The effects of thermal fly ash discharge in nearby drinking water resources, Parli-Vaijnath Thermal Power Plant, Parli-Vaijnath, Dist. Beed. (MS).

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Abstract

Thermal power plant generates a huge amount of fly ash on combustion of coal which is becoming a major environmental issue. The total eradication of the huge amounts of solid waste from coal-fired thermal power plants is becoming a critical problem to the environmentalists. Thermal power plants are greatly facing a fly ash management problem. Open dumping of fly ash can deteriorate the groundwater quality by runoff. In the present investigation, the ground water samples were collected from nearby areas of Parli-Vaijnath thermal Power Plant at three locations during the period of June 2017 to May 2018.

The fly ash samples were taken to the laboratory and analyzed for physico-chemical properties and heavy metal content. The physico-chemical analysis was done for the parameters like pH, Turbidity, Temperature, Electrical Conductivity, Alkalinity, Total Dissolved Solids, Total Hardness, Calcium Hardness and Magnesium Hardness.

The physico –chemical parameters was exceeding the standard at all locations and shows that the groundwater of the area is not fit for drinking. The ground water samples were also analyzed for the presence of lead and cadmium and it was found that lead was exceeding the limit although cadmium was found within the limit. Thus the aim of this study was to know about the different physiochemical parameters of this water.

Key words: Fly ash, Heavy metal, Physico- chemical parameters, Thermal power plant.

Introduction

Fly ash is defined as per Cement & concrete terminology, “Finely divided residue resulting from the combustion of ground or powdered coal which is transported from the fire box through the boiler by flue gases”. Fly ash is a waste material generates on the combustion of coal in power station throughout the world. The increasing amount of fly ash being generated from thermal power plants can pose a serious environmental threat (Nalawade *et al*., 2012). Fly ash contains major elements like Silica, Aluminum and Iron with significant amount of Calcium, Magnesium, Potassium, Phosphorous and Sulphur (Ivanova *et al*., 2011; Aswar, 2001). It also contain trace amount of some heavy metals like Molybdenum, Mercury, Selenium and Cadmium etc. (Adriano *et al*., 1980).

Fly ash in itself is a waste product and contains a huge problem for disposal. Fly ash is disposed off in ash pond by collecting it in the form of wet slurry (Singh *et al*., 2010). Disposal of fly ash in surface water bodies can damage the aquatic life. Mosquitoes and bacteria may grow in large number in slurry disposal lagoons/settling tank (Nawaz, 2013). The soil and water contamination from ash ponds has been a major subject of research all over the world (Theis *et al*., 1978; Theis and Richter, 1979; Theis and Gardner, 1990; Carlson and Adriano, 1993; Deshmukh *et al*., 1994; Deshmukh *et al*., 1995; Gulec *et al*., 2001; Praharaj *et al*., 2002; Singh *et al*., 2010; Ramya *et al*., 2013; Nawaz, 2013). The water quality plays a vital role for the mankind as it directly affects the human health. More than 90% population in India is dependent on groundwater for drinking purpose (Yadav *et al*., 2012; Ramachandraiah, 2004; Tank and Singh, 2010). The present study was done to assess the impact of fly ash disposal on groundwater quality near Parli-Vaijnath thermal power plant at Parli-Vaijnath.

Research Study Area

Locality near Parli-Vaijnath thermal power plant at Parli-Vaijnath was selected as the study area. Parli-Vaijnath thermal power plant is located at 18.868768° N and 76.526127° E. and Parli-Vaijnath is located at 18°.85 N and 76.5333° E. The villages like Naikota, Wadgaon Dadahari lies on East. Parli city and Dautpur lies on West to thermal power station, Sangam and Karam on North and Loni on South which all are join the Parli-Vaijnath city by narrow roads.

Method of Collection of Sample

The groundwater samples were collected from 6 different locations near Parli-Vaijnath Thermal Power Plant during June 2017 to May 2018. The water samples were collected in bottles which were pre-cleaned by nitric acid and distilled water in the laboratory.

The pre-cleaned bottles were also washed twice by water sample prior to collect the samples. The water samples were immediately taken to the laboratory and analyzed to minimize the physicochemical changes.

Physico-Chemical Analysis

Physico-chemical parameters like pH, turbidity, temperature, electrical conductivity, alkalinity, total hardness, calcium hardness, magnesium hardness and heavy metals like Lead and Cadmium were determined using standard methods of APHA (1995) and the methods by Trivedi and Goel (1986). The reagents of analytical grade were used for analysis and the instruments were calibrated.

Result and Discussion

The result of physico-chemical and heavy metal analysis of groundwater collected near Parli-Vaijnath Thermal Power Plant the pH value of studied samples ranges from 6.99 to 7.55 which conform to the IS 10500:2012 drinking water standard. High temperature may raise the alkalinity of water because it reduces solubility of CO_2. Temperature was ranges from 22ºC and 24.5ºC.

The turbidity was varied between 14.63 Nephelometric Turbidity Unit (NTU) to 15.78 NTU. It was found greater than the IS 10500:2012 standard in all the samples.

Conductivity is a carrying capacity of electrical current of a solution through the water (Gupta *et al*., 2013). Electrical Conductivity (EC) values were varied between 614 to 1317 µm/cm. It is directly proportional to the ionizable solids.

Alkalinity of water may be due to either the always presence of strong bases like sodium hydroxide or potassium hydroxide in water or the extreme low concentration of them. Maximum alkalinity of 455.5 mg/l was recorded in GW-1 and minimum i.e. 289.5 mg/l was recorded in GW-6 which exceeds the standard value. It may be due to the minimum rate of decomposition of salts caused by low temperature and low water table (Mahananda *et al*., 2010). The water is well buffered if it has high alkalinity.

The range of hardness analyzed is 143.84 – 725.20 mg/l. Some samples were within the standard of drinking water and some was exceeding the limit. Hardness caused excessive soap consumption and formation of scum due to the presence of calcium and magnesium in water

Different type of rocks, sewage and industrial waste are responsible for the calcium and magnesium in water (Trivedy and Goel, 1984). The values of calcium varied from 39.91 – 188.57 mg/l and the values of magnesium ranged from 95.56 – 640.78 mg/l.

Total Dissolved Solids and conductivity usually related with each other. The water is not considered good for drinking if TDS of water is more than 500 mg/l (Jain, 2002). The values of investigated samples were ranged between 209.5 – 958.5 mg/l. Half samples were within the drinking water standard of IS 10500:2012 and half were exceeding the limit.

The value of lead was ranged from 0.02 to 0.04 mg/l and the range of cadmium was 0.002 to 0.004 mg/l. Use of mineral phosphate fertilizer is important source of cadmium (Lambert *et al*., 2007).

Conclusion

In the present communication it concluded that the groundwater is contaminated in terms of Turbidity, alkalinity, magnesium, total hardness, calcium and TDS. This may be due to the disposal of fly ash near Parli-Vaijnath Thermal Power Station.

The study shows that the groundwater needs attention for certain degree of treatment before drinking. Perfect positive correlation evolved between Turbidity and Temperature (0.960), TH & EC (0.935), Mg & EC (0.0.955), Mg & pH (0.969) and perfect negative correlation evolved between TH & pH (-0.797) and Ca & pH (-0.803).

Finally it shows that Turbidity, Total Hardness and Magnesium are permanent in nature however there is no relation between TH & pH and Ca & pH.

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