

Cement Industries, Their Effect on Environment & Management

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Abstract— World's most seriously problem is global warming and environment pollution, many reasons are responsible for environment pollution & global warming. Cement industry is one of the major part of this, cement industry contributes 7% of total emission of CO₂ in atmosphere which is major reason of global warming and environment pollution. Cement is the primary binding material used in various construction work like dam, building, bridges, canal, tunnel and many other. It has the binding property which bind aggregates and sand together to form hard and rigid structure. It reacts with water and gets harden property. But it has some drawbacks like:

- cement manufacturing emits lots of CO₂ gas which is harmful for environment.
- Cement manufacturing process depends on fossil fuels burning which is natural minerals and is limited and also pollute environment by burning itself.
- If there are any alternate to cement by waste products then cement is expensive then other for any project.

Cement manufacturing industry is one of the carbon dioxide emitting sources besides deforestation and burning of fossil fuels. The global warming is caused by the emission of green house gases, such as CO₂, to the atmosphere. Among the greenhouse gases, CO₂ contributes about 65% of global warming. The global cement industry contributes about 7 % of greenhouse gas emission to the earth's atmosphere. In order to address environmental effects associated with cement manufacturing, there is a need to develop alternative binders to make concrete. Consequently, extensive research is on going into the use of cement replacements, using many waste materials and industrial by products. The cost of cement used in concrete works is on the increase and unaffordable, yet the need for housing and other constructions requiring this material keeps growing with increasing population, thus the need to find alternative binding materials that can be used in partial replacement of cement. There are several industrial and agriculture waste product which can be used as pozzolanas or in place of cement like flyash, coconut shell ash which is also economical or sometimes more durable and as well as more strengthening material. The main objective of this study is to determine the alternate of cement in more percentage and reduce cement production in respected ratio to protect environment against global warming and air pollution by CO₂ emission.

Key words: Cement Industries, Pollution, Alternate Fuel, Alternate Material to Cement: Fly Ash, Coconut Shell Ash, Rice Husk Ash Etc

I. INTRODUCTION

Cement production, in any country, plays a major role in the growth of the nation. The cement industry in its various processes emits Suspended Particulate Matter (SPM) and oxides of nitrogen besides carbon dioxide, which is

produced during calcinations process. The emission of carbon dioxide depends on the type of production processes, their efficiency, fuel used, yet concrete is a desirable construction material with relatively low embodied energy, very useful thermal mass and high potential durability. Particulate matter is the main pollutant emitted from cement industries.

Cement manufacturing is an energy intensive process. The production of cement (key binding component of concrete) is costly, consumes high energy, depletes natural resources and emits huge amounts of greenhouse gases (1 ton of cement production emits 1 ton of CO₂). Consequently, environmental degradation, serious pollution and health hazards associated with cement and concrete industries, have come under intense scrutiny from environmentalists and the governments. Consuming energy from fossil fuels such as oil and coal creates carbon dioxide, the most important Greenhouse Gas causing climate change. In industrial sector, cement industry is the second largest emitter of carbon dioxide and accounts for 5 per cent of global manmade carbon dioxide emissions, of which 60 per cent is from the chemical process and 40 per cent from burning fuel. Majority of particulates emitted from cement industry may range from 0.05 to 5.0 µm in diameter. Concentration of CO₂, CO, NO_x and SO₂ in the flue gas emanating from the kiln stack was also measured by permanently installed gas sensors. Average concentrations of CO₂, CO, NO_x and SO₂ in the kiln stack emission were 16.1%, 222.6 mg/Nm³ (Normal cubic meter), 1127mg/Nm³ and 3.8 mg/Nm³, respectively, and these values were similar to an earlier report done for cement kilns. These concentrations amounted to emissions of 160.1 Mt/h (Mt-megaton) of CO₂ and 123, 623 and 2.1 kg/h emissions of CO₂, CO, NO_x and SO₂, respectively.

The Emission Standards for Existing Cement Industry with plant capacity of 200 tonnes per day and less in all sections for protected area is 250 mg/Nm³ and in other area 400 mg/Nm³. Similarly the standard for plant capacity of greater than 200 tonnes per day in all sections for protected area is 150 mg/Nm³ and in other area 250 mg/Nm³. About 60 percent of emissions caused by making cement are from this chemical process alone.

As a rough estimate, total carbon dioxide emissions range from 0.85 – 1.15 tonne of cement produce, assuming clinker to cement ratio as 0.95. The approximate contributions of each of the three main sources of carbon dioxide emissions are Calcinations - 50-55 percent; Fuel combustion - 40-50 per cent and Electricity - 0-10% (assuming that electricity is generated from fossil fuels).

A. Global Production of Cement

In 2010, the worldwide production of cement was about 3.3 billion tonnes [4]. China is the largest cement producer (1,880 million tonnes), followed by India (210 million

tonnes) and the United States (67 million tonnes). The world cement production in 2010 is shown in Figure

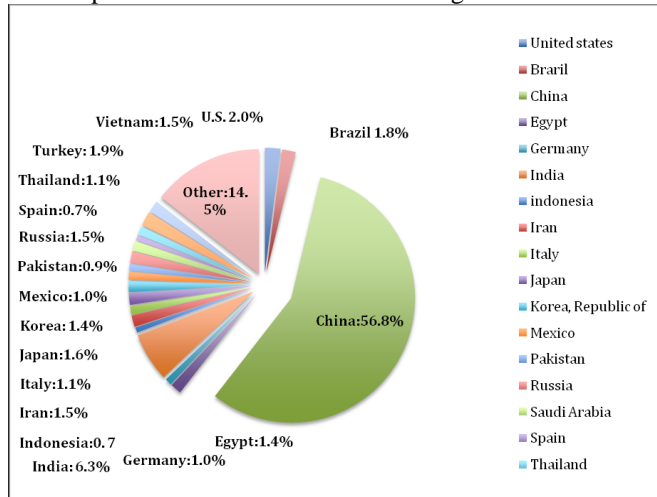


Fig. 1:

II. POLLUTANTS FROM CEMENT INDUSTRY

Four criteria air pollutants are released to the air during cement manufacturing which includes particulate matter (PM), nitrogen oxides (NOX), sulfur dioxide (SO₂) & carbon dioxide (CO₂) which can be categorized into two headings:

- 1) Particulates
- 2) Gaseous pollutants

Particulates Particulate air pollution is a complex mixture of small and large particles of varying origin and chemical composition. Larger particles, ranging from about 2.5 microns to 100 microns in diameter, usually comprise smoke and dust from industries. Smaller particles those less than 2.5 microns in diameter generally come from combustion of fossil fuels. **Gaseous pollutants** Gaseous pollutants have major negative impacts on health. They also play an important role in environmental changes in atmospheric chemistry. The combustion of fuels at high temperatures in cement kilns results in the release of NOX emissions, which causes various health adverse health effects. In SO₂ emissions from cement plants result from the combustion of sulfur-bearing compounds in coal, oil, and petroleum coke, and from the processing of pyrite and sulfur in raw materials. Cement manufacturing releases carbon dioxide (green house gas) in the atmosphere both directly when calcium carbonate is heated, producing lime and carbon dioxide, and also indirectly through the use of energy if its production involves the emission of carbon dioxide.

III. CEMENT INDUSTRIES IN INDIA

India is the second largest producer of cement. In india there are more than 180 no. of major cement plant and more than 350 no. of small cement plant. Cement production by indian cement industry is about 350 MT per annum which is estimated 470 MT in year 2017. The indian cement industry is accounting for about 8% of the total global production. It had a total cement manufacturing capacity of 375-390 million tonnes as a financial year ended 2014-2015. Cement is a cyclical commodity with a high correlation with GDP. The housing sector is the biggest demand driver of cement, accounting for about two third of the total consumption. The

other major consumers of cement include infrastructure, commercial construction and industrial construction. According to a survey, with nearly 390 MT of cement production capacity, india is the second largest cement producer in the world and account for 6.7 percent of world's cement output. The cement production capacity is estimated to touch 550 MT by FY20. Of the total capacity, 98% lies with the private sector and the rest with the public sector. The top 20 companies account for around 70 % of the total production. A total of 188 large cement plant together account for 97% of the total installed capacity in the country, while 365 small plants make up the rest. Of the total 188 large cement plants in india, 77 are located in the state of Andhra Pradesh rajasthan and tamilnadu.

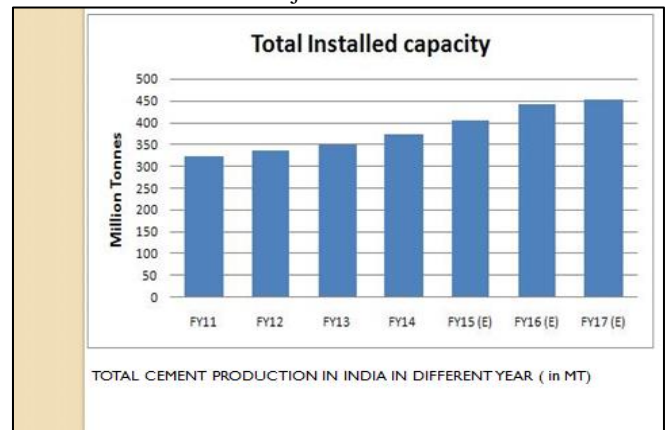


Fig. 2:

IV. METHODOLOGY & INVESTIGATION

For the control of global warming by the cement industry some analysis are given below:

The main reason of pollution from cement industry is to

- Burning of fossil fuels for clinker production, and
 - Calcination process of lime
- The burning of fossil fuels like coal (80%), petroleum gases such fuels emits lot of CO₂ and other harmful gases by burning itself and the percentage of smoke emissions by fossil fuels is 60%. Calcination process of lime emits CO₂ is 40% of total pollution from cement industry. Now, how to control pollution by cement industry is the main objective for this purpose the effective and practical terms are analysed and they are
- Use alternate fuel or eco-friendly fuel for burning purpose in cement industry.
 - Use waste material or BY-products for replacing cement in concrete as more as possible by this burden on cement can reduce.
 - Dry mix process unit should be installed more as compared to wet mix process because wet mix process of cement production requires too much heat.
 - Use filter or precipitator in cement plant chimney to capture particulates matter and hazardous gases from smoke of cement plant.
 - Beware of industry's owner and society as well as people against pollution by the cement industries.

A. Alternate fuel

Alternate fuel like renewable energy source, nuclear energy, burnable waste material (industrial & agriculture)

B. Replacement of Cement

there are several waste materials are to be tested for replacement of cement like flyash, coconut shell ash, stone waste etc in great proportion.

- Waste materials are fly ash, rice husk ash, coconut shell ash, stone waste etc
- Air filter equipment fabric filter, electrostatic precipitator, scr, snrcr, scrubber, thermal oxidizer

V. CONCLUSION

Cement production can be minimized by using rice husk ash fly ash and other waste product. As 25% of Rice husk ash can be substituted for cement without effecting the cement strength. The best alternative is the use of Green cement which is a cementitious material that meets or exceeds the functional performance capabilities of ordinary Portland cement by incorporating and optimizing recycled materials, thereby reducing consumption of natural raw materials, water, and energy, resulting in a more sustainable construction material. According to previous study cement is replaced 40% by flyash and 20% by coconut shell ash which give result in control cement demand and helpful in cement manufacturing reducing which is feasible for controlling pollution by the cement industries. An alternate fuel is used in place of coal or other carbon majority fuel can also control the pollution during burning of itself. Because fossil fuel burning emits lots of CO₂ to the atmosphere which contributes 60% of total pollution of total pollution by cement industries.

VI. SCOPE OF THE THESIS

Since, cement industry emits lots of CO₂ and other harmful gases and pollutants matter which responsible for environment pollution, global warming so, the study of this thesis is provide data about different type of drawbacks of cement manufacturing and their effect on nature, this thesis also provide waste product utilization in place of cement and alternate fuel use in cement industry.

A further study is need in the direction of protect environment against cement industry because cement industry contributes 5% of global warming by the CO₂ gas and other pollutants emission in the atmosphere and whole world is tend to move towards the growth in construction sector so what there is lot of chances to growth in cement production in future.

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