

# A CRITICAL LITERATURE REVIEW OF AIR POLLUTION IN CEMENT INDUSTRY

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## ABSTRACT

Cement is key constructive material for infrastructure. Cement is a second consumptive product after water and cement sectors are also major contributor in air pollution. With degradation of air quality basic problems like climate change is happen. Fruitfulness of this reviews are to provide and suggest Sustainable development solutions with using mitigation strategies of air pollution in cement sectors. Sustainable Development is to meet the demand without compromising needs of future generation. Impact of this study is to check effectiveness of some sustainable development solutions and create harmonization between different developing sectors.

**Keyword:** - Climate Change, Sustainable Development, Cement

## 1. INTRODUCTION

Cement is key constructive material for infrastructure. Cement is a second consumptive product after water and cement sectors are also major contributor in air pollution. Cement is basically produced from burning a mixture of calcereous and silicious material with smaller amounts of alumina ( $Al_2O_3$ ) and iron oxide ( $Fe_2O_3$ ) (combined as the raw meal) together at high temperature.<sup>6</sup>

### 1.1 Manufacturing Process of Cement :

Cement is the substance which holds concrete together, which means that it is extremely widely used in our society. It has been manufactured in New Zealand for more than 100 years, and during this century production has increased one hundred-fold. Portland cement (the only type of cement in common use today) is manufactured in a four step process.

#### Step 1 - Quarrying

Limestone and a 'cement rock' such as clay or shale are quarried and brought to the cement works. These rocks contain lime ( $CaCO_3$ ), silica ( $SiO_2$ ), alumina ( $Al_2O_3$ ) and ferrous oxide ( $Fe_2O_3$ ) - the raw materials of cement manufacture.

#### Step 2 - Raw material preparation

To form a consistent product, it is essential that the same mixture of minerals is used every time. For this reason the exact composition of the limestone and clay is determined at this point, and other ingredients added if necessary. The rock is also ground into fine particles to increase the efficiency of the reaction.

#### Step 3 - Clinkering

The raw materials are then dried, heated and fed into a rotating kiln. Here the raw materials react at very high temperatures to form  $3\text{CaO}\cdot\text{SiO}_2$  (tricalcium silicate),  $2\text{CaO}\cdot\text{SiO}_2$  (dicalcium silicate),  $3\text{CaO}\cdot\text{Al}_2\text{O}_3$  (tricalcium aluminate) and  $4\text{CaO}\cdot\text{Al}_2\text{O}_3\cdot\text{Fe}_2\text{O}_3$  (tetracalcium aluminoferrate).

#### Step 4 - Cement milling

The 'clinker' that has now been produced will behave just like cement, but it is in particles up to 3 cm in diameter. These are ground down to a fine powder to turn the clinker into useful cement. Cement production has several quite serious environmental hazards associated with it: dust and CO<sub>2</sub> emissions and contaminated run-off water.<sup>8</sup>

1.2 Table-1–Emission from Cement Manufacturing Process

Sr. No.	Point of Generation	Air Pollutant
1	Coal Mill	Dust
2	Clinker	Dust,SO <sub>2</sub> ,VOC,NO,NO <sub>2</sub> ,NO <sub>x</sub> ,CO <sub>2</sub> ,CO
3	Clinker Cooler	Dust
4	Cement Mills	Dust
5	Crusher Stack	Dust
6	Packing Plant Stack	Dust

## 2. CRITICAL LITERATURE REVIEW

In this chapter, a brief overview of historical background followed by the brief review of earlier investigations carried out on Air Pollution and Sustainable development related to cement industries. Waste of cement industries are presented. Evaluation of Air Pollution and Sustainable development related to cement industries and the work done on this field is described over here.

India is the second largest cement producing country. In the last decade, installed production capacity of Indian cement industry has increased almost two fold (from 61 to 110 million tones / annum). At present, there are large cement plants in the country.

Air pollution is a major problem in cement industry. During the process of cement manufacture considerable amount of dust is emitted at almost every stage. For control of dust emission, the Central Pollution Control Board developed the emission standards for cement industry in 1986. Since then, significant developments have taken place in terms of cement production as well as technologies. In order to develop a composite index for determining the performance of emission control systems, the Central Pollution Control Board commissioned a study on "Development of emission factors for cement industry". The study was conducted through the National Productivity Council, New Delhi.<sup>1</sup>

**Winkler Harald (2005)** said that UNFCCC and its Kyoto Protocol, and summarizes national commitments to making the effort required to mitigate climate change by limiting the emission of greenhouse gases. They have to identified, focus on particular on carbon markets and adaptation of funding. Also fix the emissions targets for developing countries. The gap between current targets and the projected emissions says greater mitigation effort is needed.<sup>2</sup>

**Sathaye Jayant et al.** stated that The most effective way for climate change is to adopt a sustainable development pathway by shifting to environmentally sustainable technologies and promotion of energy efficiency, renewable energy, forest conservation, reforestation, water conservation, etc. India and other developing countries will face the challenge of promoting mitigation and adaptation strategies, bearing the cost of such an effort, and its implications for economic development.<sup>7</sup>

**Nyirenda Gibson et al. (2014)** studied that Current environmental management practices have dissimilar effects on sustainable development. These practices in the fields of health and law are more indicative of policy based practices, while those in engineering and industry are more hands on and concludes by recommending that these environmental management practices be harmonized across the different sectors of society which will result in improved sustainable development and promote green economic development.<sup>3</sup>

**Patil K. et al. (2012)** State that The combustion of coal and tyre are used in cement industry to generate heat energy at 1300°C and remaining residue to enhance the strength of the cement. Combustion experiments were conducted using Nelson reactor under controlled conditions in presence of air and nitrogen gas (INOX). The temperature range was varied from 300-1300C. At the highest temperature around 1300C, the effluent of combustion of both (coal and tyre) fuels was practically devoid.<sup>4</sup>

**Patil R. K. et al. (2002)** concluded that Future policy for climate change need to recognize the diverse situations of developing countries like their level of economic development, their vulnerability to climate change, and ability to adapt to or mitigate it.<sup>5</sup>

### 3. MAJOR FINDINGS OF CRITICAL LITERATURE REVIEW OF AIR POLLUTION IN CEMENT INDUSTRY:

After completion of critical literature review, Following are the various major findings from critical literature reviews as follows:

1. For mitigation climate change by limiting green house gases too much effort are needed.
2. To mitigate climate change sustainable development is most effective way but developing countries like India, they are facing some problems to adopt these strategies.
3. To achieve sustainable development in different sector harmonization is necessary in society.
4. In cement industry to get highest temperature; use tyre as a co combustion and coal as a fuel is acceptable and after combustion at highest temperature no residue are present.
5. In the way to mitigation of climate change for developing countries some question are always there.

### 4. CONCLUSIONS

In this work global strategies and potentials towards mitigation of air pollution reduction in cement plant is discussed. Cement industry plays an important role in air pollution. Emissions from cement industries based on their process which require replacement of old strategies to new emerging strategies/technologies but not with degradation of environment. Replacement should not be with compromising demands of future generation. So, with sustainable development solution should mitigate air pollution.

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