic components of the environment (Gbadebe and Bankole, 2007). We can have a visit to air pollution & air pollution due to dust and get familiar to its influences on us and our surroundings through this paper

II. Air Pollution Due To Dust

Air pollution is the release of chemicals, particulate matter, or biological materials in to the atmosphere through human activities. It causes harm to his health, other living organisms and the environment. Pollution stress can alter plant and animal growth as well as quality and the effects are often extensive. Air pollution can have both short-term and long-term effects and physical

injuries to the leaves of plants and skin of animals. These are the immediate effects of air pollution . Of all the main poisonous gases in polluted air, sulfur dioxide appears to be the most toxic to plants and animals and has been implicated in some diseases. Other pollutants that may adversely affect plants and animals are nitrogen dioxide, ammonia, carbon monoxide and troposphere ozone. The calcinations and burning processes of cement production produce these poisonous gases that cause injuries to plants and animals. This is one of the contribution of cement in the field of air pollution. It can be said that air pollution is a social disease, a disease generated primarily from the activities of man and adversely affecting his own health and welfare. We are facing the fact that in relatively recent times, the total amount and complexity of toxic pollutants in the environment are increasing day by day. These toxic pollutants play a vital role in degrading quality of human life. These are an important part of air pollution.

Air pollution is a major problem of modern society and in recent years, the definition of air pollution has been broadened. Research activities have been expanded to include analysis on p response of plants to a wide range of atmospheric chemicals emitted from anthropogenic sources. Even though the problem is usually greater in cities, air pollutants are found everywhere. Air pollutants are responsible for vegetation injury and crops yields losses. Injury ranges from visible markings on the foliage, to reduced growth and yield, to premature death of the plant. The severity of injury depends on a number of factors which include: the concentration of the air pollutants, length of exposure to the pollutant, plant species involved as well as environmental factors conducive to the build-up of the pollutants. The problem of air pollution in the form of particulates has become a threat to the survival of plants and the reduction of the integrity of soils in the industrial areas.

Fig-www.monitor.co.ug

III. ROLE OF CEMENT INDUSTRY

One industry that causes significant particle pollution is the production of cement. The main airborne pollutants of cement production to the environment are dust and gases emitted during the process. Many studies has been carried out to improve the knowledge of matter.

Hindyet from his experiments reported that in Egypt, 1 kg of cement manufacture generates about 0.07 kg of dust in the atmosphere. Cement dust can spread over large areas through wind and rain and are accumulated in and on soils, plants and have the potential to affect

animal and human health adversely . Dust from cement factories adversely affects the forest ecosystem, soil enzymes, fungi and bacteria population within the vicinity of cement factory. Darley et al., noted that plants were stunted and had few leaves in the heavily dusted portions of an alfalfa field downwind a cement plant in California. Furthermore, it was shown that plant height, phytomass, net primary productivity, chlorophyll content, metabolites and yield were reduced in response to cement dust in polluted areas. The cement industry is involved in the development of structures in this advanced and modern world because it is the basic ingredient of concrete use in constructing modern edifices and structures. In fact, life without cement in this 21st century is inconceivable. This is also a reality that cement generates dust during its production. Cement is a fine, gray or white powder which is largely made up of Cement Kiln Dust (CKD), a by-product of the final cement product, usually stored as wastes in open-pits and landfills (Although, the basic constituents of cement dust are calcium ($CaCO_3$), silicon (SiO_2), aluminum (Al_2O_3), ferric and manganese oxides) its production produces known toxic, carcinogenic and mutagenic substances, such as particulate matters, sulfur dioxide, nitrogen dioxide, volatile compounds, long lived dioxins and heavy metals).

Exposure to cement dust for a short period may not cause serious problem, however prolonged exposure can cause serious irreversible damage to plant and animal. Cement dust of sufficient quantities have been reported to dissolve leaf tissues and cause injury to both plants and animals. Other reported effects of cement dust on plants and animals include reduced plant and animal growths, reduced chlorophyll of plants, clogged stomata of plants leaves, cell metabolism disruption in plants and animals, respiratory diseases in animals, hematological disease, cancers, eye defects and many more adverse effects on surroundings.

Fig commons.wikimedia.org

IV. EFFECTS OF CEMENT DUST POLLUTION

It can be drawn till that cement dust is dangerous to us. It is branch of air pollution that prolongs the human problems caused by him only. It is not something behind our eyes but is a part of our daily life. We are now well aware of its effects on plants, animals, vegetations and human beings. We can sum up our study and look at the effects as following.

- **On Human Beings**
- Studies have shown that adverse respiratory health effects seen in the people exposed to cement dust, exemplified in increased frequency of respiratory symptoms and decreased ventilator function, observed among cement workers could not be explained by age, BMI and smoking, thus are likely to be caused by exposure to cement dust.
- Several studies have demonstrated linkages between cement dust exposure, chronic impairment of lung function and respiratory symptoms in human population. Cement dust irritates the skin, the mucous membrane of the eyes and the respiratory system. Its deposition in the respiratory tract causes a basic reaction leading to increased pH values that irritates the exposed mucous membranes.
- Diseases such as chest pain, cough, and eye problems in the villages affected by cement dust are likely to be derived due to cement dust. Indeed, the higher percentage of related diseases occurs near the source of pollutant. A relative risk ratio assessment indicates that the exposed subjects are 7.5 and 22.5 times as likely to develop the disease during the follow-up period compared to the unexposed subjects.
- Total cement dust exposure has been found to be related to acute respiratory symptoms and acute ventilatory effects. Implementing measures to control dust and providing adequate personal respiratory protective equipment for the production workers are highly recommended.
- **On Plants**
- Increased concentration of cement dust pollutants causes invisible injuries like progressive decline in the physiological

process such as photosynthetic ability and respiration rate of leaves. Similarly, visible injuries such as closure leaf stomata, a marked reduction in growth and productivity were observed due to cement dust.

- Alkaline nature of cement dust reduce the absorption of mineral substances form the soil its leads to changes in the plant physiology and morphology.
- pH is gradually increased due the effect of cement dust when compare to control soil.
- Geochemical analysis of different samples of soil has indicated presence of high values of sulphate in soil, toxic heavy metals, like Zn, Cr, Pb, in the dust.
- High TDS values in groundwater have been detected in the buffer zone area of the cement plant.

V. CONCLUSION

The present study particularly discriminate the effect of cement dust deposition on soil and the consequential effect on the human body. The levels of pollutant deposition from cement dust on the soil decreases as the distance from the point of cement production increases. Dust falling on the soil caused a shift in the pH to the alkaline side. A number of literatures have supported these findings. The present results show that the two locations (control and polluted) received different amounts of atmospheric particulate with the polluted area receiving more. The elemental profile determined in the soil for the two locations indicated that the level of extractable Ca, Mg and Na were significantly higher than in the control one. Similar deductions were observed from the number of heavy metals (Cr, Cu, Fe, Ni and Zn) analyzed for the study. In general, these results prompt a conclusion that cement dust have degradable effect on soil properties of the nearby area. The study shows changes in the morphological and yield characteristics of the plants. The study clearly shows that particulate pollutants in cement dust have detrimental effects on plants. Changes in the morphological and yield parameters including chlorophyll, leaf area, fresh and dry weight and shoot length of plants directly corresponded to levels of air pollution at different sites. It may be concluded that cultivation of crops could suffer a loss both in size and in terms of quality in cement dust polluted area. It may not be out of place to state that the practical absence of farms within the vicinity of the cement facility as against other agricultural crops is linked to lack of cultivation interest on the part of ingenious farmers as a result of cement dust pollution.

Based on the results of the present study and previous similar studies, it could be concluded that cement factories have negative influence both on vegetation diversity and the responses of individual species. The study elucidates that air pollution emitted from cement factories are adversely affecting the ambient air and agricultural production. The pollutants from cement dust including heavy metals are potentially sufficient to have direct effect on human health also. Workers in cement factories suffers the most. It is therefore recommended that future setting of cement production facilities and other similar industrial establishment must ensure that human settlement are kept further away from the area of operation. Also new techniques should be incorporated into industrial designs so as to protect the environment from hazardous pollutants. As we are responsible directly or indirectly for this so we have to take the responsibility to find the best solution for the same. Dust can not be removed completely from environment but can be reduced to the extent that it causes less harm to us.

ACKNOWLEDGEMENT

It is a great opportunity for us to write about subject like “POLLUTION DUE TO CEMENT DUST”. At the time of preparing this paper we had gone through different books and websites which help us to get acquainted with new topics. We are actually focusing on those topics which are important for us to understand about this subject easily.

We acknowledge with gratitude to god, our parents and respective teacher, who has always been sincere and helpful in making it easy to understand the different system of research and conceptual problems in our paper.

Apart from us this paper will certainly be immense importance for those who are interesting to know about this subject. We hope that they will find it comprehensible.

We have tried hard and soul to gather all relevant documents regarding this subject. We don’t know how far we will be able to do that. Furthermore we don’t claim all the information in this paper is included perfectly. There may be shortcoming, factual error, mistaken opinion which are all mine and we all are responsible for those but we will try to give a better volume in future.

REFERENCES

[1]
Dust Pollution And Its Effects In Construction Sites
ZaniarTokmechi
Department of Civil Engineering, Mahabad Branch, Islamic Azad University, Mahabad, Iran
[2]
Cement dust pollution on growth and yield attributes of groundnut (ArachishypogaeaL.)
D. Raajasubramanian1, P. Sundaramoorthy1,2*, L. Baskaran1, K. Sankar Ganesh1, AL.A. Chidambaram1 and
M. Jeganathan1
1Department of Botany, Annamalai University, Annamalainagar-608 002,Tamilnadu – India
2P.G. Research Department of Environmental Science, Government Arts College, Ariyalur, Tamilnadu – India
[3]
http://scialert.net/abstract/?doi=rjmutag.2012.10.18