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Recent review on physicochemical investigation of ground water receiving leachates from Ash pond of thermal power plant

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Abstract: Thermal power plants produce large amount of fly ash during the combustion of coal. Fly ash is the noncombustible mineral matter in coal which is thermally altered as it cycles through the combustion process. In recent years a significant amount of fly ash is being utilized in various sectors like construction, building engineering, road, back filling and in agriculture. Inspite of its many desirable geotechnical characteristics, it contains a large number of heavy metals. These metal ions get released readily in aqueous environment, causing future threat to environment. The leaching of coal fly ash during the disposal from the plant is of great concern for potential contamination of soil, surface water and ground water. The unmanaged fly ash disposal may result in significant problems for ecology and environment. The leaching of fly ash during disposal is of concern for possible contamination, especially for aquatic environment when ash is in direct contact with water. No ash pond lining is employed in the construction of the ash pond; hence leaching of heavy metals is possible. Promotion of increased use of fly ash in construction activities, proper disposal practices with better management need to be undertaken to minimize the adverse impacts of fly ash on the surrounding environment. In this article, recent review on physicochemical investigation of ground water receiving leachates from ash pond of thermal power plant has been highlighted.

Keywords: Physicochemical, Water, Leachates, Ash, Thermal

INTRODUCTION:

The Fly-ash mission was commissioned in 1994 with the Department of Science and Technology as the nodal agency and the Technology Information and Assessment Council (TIFAC) as the implementing agency. The Ministry of Environment and Forests, Govt. of India, Ministry of Power, Thermal Power stations, R&D Institutions and Industry together have launched a Technology Project in Mission Mode (TPMM). Their focus is on the demonstration of coal ash related technologies for infusing confidence and thus ensuring large scale adoption. Fly ash utilization has great potential to lower green house gas emissions by decreased mining activities and reducing Carbon dioxide production during manufacture of materials that can be substituted by fly ash. Fly ash can substitute up to 66% of cement in the construction of dams. It is also used as a pozollanic substitute for cement in Roller Compacted Concrete dams-an innovative dam technology developed as a result of efforts to design more economical concrete dams that could be constructed rapidly with designed performance. Fly ash in R.C.C. is used not only for saving cement cost but also for enhancing strength and durability. Replacement levels of fly ash primarily Class F, ranges from 30-75% of total cement material. Fly ash can also be used in Portland cement concrete to enhance the performance of the concrete. Portland cement is manufactured with Calcium oxide, some of which is released in a free state during hydration. As much as 20 pounds of free lime is released during the hydration of 100 pounds of cement. This liberated lime forms the necessary ingredients for reaction with fly ash silicates to form strong and durable cementing compounds thus improving many of the properties of concrete. Typically, 15-30% of the Portland cement is replaced with fly ash. This results in net reduction in energy use and greenhouse gas and other emission.

REVIEW OF LITERATURE:

According to Padmavathi Papolu et al. (2019), groundwater is extremely valuable to all of the earth's living things. The quality of ground water is contaminated when pollutants are present in greater amounts. Thermal power stations using coal emit emissions that are harmful to the environment. The quality of the ground water and surface water is impacted by the massive amount of bottom ash produced as a result of burning coal and being turned into a water slurry and driven into the ash pond. This essay examines the effects of the Dr. NTTPS thermal power plant's ash pond on the quality of ground water. Fresh water samples are taken from the chosen sampling locations close to the ash pond, and the main physico-chemical characteristics are examined. At the Ibrahimpatnam, Mulapadu, and Keleswarapuram sample sites, which are near to the ash pond areas, it is discovered from the values recorded in all three seasons that the ground water quality is impacted and unfit for drinking without treatment. While heavy metal ions are within the WHO standards, Ibrahimpatnam and Mulapadu localities have high levels of TDS and total hardness.

According to Mane B.U. and Gaikwad V.B. (2019), fly ash produced by thermal power plants when coal is burned is a significant environmental problem. Environmentalists are becoming increasingly concerned about the need to completely eliminate the massive quantities of solid waste produced by coal-fired thermal power plants. The management of fly ash is a major issue for thermal power facilities. Runoff from the open disposal of fly ash can degrade the quality of the groundwater. In the current investigation, ground water samples were taken from three places near the Parli-Vaijnath thermal power plant between June 2017 and May 2018. In the lab, the fly ash samples were examined for their physico-chemical characteristics and heavy metal concentration. pH, turbidity, temperature, electrical conductivity, alkalinity, total dissolved solids, total hardness, calcium hardness, and magnesium hardness were among the parameters that underwent physico-chemical analysis. The area's groundwater is unfit for drinking since all locations had physico-chemical parameters that were over the acceptable range. The presence of lead and cadmium in the groundwater samples was also examined, and it was discovered that lead exceeded the limit while cadmium was found to be within the limit. So, this study's goal was to learn more about the many physiochemical characteristics of this water.

According to Chanchal Verma and Ranjeet Verma (2019), a significant issue in coal-fired thermal power plants is the disposal of the vast amounts of fly ash that are produced. The rank and grade of the coal determine its quality. Indian coal contains between 35% and 50% fly ash, which is made up of several harmful substances, including heavy metals that harm the environment. The leaching of coal combustion wastes throughout the phases of transportation, disposal, and storage could contaminate ground and surface waters. In acidic or ion-exchangeable environments, the fly ash that was richer in Ca, Ni, and Fe demonstrated increased leachability. The principal solids dissolving in an aggressive environment and/or precipitation sorption processes, which are heavily reliant on pH, are the main mechanisms of metal leachability. While Ca is extremely soluble and leaches out of practically all media, Fe is found to be securely bonded to the ash and does not leach easily. Trace elements can leach out of fly ash depending on how much time has passed and what is the pH level of the leaching solution?

CONCLUSION:

Fly ash filled unsaturated polyester resin has been cast into sheets and tensile strength, flexural strength and flexural modulus compared with calcium carbonate filled polyester resin (Saroja

Devi et al., 1998). The fly ash filled polyester resin was found to have a better flexural modulus than the calcium carbonate filled polyester resin.

Fly ash from 050% content has also been mixed with post-consumer polyethylene terephthalate (PET) to produce a molded composite material (Yadong et al., 1998). The fly ash reduced the thermal decomposition of PET, expedited the melting and mixing characteristics and reduced the shrinkage of material during the moulding process. The addition of fly ash also increased the compressive strength by 31-53% and water absorption was found to be negligible.

Adsorption of arsenic on fly ash was found to conform to Freundlich's isotherm and the efficiency of adsorption was comparable to activated carbon (Sen and De, 1987). Arsenic was also successfully removed from samples of industrial wastewaters. Adsorption of cadmium and chromium from wastewater by adsorption onto fly ash was investigated to determine the effects of contact time, pH and temperature (Viraraghavan and Rao, 1995). An aqueous medium pH of 7-8 was found optimal for removal of cadmium and a pH of 2-3 for chromium. Batch adsorption experiments conducted at 5, 10 and 21°C showed that the adsorption capacity of fly ash decreased with increase in temperature. The maximum removal levels at 5°C of cadmium and chromium were 93 and 44%, respectively.

Fly ash effectively adsorbed mercury from wastewater when the contact time was 2 hour and the pH was 5-5.5 (Viraraghavan and Kapoor, 1992). When fly ash was treated with radionucleotide containing water, removal of cesium-137 was at a maximum at neutral pH, whereas strontium-90 adsorption increased with pH, especially above pH 8 (Resat et al., 1996). Tobermorites synthesized from oxides and from fly ash has also been shown as a resource in the separation, immobilization and disposal of radioactive species, such as Cs and Sr (Ma et al., 1995). The acid-base properties of fly ash were found to be suitable for the removal of heavy metals such as nickel, cadmium, chromium, lead, copper, mercury and zinc from industrial wastewaters (e.g. electroplating and battery manufacture). Fly ash being readily available and inexpensive was considered an economic alternative to conventional adsorbents such as activated carbon and ion- exchange resins.

In stochastic approach transport of pollutants in porous medium is accidentally processes and variable for flow and transport are accidentally characteristic too. Flux liquid phase and transport everyone components is always three dimension process. Chemical and biological reaction that can change concentration contamination in ground water can be divided in six groups: (Sperac, 2003)

- Processes of adsorption and desorption
- Reaction at the sour base

- Processes of melt and sedimentation
- Oxidation and reduction
- Ionization connection
- Microbes cellular synthesis

REFERENCES:

Chanchal Verma, Ranjeet Verma (2019). Leaching Behaviour of Fly Ash: A Review, Nature Environment and Pollution Technology, 18 (2), pp. 403-412.

Devi, M. Saroja., Murugesan, V., Rengaraj, K., Anand, P. (1998). Utilization of fly ash as filler for unsaturated polyester resin. *Journal of Applied Polymer Science;69,* pp. 1385-1391.

Ma, W., Brown, P. W., Komarneni, S. (1995). Sequestration of cesium and strontium by toberomite synthesized from fly ashes. *Journal of American Ceramics Society*; 79, pp. 1707-1710.

Mane B.U. , Gaikwad V.B. (2019). The effects of thermal fly ash discharge in nearby drinking water resources, Parli-Vaijnath Thermal Power Plant, Parli-Vaijnath, Dist. Beed. (MS)., Journal of Emerging Technologies and Innovative Research, 6 (5), pp. 76-79.

Padmavathi Papolu, Jyotsna Cherukuri, M Anji Reddy (2019). Impact of Ash Pond on the Groundwater Quality In The Vicinity Of a Coal –Based Thermal Power Plant, Chemical Science Review and Letters, 8 (31), pp. 125-131.

Resat, R., Atun, G., Guclu, K., Tutem, E. (1996). Sorptive removal of cesium-137 and strontium-90 from water by unconventional sorbents II-usage of coal fly ash. Journal of Nuclear Science and Technology; 33, pp. 396-402.

Sen, A. K. and De, A. K. (1987). Adsorption of arsenic on coal fly ash. *Indian Journal of Technology;* 25, pp. 259-261.

Sperac, M. (2003): urbanization Impact on hydrology. XIII International Symphosium on Water Management and Hydraulic Engineering, 5-9 October 2003., Podbanskee, Slovakia.

Viraraghavan, T. and Kapoor, A. (1992). Adsorption of mercury from wastewater by fly ash. *Adsorption Science* & *Technology*; 9, pp. 130-147.

Viraraghavan, T. and Rao, A. K. G. (1995). Adsorption of cadmium and chromium from wastewater by fly ash. *Journal* of *Environmental Science* and *Health, Part* A; 26, pp.721-753.

Yadong, L., White, D. J., Peyton, R. L. (1998). Composite material from fly ash and post consumer PET. *Resources, Conservation* and *Recycling*; 24, pp. 87-93.