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IMPACT OF CEMENT INDUSTRIAL EMISSION ON AGRICULTURAL POLLUTION: A CASE STUDY OF JK CEMENT INDUSTRIAL PLANT, KASHMIR, INDIA

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ABSTRACT

Study has been carried out to assess the impact of cement industrial emission on agricultural pollution and inversely affects crop yielding plant productivity in the two selected villages around the JK Cements Ltd plant in Khrew tehsil of Pulwama district. This study is conducted in order to analyse the correlation between cement industrial pollution and its impacts on agricultural productivity. Several emissions produced in cement manufacturing industries playing a major role in the deterioration and contamination of global environment and brought several hazardous changes in agricultural productivity. Man has made several types of industries for their own benefit. No doubt these industries have increased the economic profits of several industrialists on one hand, but on the other hand, these industries have degraded, damaged and contaminated to all the components of our environment. The cement emission, produced by cement manufacturing processing is considered one of the most hazardous pollutants which affect the all surrounding environmental components like water, air, soil and all green plant vegetation. Increased concentration of the cement manufacturing emission pollutants can cause continuous reduction in the photosynthetic process ability of all green plant leaves, resulting reduction of crop productivity, loss of soil fertility, scarcity of food and finally the death of crop yielding plant species.

KEYWORDS: *cement industry, environmental impact assessment, environmental problems, cement emission, agricultural pollution.*

INTRDUCTION:

Agriculture is the main occupation in the Pulwama district and it plays an important role in the economy of the district. The agriculture products like paddy, oil seeds, fodder, saffron & milk are the main contributors to the Gross Domestic Product (GDP) of the District. District Pulwama is famous for saffron cultivation which is mainly grown in Karewa lands of Pampore, Kakapora and Pulwama blocks. The area under saffron cultivation during 2010-11 was 2414 hectares. Among the fruits, apple, almonds, walnut, cherry and Apricot are the important fruits in this district. But after the establishment of JK cement industrial plant, there have been tremen dous degrading changes in the agricultural productions throughout the area because of continues air, water and soil pollutions.

Environment plays an important role in the

emergence of life on the planet of Earth. . All living things are directly and indirectly dependent on environment for day to day needs and approximately 95 % of the human needs which includes food, shelter, water, medicines and much more are derived from the environment. The air which we breathe (oxygen) comes from all green plants species which is important component of our environment. Survival of life on the planet of earth is impossible without environment because it provides us basic requirements of life and probably we can't live for a minute and in this way we can estimate the importance of environment in our life. But multiple industrial activities are degrading and damaging various environmental components like water, air, soil, green plant vegetation and human health in an unprecedented speed and if we will fail to control this speed, then the day is not far away to us when we have to lost our environment and if we will lost our environment, we will lost everything because in every way human life is dependent on environment. The environmental pollution as a result of cement industrial emission could be defined as an undesirable process that is responsible to pollute our environment, harm to human health and finally degrade our society through its various activities, right from the mining activity of the raw material to its crushing, grinding and other associated processes in cement plants.

Cement industry is one among the 17 most polluting industries listed by the Central Pollution Control Board (CPCB). Cement industry is the major source of various harmful matters such as SOx (sulphur oxides) NOx (nitrogen oxides) and CO2 (carbon dioxide) emissions, huge quantities of dust and smoke, chlorides, fluorides, sulphur dioxide, carbon monoxide, and smaller quantities of organic compounds and heavy metals like nickel, cobalt, lead, and chromium pollutants which harmfully affects human health, environmental components and agricultural production. These industries also emit 100,000 kilograms of toxic fumes, poisonous gases and life threatening elements in the air on daily basis. It is estimated that the 5-6% of all greenhouse gases are generated by human activities originates from cement manufacturing process. These emissions are not only deteriorating air quality but also degrading human health, global environment, resulting global warming, ozone depletion, acid rain, biodiversity loss, reduction in crop production and finally scarcity of food and water. Soil pollution is also caused due to constant fall of cement dust which contains harmful substances resulted in the formation of colloidal gels of calcium silicate and calcium aluminates which affects and degrades fertility quality of soil and when the soil loses its fertility capacity then its direct effects goes to plant growth life and loss of crop production (Sarala Thambavani and Saravanakumar, 2011; 2012).

REVIEW OF EXISTED LITERATURE

The impact of the cement dust on soil properties and plant production has been investigated by some researchers (Saralabai and Vivekanadau 1995, Schuhmacher et al 2004., and Zerrouqi et al., 2008). Cement kiln dust is proven to have cytogenetic and mutagenetic properties (Shivkumar et al., 1995). Cement dust pollutants causes reduction in the photosynthetic ability of leaves, mechanism of open-closing leaf stomata and, mainly, a reduction in growth and productivity of plants (Larcher 1995). Cement dust contains different particulate pollutants which harmfully affecting our vegetation part of environment (Iqbal and Shafig 2001). The role of cement pollutants causing injury to plants either by direct toxic effect or modifying the host physiology rendering it more susceptible to infection (Gupta and Mishra 1994). Cement dust pollution has been described as an additional stress on crop yielding plants since they often respond to atmospheric contamination in the same way as they respond to drought and other environment stressing severe case of pollution, the injury symptoms were expressed as foliar necrosis or completely disappearance of the plant (Mishra 1996). (Samal and Santra 2002) have also previously studied the impact of cement dust pollution on crop yielding plants and with reference to foliar anatomical and biochemical changes by experimenting on various sensitive plants. One of the most recent studies of these stresses was a dust accumulation, which provokes severe damage in the photosynthetic apparatus and finally reduction in crop production (Santosh and Tripathi, 2008). It was found that dust deposition affect photosynthesis, stomatal functioning and productivity (Santosh and Tripathi, 2008).

STATEMENT OF THE PROBLEM

The investigator while scanning the literature found that no study have been conducted on the current research problem. The investigator found that the entire field is unexplored and after making in-depth study of

different surveys, journals and other research inputs, it is found that no systematic study have been conducted which could objectively study the impact of cement emission on agricultural production in the study area So, therefore taking these things in our mind, we have chosen this problem in my current research paper. We hope this research will be useful for the planners and policy makers to frame several policies and schemes for improving the agricultural productivity problems facing in the study area due to cement industrial pollution.

METHODOLOGY

In order to study the impact of cement industrial emission on the agricultural pollution, Jk cement industrial plant has been selected in order to analyse the correlation between cement industrial emission and agricultural pollution. The investigator has followed the Normative Survey method that is found to be most suitable method for gathering the essential, reliable and required data.

The study was purposively conducted in the two villages namely Noginder and Bathen which are located around the cement plant. The present study is based on the descriptive research design to evaluate the changes that occurred in the agricultural production due to the harmful emissions of selected cement industrial plant. The study is based on both primary as well as secondary data. The primary data were gathered with the help questionnaire schedule and interview method and the secondary data were collected from the various sources like journals, internet and official governmental departments.

OBJECTIVES OF THE STUDY

1.To study the impact of cement industrial emission on the crop production of plants.
2.To study the impact of cement industrial emission on the physical growth of plants.
3.To study the impact of cement industrial emission on the soil fertility.

HYPOTHESES OF THE STUDY

1.There is no impact of cement industrial emission on the crop production of plants.
2.There is no impact of cement industrial emission on the physical growth of plants.
3.There is no impact of cement industrial emission on the soil fertility.

SAMPLING PROCEDURE

In the study area the total population is 1050 i.e. 588 in Noginder village, 462 in Bathen village as per census 2011. Out of the total population, the researcher has selected 10 percent i.e. 105 respondents by applying the stratified random sampling technique for the purpose of data collection regarding

DATA ANALYSIS AND INTERPRETATION

The collected data has been analyzed by coding and tabulating. Simple percentage and Chi-Square test were applied to analyze the data regarding the changes brought in the agricultural production by JK Cement industrial plant in the study area with an intention to draw a logical conclusion.

Table 1: Age wise Distribution of the Selected 105 Respondents

Age Group	NO. of Respondents	Percentage
21-30 Years	34	32.38
31-40 Years	35	33.33
Above 40 Years	36	34.28
Total	**105**	**100.00**

Table 1 presents data on the age wise distribution of the respondents. It could be noted that out of the total 105 respondents, 34.28 percent of the respondents are belong to the age group of Above 40 years and 33.33 percent of them fall in the age group of 31-40. The remaining 32.38 percent of them belong to the age group of below 21-30 years. It is clear from the above table that the majority of the responds are in the age group of Above 40 years.

Table 2: Caste wise Distribution of the Selected 105 Respondents

Caste Group	No. of Respondents	Percentage
General Caste	52	49.52
Backward Caste	34	32.38
Most Backward Caste	19	18.09
Total	**105**	**100.00**

Table 2 indicates the caste wise distribution of the respondents. It could be noted that out of the total respondents, 49.52 percent of them belong to general castes and 32.38 percent of them belong to backward castes. Only 18.09 percent of the respondents belong to most backward castes. It could be seen from the table that most of the respondents belongs to General castes and backward castes.

Table 3: Educational level wise Distribution of the Selected 105 Respondents

Educational Level	No. of Respondents	Percentage
School dropouts	36	34.28
High School Level	43	40.95
College level	20	19.04
Diploma/ Technical	6	5.71
Total	**105**	**100.00**

Table 3 Shows that data on education wise distribution of the respondents. It could be noted that out of the total respondents, 40.95 percent of the respondents are high school level and 34.28 percent of them have school dropouts. 19.04 per cent of them have college level education and only 5.71 percent of them have diploma in technical education. It could be seen that mostly respondents are high school level education.

Table 4: Income wise Distribution of the Selected 105 Respondents

Monthly Income (In Rs)	No. of Respondents	Percentage
Up to 3000	34	32.38
3000-6000	43	40.95
6000-12000	20	19.04
Above 12000	8	7.61
Total	**105**	**100.00**

Table 4 presents the data on the income wise distribution of the respondents. It could be observed that out of the total respondents, 40.95 percent of them earn between Rs. 3000-6000 per month and 32.38 percent of them earn up to Rs. 3000 per month. 19.04 percent of them earn between Rs. 6000-12000 and 7.61 percent of them earn Rs. above 12000 per month. It is clear from the above discussion that majority of the respondents are in the Rs. 3000-6000 income group.

Table 5: Age wise 105 Respondents Opinion on Effects of Cement Emission on Agricultural Production

Age Group	No. of Respondents					
	Loss of Soil Fertility		Crops Retarded		Change of Crops Colour	Total
21-30 Years	16	(40%)	14 (36.84)		4 (14.81)	34 (32.38)
31-40 Years	6	(15%)	19	(50%)	10 (37.03)	35 (33.33)
Above 40 Years	18	(45%)	5 (13.15)		13 (48.14)	36 (34.28)
Total	**40**	**(100)**	**38**	**(100)**	**27 (100)**	**105 (100)**

X^2 Calculated value : 16.42
No. Of degree of freedom : 4
X^2 Tabled value (5% level of significance) : 9.488

The variations in the levels of Cement Industrial Pollution between different age groups such as those who are below 30 years, those who are 30-40 years, and those who are above 40 years among respondents are defined in hypothesis-1, taken up and its results are shown in the table-5, as an outcome of Chi-Square model test. From the results of this Chi-Square model shown in table-5, it can be inferred that the X^2 Calculated value: 16.42 corresponding to Cement Industrial Pollution on each different considered Age group is found greater than the X^2 Table value 9.48 at 5 percent level. Hence, hypothesis-1 is rejected at 5 percent level of significance. This result clearly shows that there exists significant variation in the Cement Industrial Pollution and Agricultural production on different Age groups.

Table 6: Caste wise 105 Respondents Opinion on Effects of Cement Emission on Agricultural Production

Caste Group	No. of Respondents							
	Loss of Soil Fertility		Crops Retarded		Change of Crops Colour		Total	
General Caste	32	(53.33)	13	(46.42)	7	(41.17)	52	(49.52)
Backward Caste	18	(30%)	13	(46.42)	3	(17.64)	34	(32.38)
Most Backward Caste	10	(16.66)	2	(7.14)	7	(41.17)	19	(18.09)
Total	**60**	**(100)**	**28**	**(100)**	**17**	**(100)**	**105**	**(100)**

X^2 Calculated value : 14.34
No. Of degree of freedom : 4
X^2 Tabled value (5% level of significance) : 9.488

The variations in the levels of Cement Industrial Pollution between different Caste groups such as those who are General Castes, those who are Backward Castes, and those who are Most Backward Castes among respondents are defined in hypothesis-2, taken up and its results are shown in the table-6, as an outcome of Chi-Square model test. From the results of this Chi-Square model shown in table-6, it can be inferred that the X^2 Calculated value: 14.34 corresponding to Cement Industrial Pollution on each different considered Caste groups is found greater than the X^2 Table value 9.48 at 5 percent level. Hence, hypothesis-2 is rejected at 5 percent level of significance. This result clearly shows that there exists significant variation in the Cement Industrial Pollution and Agricultural Production on different Caste groups.

Table 7: Education wise 105 Respondents Opinion on Effects of Cement Emission on Agricultural Production

Educational Level	No. of Respondents							
	Loss of Soil Fertility		Crops Retarded		Change of Crops Colour		Total	
School dropouts	19	(40.42)	12	(25.53)	5	(45.45)	36	(34.28)
High School Level	10	(21.27)	29	(61.70)	4	(36.36)	43	(40.95)
College level	17	(36.17)	2	(4.25)	1	(9.09)	20	(19.04)
Diploma/ Technical	1	(2.12)	4	(8.51)	1	(9.09)	6	(5.71)
Total	**47**	**(100)**	**47**	**(100)**	**11**	**(100)**	**105**	**(100)**

X^2 Calculated value : 26.5
No. Of degree of freedom : 6
X^2 Tabled value (5% level of significance) : 12.592

The variations in the levels of Cement Industrial Pollution between different Educational level groups such as those who are Illiterates, those who have School level education, those who have College level education

and those who have Technical education among respondents are defined in hypothesis-3, taken up and its results are shown in the table-7, as an outcome of Chi-Square model test. From the results of this Chi-Square model shown in table-7, it can be inferred that the X^2 Calculated value: 26.5 corresponding to Cement Industrial Pollution on each different considered Educational groups is found greater than the X^2 Table value 12.59 at 5 percent level. Hence, hypothesis-3 is rejected at 5 percent level of significance. This result clearly shows that there exists significant variation in the Cement Industrial Pollution and Agricultural Production on different Educational groups.

Table 8: Income wise 105 Respondents Opinion on Effects of Cement Emission on Agricultural Production

Monthly Income (In Rs)	No. of Respondents							
	Loss of Soil Fertility		Crops Retarded		Change of Crops Colour		Total	
Up to 3000	18	(26.08)	13	(52%)	3	(27.27)	34	(32.38)
3000-6000	30	(43.47)	9	(36%)	4	(36.36)	43	(40.95)
6000-12000	17	(24.63)	2	(8%)	1	(9.09)	20	(19.04)
Above 12000	4	(5.79)	1	(4%)	3	(27.27)	8	(7.61)
Total	**69**	**(100)**	**25**	**(100)**	**11**	**(100)**	**105**	**(100)**

X^2 Calculated value : 18.85
No. Of degree of freedom : 6
X^2 Tabled value (5% level of significance) : 12.592

The variations in the levels of Cement Industrial Pollution between different Monthly Income groups such as those who have up to 5000, those who have 5000-10000, those who have 10000-15000 and those who have above 15000 among respondents are defined in hypothesis-4, taken up and its results are shown in the table-8, as an outcome of Chi-Square model test. From the results of this Chi-Square model shown in table-8, it can be inferred that the X^2 Calculated value: 18.85 corresponding to Cement Industrial Pollution on each different considered Monthly Income groups is found greater than the X^2 Table value 12.59 at 5 percent level. Hence, hypothesis-4 is rejected at 5 percent level of significance. This result clearly shows that there exists significant variation in the Cement Industrial Pollution and Agricultural Production on different Monthly Income groups.

FINDINGS OF THE STUDY

1.From the analysis of the data, the study has found that majority of the age wise respondents stated that their agricultural production have been affected either loss of soil fertility, crop retardation of plants or even changing colour of crop yielding production due to the establishment of the JK Cement Industrial Plant in their residential zone. It is inferred from the table 5 that more than 45 percent of respondents in the age group of above 40 years have stated that their agricultural production have been changed due to loss of soil fertility, more than 50 percent respondents in the age group of 30-40 have been responded that their agricultural production has been affected due to crop retardation problems, 48.14 percent respondents in the age group of above 40 years have responded that their agricultural production has been affected due to the changing colour of leaves because of excessive cement industrial pollutions.

2.From the analysis of the data, the study has found that majority of the caste wise respondents have stated that their agricultural production have been affected either loss of soil fertility, crops retardation or even changing colour of leaves of the crop yielding plants due to the establishment of the JK Cement Industrial Plant in their residential zone. It is inferred from the table 6 that more than 53 percent of respondents in the general caste group have been responded that their agriculture has been affected loss of soil fertility, more than 46 percent respondents in the general and backward caste groups have responded that their agriculture has been affected by crop retardation problems, 41.17 percent respondents in the most backward and general caste groups have responded that their agriculture has been affected due to changing colour of leaves because of excessive

cement industrial pollutions.

3. From the analysis of the data, the study has found that majority of the educational wise respondents have stated that their agricultural production have been affected either loss of soil fertility, crops retardation or even changing colour of leaves of the crop yielding plants due to the establishment of the JK Cement Industrial Plant in their residential zone. It is inferred from the table 7 that more than 40 percent of respondents in the dropouts have responded that their agriculture has been affected due to loss of soil fertility, more than 61 percent respondents in the high school level have responded that their agriculture has been affected due to crop retarded problems, 45.45 percent respondents in the dropouts group have responded that their agriculture has been affected due to changing colour of leaves of the crop yielding plants because of excessive cement industrial pollutions.

4.From the analysis of the data, the study has found that majority of the monthly income wise respondents have stated that their agricultural production have been affected either loss of soil fertility, crops retardation or even changing colour of leaves of the crop yielding plants due to the establishment of the JK Cement Industrial Plant in their residential zone. It is inferred from the table 8 that more than 43 percent of respondents in the 3000-6000 income group have responded that their agriculture has been affected due to los of soil fertility, 52 percent respondents in the up to 3000 income group have responded that their agriculture has been affected due to crop retarded problems, 40.95 percent respondents in the 3000-6000 income group have responded that their agriculture has been affected due to changing colour of the crop yielding plants because of excessive cement industrial pollutions.

CONCLUSION

The analysis concludes that JK Cement Industrial Plant have affected the agricultural production in the study area. So, this indicates that there is a positive correlation between cement industrial pollution and the degradation of agricultural crop production in the study area. The study has shown that agricultural crop production has been affected in either loss of soil fertility, crop retardation or even sudden changing colour of plant leaves and these agricultural problems has taken the origin in the study area after the establishment of the JK cement industrial plant. It is inferred from the study that many diseases are occurring in all types of crop plants in every year because of continuous release of some harmful substances from this cement industrial plant in the study area. It is also inferred from the study that the local people are suffering from food shortage, pure water to drink and clean air to breath.

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