

Environmental Risk Assessment, Health Hazards and Aspect of Eco-Labeling of Cement Dust Pollution

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Abstract:- Cement industries is among the primary sectors of the Indian economic system. Surely that the commercial units are dependable for the total socio-economic progress of the locality, even as it contributes considerably to the pollution drawback of the subject around. Trendy cement industries have taken measures to manage the air pollution outcomes. These constructing industries are probably the most leaders in deterioration of atmosphere via depleting assets, energy consumption or production of waste inflicting giant amount of emissions of acidifying and greenhouse gases. Cement being one of the crucial world's most large manufactured substances most commonly used as building and civil engineering building material. Considering that of its needs and abundance on the global market, working out on the environmental implications of cement manufacturing is fitting increasingly most important. Cement enterprise is a power and energy giant intensive rich and products many odors, noise and emissions. The emissions of gaseous pollutants from cement plants which motive finest problem and which need to be handled are carbon dioxide, sulphur dioxide, dirt and nitrogen oxide. This review paper deals and connects the readers with the discussions of the most important environmental misfortunes involving the cement production. Evaluation of cement have an effect onto atmosphere is a very fundamental method. There are new methods of evaluation on this area. Environmental evaluation and eco-labeling of cements has been preceded.

Keywords:- Air, Cement, Cement Industry, Clinker, Effluents, Emissions, Environment, Rotary Kiln And Preheater System, Solid Waste, Trade Waste, Waste Lime, Water.

I. INTRODUCTION

Cement industries is one in all the key sectors of the Indian financial process has been swiftly developing and progressing and it is envisioned to develop additional. Cement is a most important product for the society providing effortless, comfortable and dependable today's infrastructure and housing. In establishing nations, building work goes at very excessive charge and cement essentiality is at prime. As

there may be rapid industrialization and urbanization going on, the negative blessings of pollution closer to the environmental deterioration can also be popping up at an alarming rate. Cement enterprise would deteriorates air, land and water by means of its quite a lot of pursuits, as from the quarrying and mining undertaking of the raw resources material (dolomite, limestone, and so on) to its crushing, grinding, and other relevant systems in cement plant. Noise emissions too occur during the entire cement manufacturing system from making ready and processing of raw material, from the cement production method and clinker burning approach, from resources storage as good as from the dispatch and shipping of the final products. The neighboring atmosphere (air, water and soil) across the cement enterprises is being polluted by many industrial effluents popping out of cement plants. Carcinogenic and noxious pollutants which are tremendously poisonous are emitted from cement kiln. Adversarial respiratory wellness results are also visible inside the men and women uncovered to cement dirt.

Cement is an inorganic, finely powdered, non-metallic in nature, which on mixing with water forms a paste that unit and hardens. This kind of hydraulic hardening is most likely because of the formation of hydrates of calcium silicate consequently of the response between mixing water and the element factors of the cement. Cement is a mixture of aluminates and silicates of calcium. Within the case of aluminous cements, hydraulic hardening entails the formation of calcium aluminates hydrates. Usual Portland cement is made up of peculiarly of calcium silicate minerals. Mostly cement producing enterprise use dry technique (approx. 96%) and very few use the semi dry method and the wet approach. Mostly unit produces Portland cement at the same time only a few are concerned in white cement. Effluents from cement industries must be handled with no trouble to shrink the air pollution. A current pattern within the area of cement construction is the point of interest on using waste material in cement production, the related reduction of carbon-dioxide emissions and on low-energy cements. Cement plant entails following input and output process as raw resources; energy fuels; water and air consumption and Clinker; approach losses/waste (filter dusts); air emissions (e.g. NO_x, dust, SO_x); water emissions (in rare cases) respectively [1].

The primary steps in cement production incorporate mainly raw materials preparation; clinker creation and finish grinding are illustrated in figure 1.

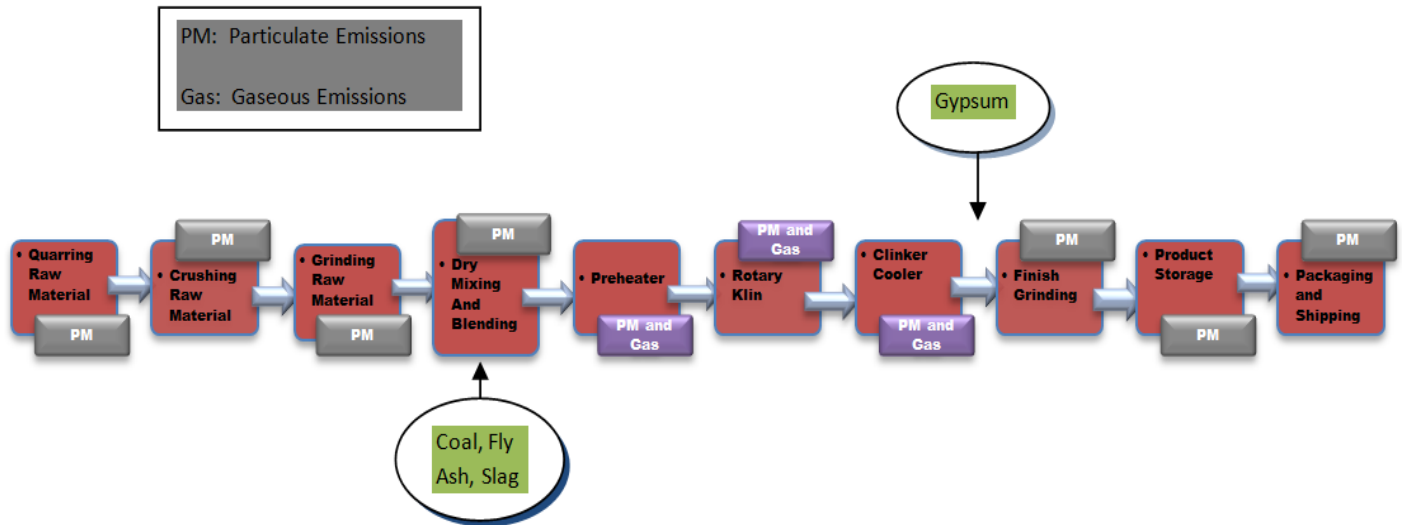


Fig 1:- Process flow diagram for the manufacture of cement [2]

II. HEALTH HAZARDS AND ENVIRONMENTAL IMPACTS FROM CEMENT DUST

The dirt emitted from cement plant would be categorized as nuisance dust or inert dirt & can also be described as dirt that includes lower than 1% quartz. Cement filth involves heavy metals such as lead, cobalt, nickel, and chromium pollution noxious to the Mother Nature [3], with hostile, have an effect on for human and animal wellness, vegetation and ecosystems. Waoo *et. al.* (2014) studied Extraction and Analysis of Heavy Metals from Soil and Plants around industrially contaminated soils, Govindpura, Bhopal. Sediment concentrations had been characterized with the aid of the increased values of Cr (209.1mg/kg), Pb (199.5 mg/kg) at the same time Cd (70.2 mg/kg). The toxic degree of chromium in soil is approximately 2-50 ppm, and in assessment with this value range chromium measurements were very excessive in the investigation subject. Imperative levels of chromium for the vegetation are 5-10 ppm, 0.006-18 ppm and their outcome confirmed that the investigated subject area runs a danger of chromium pollution in soil samples. More than a few plants were additionally analyzed and tested for heavy metal evaluation and they usually confirmed the higher storage and accumulation of heavy metals [4].

Cement dust causes irritation in the mucous membrane of the eyes, the skin and the respiratory approach [5]. Any response that can arise from such dirt is potentially reversible. Nevertheless, immoderate concentrations of cement dirt within the work and site place may just cut down visibility, could intent unpleasant deposits in ears, nasal passages and eyes, and could motive damage to the epidermis or mucous membranes via mechanical or chemical-motion

[6]. Right waste manage and remedy procedure is wanted for effluent popping out from cement enterprises so damaging influence of those pollutants will also be lessen to hold atmosphere and reusing the waste resources in other method.

The most important environmental disorders concerning cement creation are consuming energy and raw resources, as well as its emissions to air. The kind and amount of air pollution depend on certain parameters, e.g. inputs (the fuels and raw materials used) and the variety of procedure implemented. The clinker burning system is the main, a part of the approach, in phrases of the key environmental disorders for cement production. Cement industry in India is mostly location specific as they tend to be constructed around their source of raw material i.e. lime stone mines. The limestone is carried to the nearby cement plants where they are further crushed and cooked in the presence of gypsum to produce clinker. Cement is thereafter made from clinker. The entire method motives quite a lot of noise, vibration and dirt. The extensive quarrying and mining of raw material besides adding various noxious pollutants to the biosphere also disturbs the overall ecosystem of the Mother Nature.

A number of studies are on hand on the influence of cement dirt emission on Mother Nature [7, 8, 9, 10, 11]. The Kodinar region in Saurashtra of Gujarat has 04 Cement Plants- Ambuja Cement, Gajaambuja-I, GajaambujaII and Sidhi Cements. A study was conducted to check the impact of cement enterprise pollution on chlorophyll of chosen plant species of *Arachis Hypogaeo* (Ground Nut), *Sesamum Indicum* (Till which is an oil seed) & *Triticum Species* (Wheat which is the main Rabi crop). The impact was studied over a distance of 0.5 kms, 1km and 3 kms. The study

showed that the chlorophyll contents of crops near the cement plant were more damaged and the extent of damage decreased with increase in distance from the cement plant [12].

Okoro *et. al.* (2017) reported the assessment of Heavy Metals Contents in the Soil around a Cement factory cum manufacturing unit WAPCO in Ewekoro, Nigeria making use of pollution Indices from three areas (Ewekoro, Papalanto, and Itori). The outcome printed that the imply ranges of the heavy metals pollution content in the three soil samples have been in the order: Fe > Zn > Mn > Cr > Cu > Pb. The concentrations and pollution indexes of the heavy metals within the soil samples were found to minimize as the distances of the communities from the cement manufacturing facility improved. The studied area and investigated soils have been affected by dirt emissions from the cement manufacturing unit as proven within the very low concentrations of heavy metal contents of the control study area, Itori [13].

Cement enterprise is a source of continuous flows of cement dirt and their makeup constituent gases similar to SiO₂, CO₂, SO₂ and CO adversely have an impact on the ingesting water resources like mine pits, ponds and wells, surrounding areas as well as nearby vegetation. The presence of total solids within the type of salts of Na, Ca, K, Al, and Mg as hydroxides sulphates and silicates leads to and imparts hardness of water which reasons gastro intestinal ailments and dust related illnesses [14]. The control of environmental pollution in a cement industry would involve control of dust both in the mines as well as the cement plant. It also involves refilling of the open cast mines with excavated debris and its subsequent afforestation.

III. AIR EMISSIONS AND CONTROL

In cement and lime manufacturing air emissions are generated by way of the utilization and storage of intermediate and completing substances, and through the approach of kiln techniques, mills and clinker coolers. The important polluting factors emitted to air are nitrogen oxides, total natural carbon, carbon oxides, dirt, dibenzofurans, metals, sulphur dioxide, polychlorinated dibenzo-p-dioxins, hydrogen fluoride and hydrogen chloride are exhausted and emitted as well. Nitrogen oxide emissions are exhausted and generated within the excessive temperature combustion system of the cement kiln [15]. Sulfur dioxide emissions in cement manufacturing are particularly related to the content of risky, volatile or reactive sulfur within the raw materials and in fuels [16].

In cement enterprise emission of particulate matter (PM) is without doubt one amongst most predominant impacts of cement production [17]. Emissions of PM are related to intermediate and final materials utilization (grinding and crushing of raw substances) and storage,

storage and usage of solid fuel, moving of materials and packaging pursuits. Rai *et. al.* (2013) observed the impact of Maihar cement plant at Satna district of Madhya Pradesh on the human health of the people living around it. Sample based study was made especially on the impact of suspended particulate matter (SPM), sulphur dioxide and nitrogen oxide. The conclusion of the study showed more concentration of SPM in the area surrounding cement plant than the permitted limit of 200ng/m³. However, the sulphur dioxide and nitrogen oxide concentrations were found to be below the limit of 80ng/m³. There were seasonal variation in concentration of SPM, sulphur dioxide and nitrogen oxide. Highest concentration was seen during winter followed by summer followed by monsoon. Study was made on the prevalence of various diseases like respiratory disease, gastrointestinal disease, blood pressure, dental and eye problem. The population in the sample area around the Maihar cement showed the greater incidence of respiratory diseases than other problems [18].

De-carbonation of limestone and gaseous combustion emits greenhouse gases particularly carbon dioxide [19]. Contribution of carbonmonooxide is only 5-1% of green house gas emission [20] whereas majority attained through emission by way of organic subject. Raw material, waste fuel and fossil gas may intent significant emission of heavy metallic equivalent to mercury, lead, cadmium and many others [21]. Raw resources and waste gasoline can generate unstable and volatile metal (mercury), which are not feasible to manage utilizing filters most effective, however nonvolatile metals are traditionally adheres to the particulate matter.

Bioremediation approach for heavy metals either microbial or plants based, could be a rayhope for the safer biosphere. Phytoremediation is an essential tool against the industrial soil pollution because it takes advantage of natural plant processes [22]. The application of in vitro systems for basic research in phytoremediation helps to study the role of plants for the remediation of contaminated sites, and in the improvement of their effectiveness. Wao *et. al.* (2015) showed the importance of Phytoremediation in an article Phytoremediation: An Ultimate Hope for the Planet [23] after exploring and concentrating on their research studies on Evaluation of Phytoremediation Potential of *Datura innoxia* (native plant species of study area) as a heavy metal accumulator plant in an industrially contaminated area in Bhopal, India as a part of vegetation enhanced bioremediation. *Datura innoxia* having phytoremediational importance, hyper accumulating plants and can survive in highly heavy metal containing area. Phytoextraction studied and results of *Datura innoxia* revealed higher accumulation and phytoremediation potential in case of heavy metals like copper, lead, nickel, cadmium, and chromium in the leaves and shoots with highest amount of lead and chromium [24].

Encouraged tactics to manage emission of heavy metals are: activated carbon for absorption of heavy metals and effective dirt / PM abatement to seize bound metals will have to be used [25]. Handled material must be managed as a hazardous, monitoring of combustion material i.e. structure, properties, control emission by using measures accordingly, composition, restrict emergency shutoffs of the electrostatic precipitators; hinder usage of waste fuel for the duration of startup or shutdown. Pulverized coal frequently lignite and black coal are the most in general used energy fuel within the cement enterprise however petroleum coke (pet-coke) is favored since it is less expensive [26]. Each generates bigger emissions of greenhouse gases (GHG) than fuel oil and typical gasoline (~ sixty five percent higher emissions than with fuel). The handling and storage of fuels is a potential supply of illness and contamination of groundwater and soil.

In the beginning in cement industries the exhaust fuel used to be emitted to the atmosphere without reduction treatment. A good wide variety of cement plants showed tremendous efforts in regulating and controlling the emissions by means of excellent prepared managed measures like Bag Filter (BF) and Electro Static Precipitator (ESP), APCD gadgets which have excessive de-dusting effectivity throughout natural conditions and these cements plants are preserving their pollution degree. Fugitive emissions (emission not from stack) in cement plant remains to be are a primary quandary and are ready for new mighty applied sciences. To diminish very high sulphur dioxide emission moist scrubbers or Circulating Fluidized bed Absorber (CFBA) are used within the plant [27]. Selective Catalyst reduction is used to manage and control emission of nitrogen oxide. Adsorption of heavy metal, volatile organic carbon, sulphur dioxide and nitrogen oxide may also be accomplished on POLVITEC (AAC), Activated Coke.

IV. WATER EMISSIONS AND CONTROL

In cement industries water is being utilized at a number of levels in the course of the construction system. In only some instances, water is utilized in clinker burning process, for the preparation of raw material and cooling processes of manufacturing process, such as in the technological process for slurry production, as well as for the cooling of gases. In cement construction with the aid of utilizing the dry or the semi-dry process, water is most effectively utilized in small quantities, e.g. for cleansing processes. Process wastewater with suspended solids and excessive pH is also generated in some operations [28]. In principle, effluent does not generate during cement production process as no emissions to water arise since quite often water utilized for cooling reason is reused and recycled within the system [1]. Waste water discharge is commonly confined to surface run off and floor and cooling water most effective and reasons no tremendous contribution significant to water pollution.

Ipeaiyeda *et. al.* (2017) characterized the impact of cement effluent on Onyi River at Obajana, Nigeria. The monitoring of river was done up to about 1 km downstream from the discharge point. With upstream dilution of the effluent, the levels of phosphate, nitrate, pH, TS, TSS, TDS, turbidity and BOD at downstream location were much high, arising from the influx of cement effluent showing river water strongly impacted with metal pollution with Pb (0.016 ± 0.001 mg/L) and Zn (0.045 ± 0.003 mg/L) such that they overpasses the limits set by WHO and USEPA respectively. Accordingly, downstream water required adequate healing, prior to its use for useful functions [29].

V. CURRENT TREND OF CO-PROCESSING SOLID WASTE IN CEMENT INDUSTRIES

In cement production mainly solid waste includes spoil rocks and clinker production, which might be removed from the raw resources during the preparation of raw materials. Fly ash and kiln dirt from energy power plant also blanketed in solid waste. Different other waste materials are exhausted and generated from plant renovation and maintenance like metallic scrap and used oil. Typically these wastes resources are disposed via landfill in open air which purpose several inhale and lung problem [30]. Now lots of the cements plants utilizing fly ash for cement manufacture. Lime waste from crushing division may be utilized in sulphate treatment or clinker construction after re-crushing. Generally broad mining movements contact the water desk and could pollute ground water. Deposit of dirt in open field reason land pollution and degradation and in addition deposits over plant leaves. Dirt accumulated from special air pollution controlling gadgets is reused in manufacturing system [31].

Using waste resources in industrial methods as substitute fuels (waste fuels) and raw resources to get better vigour power and resources from them is co-processing. Nevertheless, these wastes cum raw resources ought to exhibit meeting similar traits, components and chemical element that could be an integral for the clinker burning system. The intense high temperature (2000°C) and lengthy residence duration in cement kiln (clinker burning approach) helps in discarding and disposing all forms of high calorific worth wastes (e.g. waste oil, waste plastics, used tires, used solvents, and natural chemical waste together with obsolete organo-chlorine pesticides, polychlorinated biphenyls (PCBs), and different chlorinated materials simply with none hazardous emissions [32]. Nevertheless, if they don't seem to be managed could cause emissions of unstable compounds like polychlorinated dibenzodioxins (PCDDs), dibenzofurans (PCDFs), hydrogen chloride (HCl), volatile organic compounds (VOCs), hydrogen fluoride (HF), and poisonous metals and their compounds. In co-processing approach emission are lowered and the treatment leaves no residue, which makes it more eco- friendly and sustainable approach of waste disposal in comparison to incineration and land filling [33].

VI. CONCLUSION

Cement enterprise is indispensable for the progress of the economic climate. Effluent from cement enterprise inflicting various variety of pollution (strong solid waste, air and water) will have to be treated readily to lessen the air pollution with heavy metals being a primary crisis. Reusing waste products and co-processing of solid waste in cement kiln will aid in lessening of waste product. A present pattern in the area of cement creation is the point of interest on utilization of waste in cement construction, on low-energy cements and the associated reduction of carbon dioxide emissions.

Cement enterprises comes beneath red mark class as per CPCB norms. Analysis of cement impact to atmosphere is an awfully major approach. Eco-labeling of cements and environmental comparison are approaches of pollution evaluation in this area. As cement plant tends to affect a wide range of surrounding areas, the State Pollution Control Board should conduct a public hearing before granting approval to any particular cement plant for starting operations. There is a need for the State Pollution Control Boards (SPCBs) to regularly monitor the environmental parameters around the cement plants. Regular submission of Environmental Statement (ES) will point out whether there may be any significant growth in environmental pollution manipulate and control through the enterprise or not [34].

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