CHAPTER-ONE: "INTRODUCTION"

* Ecological Aspects

* Pollution aspects with reference to Air, Soil and Water.

* Survey of Literature related to Cement Industry Pollution.

* Aims and Objectives of the present Study.

REFERENCES
Since the history of Civilization there have been so many disparities among living conditions, desired facilities, ambitions that neither any environmentalist nor any practical scientist can express it. No person can extract any type of immediate resultson from this problem, the reason is that man has changed so much with the time that all kinds of prospects have falsified. The things once thought luxurious as splendid buildings, automatic conveyance, telecast, telephone or fax, means of communication, means of entertainment have come in the category of necessities while the vital necessities like water, air, and food are lessening day by day, as unlimited stores of natural resources are diminishing day by day. The fast growing population has falsified all the prophesies and fore-thoughts in addition to it a terrible problem has come into existence and which is commonly known as pollution. It has put a question mark before the normal life all around. Thus no thought and planning is able to give any relief to the common man inspite of innumerable facilities and luxurious.

The quality of life has been a point of discussion since some decades as Pure air, good food, neat and airy atmosphere and other necessities and desired facilities of life are being discussed by the people and in the same reference environment and quality of environment have been enlisted in the same list.
Unless the atmosphere in which we live now named as environment is good, clean and without pollution, it is useless to talk of quality of environment. The quality of life is impossible without the quality of environment because they depend on each other i.e. they are supplementary to each other. Those things animate or inanimate which keep us in there covering or the things which surround us, are the ingredients of environment and the total effect of all these things on human life is known as environment. Under these conditions we lead good or bad life and then the search for a good environment becomes the topic of our discussion. Man is closely related with environment, hence it becomes not only important but compulsory to know deeply about it. The study of relations of man (living organisms) with environment and its different ingredients is known as Ecology.

ECOLOGICAL ASPECTS

If we analyse the word Ecology, we find that it is made with two different Greek Words. They are Oikos which means Home and Logos that means Study. Thus the meaning of Ecology is the Study of Home or Habitat. The word Ecology has been defined by different Ecologists in many different ways:

1. Ecology has been defined as the study of organisms in relation to their environment.¹
2. Ecology is the study of the inter-relationship among Organisms, and between organisms and their environment.²

3. Ecology is the pattern & balance of relationships between plants, animals, people and their environment.³

4. Ecology is the Scientific study of the relationship of living organisms with each other and with their environments.⁴

It is clear from the definitions given above that the meaning of Ecology is not so simple as it sounds. Neither its scope is so simple nor the process of its study is very easy because after all it is a matter of uncountable animals, plants, men and fossils in relation with environment and of the study of there individual differences, action and reaction and effects and bad effects. Hence the scope of Ecology to be the mere natural environment looking very simple from out side, but on the other hand it seems to be complicated also as it comprises of the study of environmental, biological and social ingredients in relation to men and other creatures. On the basis of the above description it can be said that now Ecology is not only the scope of study of Life Sciences i.e. Zoology, Botany and Anthropology but now it consists of Chemistry, Geology, Geography, Meteorology, Climatology, Hydrology, Palaeontology, Archaeology, Sociology, and Astronomy and those other fields which are directly or indirectly related to environment.
and its different activities. In short to define it briefly all Natural Sciences and Social Sciences include in the Ecology because all the atmospheric conditions affect men and other living creatures.

The familiar word of the day is "Ecology" is the branch of science concerned with the inter relationships of organisms and their environment. The layman desires an improvement in that area of his environment which will allow him to breathe uncontaminated air; the naturalist is concerned with the spoilation of the forests and its effect on animal and plant life; and the sportsman decries the polluted conditions of his lakes and streams which deprive him of his fishing rights. These are problems of ecology, each dealing with a different facet of environment.

Pollution Aspects with Reference to Air, Soil and Water:

When any environmental ingredients like air, water and land combine with undesired substances and bring physical, chemical or biological changes than they either become useless or harm human health. This process and results are known as pollution. Such substances or things which create pollution are known as pollutants. It becomes clear by the following definitions:

1. "Pollution is the addition of unwanted substances of effects (pollutants) which adversely alters the natural or man made environment."
2. "An undesirable change in the physical, chemical or biological characteristics of air, water and soil, that may create a hazard or potential hazard to the health, safety or welfare of living species is called pollution."\(^6\)

With the help of these definitions it is clear to understand that how can a good life be imagined in the absence of necessities like air, water and land. Undoubtedly the environmental pollution has put human life in a great trouble and made it very terrible.

The control of man's environment requires the solution of those problems concerned with air pollution, water quality control, waste management, and noise abatement. In many instances these problems are interrelated. Man's early efforts to dispose of his own excrement was to discharging it into the nearest stream; unfortunately, in some areas, this disposal method is still used. The health hazards of this practice were soon realized and consequently the modern sanitary sewage system was developed. In these plants, the bacteriological decomposition of human wastes, causes the emission of noxious gases into the atmosphere, thereby requiring the application of an air pollution control system.

**AIR POLLUTION**

Air Pollution causes pollution in water and soil thus affecting whole atmosphere around it, can be defined
as the emission into the atmosphere of a waste gas stream containing one or more contaminants such as dust, gases, mists, or fumes in concentrations sufficient to be injurious to human, animal, or plant health, or to affect property values adversely.

The health effects of air pollution can be determined by a number of approaches: statistical studies of past illness and death, as related to notable air pollution incidents; correlation of respiratory epidemics as a function of air pollution concentrations; and laboratory studies of the responses of animals and in some cases; human beings, to exposure to various pollutants. For example, it has been demonstrated that asthmatic attacks among susceptible patients correlate with air pollution caused by incomplete refuse combustion. The incidence of employee absenteeism due to respiratory illness has closely followed sulfate pollution levels. Laboratory studies with animals have proved the development of lung cancer caused by their infection with influenza virus, followed by exposure to an artificial smog comprised of ozonised gasoline. These studies among others have conclusively demonstrated the association of air pollution with such respiratory diseases as lung cancer, emphysema, chronic bronchitis, and asthma.

The air pollution situation is growing progressively worse. The extent of the various effects of uncontrolled atmospheric emissions from stationary and mobile sources has still not been completely defined. However, it is
generally agreed that at this moment in the history of our industrial development the acceleration rate of pollutant emissions has exceeded man's attempt to control them.

Atmospheric pollutants can be simply classified as solid, liquid, or gaseous materials discharged from various processes in sufficient amounts so as to constitute a health hazard or a nuisance source. Air pollution can be defined as that condition where the atmosphere is overloaded with harmful or unpleasant substances. To what degree such materials being discharged to the atmosphere can be considered injurious to man and his properties, or which represent an inconvenience to the public's welfare, is defined by the various regulatory bodies responsible for atmospheric quality.

The existence of atmospheric pollution is governed by both emission source and geographical factors associated with the concerned area. Thus, both physical landscape and meteorological conditions in one area which might promote the buildup of atmospheric pollution could make it necessary to impose severe restrictions on a specific pollutant emission rate. This same contaminant might be considered relatively harmless in a more generous physical environment. In addition, atmospheric reactions might make it necessary to restrict the discharge of a particular substance, which, although harmless in itself, can react under certain atmospheric conditions to create an unacceptable air pollution condition. For example, emission restrictions are more stringent in certain areas for those hydrocarbon
materials that are known to participate in photochemical reactions with nitrogen dioxide in the atmosphere to yield peroxy acetyl nitrate (PAN) and ozone. The former is the major ingredient of smog, which is responsible for eye irritation and reduction in visibility in most of the major cities of the world.

The definition of an atmospheric pollutant, therefore, is a function of the affected geographical region as influenced by the various emission sources and the physical features of the area. Thus, central Florida's pollution regulations reflect the concern of that region with fluoride emissions from its fertilizer industries, whereas (because of smog problems) Los Angeles country emphasizes hydrocarbons and nitrogen oxides control. Because of the use of coal and oil fuels that contain sulphur, in the eastern United States, flyash particulates and sulphur oxides are the major pollutants subjected to regulatory legislation. In the west, where natural gas is the major combustion fuel, particulates are not a cause of concern, but nitrogen oxides are. As might be expected as a result of this geographical predilection for the various types of atmospheric pollutants, the majority of particulate control equipment installations applied to combustion processes can be found in the eastern United States, where solid and liquid fossil fuels are utilized.

The sources of particulate and gaseous atmospheric pollutants are infinite. Every major industry is be set by atmospheric emission problems. The list of pollutants is steadily growing as the deleterious effects of an ever-
increasing number of air borne materials are being realized. At one time the criterion for atmospheric pollution control was to reduce the visible stack emissions. Therefore, up through 1950, the major emphasis was placed on particulates removal. Then the need for gaseous control became evident, with the sulphur oxides produced by the combustion of sulphur bearing fossil fuels being the first target of the criteria established by the U.S. Department of Health Education, and Welfare (H.E.W.) in 1969.

Pollution, now a days, is buring issue before society. In "Nai Duniya"7 Indore dated 22th October 1992 a report has been published mentioning that Cement Industries are hazardous to mankind. This promotes to study the effect of Cement Industries and Pollution caused by them in soil and also in water.

There is considerable evidence that the present levels of atmospheric contaminants which exist in many larger urban areas are sufficient to cause discomfort or significantly impair health. Air pollution is increasing, and it is presumed that the associated health hazard will also increase. Toxicologic and epidemiologic studies suggest that the noxious nature of the atmosphere is usually due to a complex mixture of pollutants and to meteorologic factors.

It is difficult to identify the irritant or toxic potential of single pollutants in the urban atmosphere.
The large number of organic and inorganic compounds found in urban air may vary considerably according to the nature, source and volume of emitted pollutants (e.g., industrial processes, automotive exhaust, domestic heating and incineration) and climatic influences (e.g., temperature, sunshine, humidity, barometric pressure, wind currents).

Air pollutants are usually divided into 2 broad classes: (1) particulates (smoke, dust, ash, mists and fumes) which exist in the atmosphere in either a solid or liquid state and (2) gases (e.g., carbon monoxide, sulphur oxides, hydrogen sulfide, nitrogen oxides) and carbon compounds—particularly those reacting in the atmosphere to form photochemical smog.

Air pollution is not believed to be the cause of specific illnesses which may result in death, but it may seriously aggravate preexisting respiratory and cardiac conditions. The irritating effects of air pollution on the eye and upper respiratory tract are well known. Inhalation of irritant materials may interfere with lung function, aggravating chronic bronchitis, chronic constrictive ventilatory disease, pulmonary emphysema, and bronchial asthma. Carbon monoxide can interfere with oxygen delivery to the heart and to the brain—perhaps a critical factor in patients with coronary artery disease or in police and motorists in city traffic whose mental functioning is impaired by cerebral hypoxia. The particulate fraction contains a number of carcinogenic substances and these could play a part in the rapidly changing incidence of different cancers.
The ill effects of atmospheric pollution are most obvious during acute episodes of unusually high pollution. Marked increases in the incidence of illnesses and deaths due to cardio-respiratory damage were reported in the Meuse valley in Belgium in 1930, in Donora, Pennsylvania, in 1948, and in London in 1952 and 1962. The insidious long-term toxic potential of exposure to single or multiple air pollutants is not known.

Air pollution due to rapid industrialization and urbanization is becoming a cause of public concern. In India out of five major air pollutants viz., sulphur oxides, nitrogen oxides, carbon mono-oxide, particulate matter and oxidants, the atmospheric environment is much disturbed by sulphur oxides and suspended particulate matters. The sulphur oxides are causing damages in the industries, lime kilns, major coal burning processes and petroleum refineries are situated, but the particulate matter is causing problems all over big cities. The particulate matter is much prevalent in the areas where industries such as fertilizer plants, cement factories, refineries, thermal power and chemical plants are being set up at a rapid rate. Emissions from some of the industries have become a source of nuisance and have damaging effects on neighbouring factories as well.

The number of pollutants in the atmosphere is very large and few of them are as given below showing tolerance level in terms of viz. suspended particulate matter (S.P.M.), SO₂, CO and oxides of Nitrogen.
National Tolerance Level of Pollutant for Air quality in microgram per cubic meter is as under:

<table>
<thead>
<tr>
<th>Area</th>
<th>S.P.M.</th>
<th>SO₂</th>
<th>CO</th>
<th>Nitrogen Oxides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial/Mixed</td>
<td>500</td>
<td>120</td>
<td>5000</td>
<td>120</td>
</tr>
<tr>
<td>Inhabitable and Rural</td>
<td>200</td>
<td>80</td>
<td>2000</td>
<td>80</td>
</tr>
<tr>
<td>Sensitive*</td>
<td>100</td>
<td>30</td>
<td>1000</td>
<td>30</td>
</tr>
</tbody>
</table>

* The National Parks, Wild life Sanctuaries and areas of environmental importance include in the sensitive area.

In India ambient air quality monitoring was initiated in a few cities with selected parameters such as suspended particulate matter (S.P.M.), sulphur dioxide sulphation rate and dust fall.

According to Subdaresan (1983) the summary of air quality data for the year 1979 has been listed below:

<table>
<thead>
<tr>
<th>City (Location)</th>
<th>Suspended particulate $\mu$g/m$^3$ (24 hr. avg)</th>
<th>Sulphur dioxide $\mu$g/m$^3$ (24 hr. avg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bombay</td>
<td>275</td>
<td>83</td>
</tr>
<tr>
<td>Calcutta</td>
<td>413</td>
<td>48</td>
</tr>
<tr>
<td>Delhi</td>
<td>417</td>
<td>30</td>
</tr>
<tr>
<td>Hyderabad</td>
<td>236</td>
<td>27</td>
</tr>
<tr>
<td>Jaipur</td>
<td>226</td>
<td>11</td>
</tr>
<tr>
<td>Kanpur</td>
<td>261</td>
<td>20</td>
</tr>
<tr>
<td>Madras</td>
<td>169</td>
<td>25</td>
</tr>
</tbody>
</table>
As mentioned earlier, the standard limits for S.P.M. level is 200 µg/m³ for 24 hours, whereas for sulphur dioxide is 80 µg/m³ annual arithmetic mean. The above data exceeds the standard permissible levels, which is a cause of concern.

On one hand Indore (M.P.) is the most highly industrialized and commercial city of Madhya Pradesh while on the other it is the most highly polluted city also. In the first half of the year 1994 the quantity of pollution was measured of three different places of Indore i.e. Kothari Market, Pologround Industrial Area and Telephone Nagar. The results extracted from the measurement are as given below:

Results of Pollution measurements in Microgram per cubic meter -

<table>
<thead>
<tr>
<th>Area</th>
<th>S.P.M. µg/m³ (24 Hr.Avg)</th>
<th>SO₂ µg/m³ (24 Hr.Avg)</th>
<th>NOₓ µg/m³ (24 Hr.Avg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kothari Market</td>
<td>688.30</td>
<td>47.00</td>
<td>46.80</td>
</tr>
<tr>
<td>Pologround Industrial Area</td>
<td>637.00</td>
<td>34.80</td>
<td>45.80</td>
</tr>
<tr>
<td>Telephone Nagar</td>
<td>306.00</td>
<td>24.80</td>
<td>28.10</td>
</tr>
</tbody>
</table>

The quantity of Lead at Palasiya Chauraha and Pologround Industrial Chauraha has been measured 2 and 1.56 microgram/ cubic meter while according to the W.H.O.
its quantity must be not more then 0.5 to 1.00 microgram/m³. The presence of pollutants more than the tolerance level of air pollution in the air of the city makes it clear that the air pollution in the city is above the prescribed limits.

SOIL POLLUTION

Soil is the receptor of large quantities of waste products - domestic, human, animal, industrial and agricultural. Combustion of sulphur-containing fuels emits \( \text{SO}_2 \) and finally leaves sulphate on the soil. Nitrates from the atmosphere are deposited on the soil. Particulate lead from automobile exhausts also settles on soil along both sides of highways with heavy automobile traffic. High levels of Pb, Zn, etc. are observed on soils near lead and Zinc mines, etc. Fertilizers and pesticides applied to crops are largely retained by the soil. They become part of environmental cycles by sorption by the soil, leaching into water, etc. Pesticides undergo degradation in soil, through the processes of biodegradation, chemical degradation, or photochemical reactions. In this respect, insects, earthworms, plants and microorganisms play important roles. Thus trolene (\( o, o' \)-dimethyl \( o, 2, 4, 5 \) trichlorophenyl thiophosphate) undergoes hydrolysis is soil:

\[
\begin{align*}
\text{S} \quad \text{Cl} \\
\text{(CH}_3\text{O})_2\text{P(O)Cl} \\
\text{Cl} \\
\text{Cl} \\
\text{H}_2\text{O} \quad \text{Mineral Surfaces} \\
\text{Cl} \\
\text{Cl} \\
\text{Cl} + \text{P(OH)}_3 + 2\text{CH}_3\text{OH}
\end{align*}
\]
Pesticide residues on crops and food products cause long-term health hazards. It may be concluded that the quality of soil has an impact on public health standards through the human food chain. The environmental health aspects of soil deserve serious attention in the near future.\textsuperscript{11}

**WATER POLLUTION:**

Water quality characteristics of aquatic environments arise from a multitude of physical, chemical and biological interactions. The water bodies—rivers, lakes and estuaries are continuously subject to a dynamic state of change with respect to their geological age and geochemical characteristics. This is demonstrated by continuous circulation, transformation and accumulation of energy and matter through the medium of living things and their activities. This dynamic balance in the aquatic ecosystem is upset by human activities, resulting in pollution which is manifested dramatically as fishkill, offensive taste and odour, etc.\textsuperscript{12}

The quality of water is of vital concern for mankind since it is directly linked with human welfare. It is a matter of history that faecal pollution of drinking water caused water-borne diseases which wiped out entire populations of cities. At present, the menace of water-borne diseases and epidemics still looms large on the horizons of developing countries. Polluted water is the
culprit in all such cases. The major sources of water pollution are domestic waste from urban and rural areas, and industrial wastes which are discharged into natural water bodies.

SURVEY OF LITERATURE

Cement dust is a mixture of calcium, potassium, aluminium, silica and sodium which sets into hard mass when in contact with water. During slow hydration of calcium aluminate (CaO. Al₂O₃) and calcium silicate (CaO. SiO₂) hydrated colloidal gels are formed which crystallize out to form a thick impervious surface, also in this process hydroxides of calcium and aluminium are produced to fill the surface interstices. During quick gydration, a crust of hydrated calcium aluminate is crystallized which makes a surface of lesser strength than that formed during slow hydration (Czaja, 196613).

Cement dust, which is the main pollutant of the present study is a common air pollutant around cement factories and construction sites. Cement kiln dust is the dust contained in waste gases from the kilns and is not derived directly from processing of cement. Lerman (197214) recorded dust deposits of 1.5 g/m²/day in the vicinity of a cement factory in California. According to reports from Germany, the maximum amounts of dust that might be deposited in the vicinity of cement factories vary from 1.5 g/m²/day (Pajenkamp, 196115) to 3.8 g/m²/day
(Bohne, 1963\textsuperscript{16}), Lal & Ambashta (1982\textsuperscript{17}) have reported a maximum dust fall on leaf surface of \textit{Psidium guayava} as 47.50 g/m\textsuperscript{2}.

\textbf{Effects of Cement dust}

Cement kiln dust is one of the important air pollutants which is believed to affect the vegetation in the vicinity of cement factories. The cement kiln dust is actually a heterogenous substance whose constituents and concentrations vary with the time and location (Lerman and Darley 1975). The particle size of cement dust ranges in between 4 to 100 micron. The cement kiln dusts from different sources vary extremely in their effects on photosynthetic and production characteristics of the plant systems.

Most of the reports concerning harmful effects of cement kiln dust on plants stress the fact that crusts form on leaves, twigs and flowers. Peirce (1910\textsuperscript{18}) and Paris (1910)\textsuperscript{19} noted in California that settled dust in combination with mist or light rain formed a relative thick crust on upper leaf surface of affected plants. The central theme on which Czaja (1961 \textit{a}\textsuperscript{20}, \textit{b}\textsuperscript{21}, 1962\textsuperscript{22}, 1966\textsuperscript{13}) builds his case for harmful effects is the crust formation in the presence of free moisture. He states that crust is formed because some portion of the settling dusts consists of the calcium silicates which are typical of the clinker (burned lime stone) from which cement is being made.
Bohne (1963)\textsuperscript{16} reported a marked reduction of growth of Poplar trees located about one mile from a cement plant after production in the plant was more than doubled. Darley (1966)\textsuperscript{23} observed a reduction of spring growth elongation on conifers in Germany, where the oldest needles were incrustated.

Anderson (1914)\textsuperscript{24} observed in New York that cherry fruit set was reduced on the side of the tree nearest to a cement plant. He demonstrated that the dust on the stigma prevented pollen germination.

Pajenkamp (1961) reviewed the work of some investigators and stated that he was opposed to the view that dusts are harmful to the plants. He concluded that deposition from 0.075 to 1.5 gm/m\textsuperscript{2}/day had no harmful effects on the plants.

Raymond and Nussbaum (1966)\textsuperscript{25} also stated that cement dusts have little effect on wild plants. On the hand Guderian (1961)\textsuperscript{26} and Wentzel (1962) disagreed with Pajenkamp and stated that the limited evidence at best presented a contradictory picture and that Pajenkamp had not cited Czaja's earlier work (1961\textsuperscript{20} a,b, 1962\textsuperscript{22}, 1966\textsuperscript{13}). They also pointed out that a deposit on 1.5 g/m\textsuperscript{2}/day was not maximum, since other workers had found upto 2.5 g/m\textsuperscript{2}/day and Bohne (1963)\textsuperscript{16} has reported weekly average of upto 3.8 g/m\textsuperscript{2}/day.

Taking account of physico-chemical effects of cement kiln dust, Peirce (1910)\textsuperscript{18} demonstrated that
incrustations of cement kiln dust on citrus leaves interfered with light required for photosynthesis and reduced starch formation. This was later confirmed by Czaja (1962)\textsuperscript{22} and Bohne (1963)\textsuperscript{16} in a variety of plants. Steinhubel (1962)\textsuperscript{27} compared starch reserve changes in undusted common holly leaves and those dusted with foundry dust. He concluded that critical factor in starch formation was the light absorption by the dust layer and that the influence on transpiration or overheating of leaf tissue was of minor significance. Czaja (1962)\textsuperscript{22} attributed the reduced yields from dusted tomato and bean plants to interference with light imposed by the dust layer. Darley (1966)\textsuperscript{23} demonstrated that dust deposited on bean leaves in the presence of free moisture interfered with the rate of carbon dioxide exchange, but no measurements of starch were made.

Gzaja (1966)\textsuperscript{13} has presented good histological evidence that stomata of conifers may be plugged by dust preventing normal gas exchange by the leaf tissue. Uninhibited exchange of carbon dioxide and oxygen by leaf tissue is necessary for normal growth and development.

Lerman (1972)\textsuperscript{14} demonstrated limited clogging of stomatal opening on bean leaves which were heavily dusted with dry dusts.

Darley (1966)\textsuperscript{23} applied kiln dusts of particle size less than 10\mu in diameter at rates of 0.5 to 3.8g/m\textsuperscript{2}/day to leaves for 2-3 days in laboratory. Water mist was
applied several times each day. Even though dust adhered to the leaf in a uniform layer, it did not appear to be crustlike, probably because the experiments were of short duration. Reduction in carbon dioxide uptake was reported in these experiments.

Singh (1979)\textsuperscript{28}, Jafri (1979)\textsuperscript{29} and Lal and Ambashta (1980, 1982)\textsuperscript{17} have evaluated the effects of cement dust on the plants and soil. Singh (1979)\textsuperscript{28} has observed decrease in chlorophyll concentration in wheat, while Lal and Ambashta (1980) found increase in chlorophyll concentration in the leaves of \textit{Psidium guayava}. Jafri et al. (1979)\textsuperscript{29} studied the effect of cement dust on the epidermal characters in leaf of \textit{syzygium cumini} and reported higher stomatal and epidermal cell frequency in polluted plants. Lal and Ambashta (1980) have reported a decrease in individual biomass, an increase in concentration of minerals and a decrease in energy concentration in leaves in coated with cement dusts.

Oblisami et al. (1978)\textsuperscript{30} studied the effect of cement of cement kiln dusts on cotton plants. Their studies revealed that chlorophyll contents were more in the polluted leaves than that of the non polluted leaves indicating the dearrangement of chlorophyll metabolism.

Rangawami et al. (1975)\textsuperscript{31} observed the effect of cement dust on maize crop and soils. The cement dust deposited plants showed a suppression in most of the characters
like leaf, size, number and size of cobs and plant height when compared to plants in the non polluted fields.

Singh and Rao (1978)\textsuperscript{32} studied the effect of cement dust pollution on wheat plants and observed that the dusted plants showed stunted growth, accompanied with reduction in length of their root, shoot and ear as well as in numbers of their tillers, leaves ears and grains per spike. Changes in mineral contents of dusted plants were also observed. Yusuf and Vyas (1983)\textsuperscript{33} observed an increase in the concentration of carotenoids in \textit{C. procera}, \textit{C. fistual} and \textit{W. somnifera} during some particular season. Ambashta (1980) also observed an increase in the concentration of carotenoids in cement dust polluted leaves of \textit{Psidium guajava}.

Brandt and Rhoades (1972\textsuperscript{34}, 1973\textsuperscript{35}) also observed the reductions of growth of dominant trees in dusty sites.

Darley (1975) concluded the following ideas in his review paper. He summarizes that there has been relatively little research on the effects of particulate matter on vegetation, and most of the experiments done to date have dealt with specific kinds of dusts rather than the conglomerate mixture normally encountered in the atmosphere.

The significance of dusts as phytotoxicants is not yet entirely clear but there is considerable evidence that certain fractions of cement kiln dusts adversely affect plants when naturally deposited on moist leaf
surfaces. Dry cement kiln dusts appear to have little deleterious effect, but in the presence of moisture, the dust solidifies into a hard adherent crust, which can damage plant tissue and inhibit growth. Moderate damage has been observed on the leaves of bean plants dusted at the rate of about 0.47 mg/cm²/day (400 tons/mile²/month) for 2 days and followed by exposure to naturally occurring dew.

At levels in excess of 1.0 g/m²/day (85 tons/mile²/month), incrustations, premature needle drop and shortening of each succeeding year's flush growth have been observed on the branches of fir trees. Although the mechanism by which injury occurs is not entirely understood, there is evidence to support theories such as screening of light, plugging of stomatal openings and direct injury to plant tissue by the chemical reaction of the dust on the leaf surface.

It should be noted, however, that the harmful effect of cement dust on vegetation is not fully substantiated and has been questioned by some workers. Darley (1975) mentions that not all studies have been carried out under identical conditions or with dusts deposited on the soil also raise questions some investigators report no harmful effects at levels from 1.5 to 7.5 g/m²/day, (130 to 640 tons/mile²/month), cause shifts in the soil alkalinity which may
be favourable to one crop but harmful to another.
The great disparity between experimental results and the conclusions drawn by many investigators is due to the fact that pollutant called cement kiln dust is actually a heterogeneous substance whose constituents and amounts vary with time and location. No general conclusions can be drawn about the effects of cement kiln dust until each dust source is classified and studied separately.

AIMS AND OBJECTIVES OF THE PRESENT STUDY:

With the rapid growth of population industrialization and urbanization is becoming a common feature in the geography of each town in the country. Narsingarh (Damoh) is a town which has adrantange of mineral wealth like lime stone in the nearby areas. Due to the easy availability of raw materials, major cement industry was established. Since year 1983, the environment of Narsingarh, Imlai and near by villages of Industrial Area of Damoh District, is facing the impacts of hazard of air pollution, soil pollution and water pollution due to cement dust.

Cement dust as rated by sax (1975) as irritant, allergen and on inhalation causes significant pulmonary fibrosis. It is due to the particle size as well as its chemical composition. It is composed of compounds of lime, aluminium, silica and iron oxide as (4 CaO,Al\(_2\)O\(_3\).Fe\(_2\)O\(_3\)). (3 CaO.Al\(_2\)O\(_3\)). (3 CaO.SiO\(_2\)) and (2 CaO.SiO\(_2\)), abbreviated
as $C_4AF$, $C_3C$, $C_2S$. Small amounts of sodium potassium and sulphur are also present in combined form.

Based on the observations mentioned earlier in the literature review and the general survey carried at Narsingarh, Imlai and nearby villages of Damoh District (M.P.) regarding the studies of Air pollution, soil pollution and water pollution status of the villages, town and public complaints, against the Air, Soil and Water pollution due to cement, it was thought worth while to study some aspects of the effects of cement dust pollution. In Damoh District Kopra and Sonar rivers are flowing in the Industrial Area of Narsingarh and Imlai region. Since environment in relation to man is directly concerned with soil, air, water, plants and living organism, it has been proposed in the present study to observe the effects of cement dust falling on vegetation soil, water resulting soil pollution and Water pollution and finally affecting the human health. It is not possible to study each component of environment at initial stage, hence at the first instance the scope of the present study has been aimed for following objects :-

(i) General Description of the study area;
(ii) Studies of water pollution;
(iii) Studies of soil pollution;
(iv) Studies of effect of cement dust on human health.
(v) Studies of effect of cement dust on vegetation;
(vi) Major controlling steps taken by the Government in Co-operation with the public and in the National Planning to control Soil, Water and Air Pollution.

Thus in brief the object of the study is also to adopt measures and precautions by the government to control the pollution through proper scientific techniques, agronomical practices, forestation and other legal devices and advices, sponsored by the Government in co-operation with the public.
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