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MONITORING OF PHYSIC-CHEMICAL PARAMETERS OF WASTE WATER FROM CEMENT INDUSTRIES

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ABSTRACT: Water pollution due to industrial activities has been destructive and recognized as a major environmental concern due to their occurrence and persistence. The hasty development of cement manufacturing in the state of Rajasthan of India has caused a severe anxiety to the ecological and social scientist. Pollution due to mining and cement industries in varying degree in air, water and soil and its consequences on living beings have been observed and reported. In the present research work effluent water samples from cement Industries were collected and analysed for different physicochemical parameters viz. pH, BOD, COD, TSS and TDS. The results revels that the effulent water form cement industries is not fit for any domestic use.

KEYWORDS: Effluent water, cement industries, waste water

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1. INTRODUCTION

Dissolved mineral deposits may affect suitability of water for a variety of industrial and household purposes. The well-known of these deposits is probably the occurrence of ions of calcium and magnesium which hamper with the cleansing action of soap, and can form hard sulfate and soft carbonate deposits in water reservoirs and boilers. Hard water can be converted into soft by removal of remove these ions. Hard water is preferred than soft water for human consumption, since health problems have been associated with excess sodium and deficiencies of calcium and magnesium. Although softening of water increase cleaning effectiveness but it decreases nutritional value. The manufacturing of cement involves mining; crushing, and grinding of raw materials mainly limestone and clay. The process of cement production starts from calcining the materials in a rotary kiln followed by cooling the resulting clinker and mixing the clinker with gypsum and milling, storing, finally bagging the finished cement. The process generates a variety of wastes, including dust, which is captured and recycled to the process.Waste matter from cement industries is composed of a mixture of chemicals, such as hydroxide, chlorides, sulphates of potassium and sodium and calcium carbonate, varying in composition over time. When mixed with the water, this waste matter may trigger a substantial change in pH, temperature, colour, suspended solid, conductivity and biological oxygen demand (BOD5) of the water body. This affects the normal environment for aquatic organisms with an unprecedented change in the amount of dissolved oxygen. This will affect the ecological parameters of the water body.Rokade and Ganeshwade showed high fluctuations in the physico-chemical parameters indicating the intensity of pollution. The pH ranged from 6.6- 8.4, chlorides 132.5 to 820.4mg/l, hardness 74 to 281 mg/l, CO2 2.1 to 5.09, BOD 4.437 to 112.432 mg/l, sulphates 0.192 to 5.12 mg/l, nitrates 0.5 to 1.012 [1] . Sharma et al. studied ground water quality of industrial area of Kishangarh and in cement industries for various physicochemical parameters seasonally without and after addition of marble slurry in different proportions. It is clear that these parameters increase with the addition of marble slurry leading to deterioration of the overall quality of the groundwater [2]. In the present study water samples from surrounding areas of cement and marble industries of Rajasthan state of India were collected and analyzed for determination of essential physio-chemical parameters pH, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS) and Total Dissolved Solids (TDS)

2. MATERIALS AND METHODS

The study was conducted near cement industries, marble production and cutting areas in the State of Rajasthan of India. The location is situated at 108 km away from the Jaipur Capital city of Rajasthan and cement plant situated from 172 km South of Ajmer. A cement factory and Marble industry is situated on that location. The study area shows characteristic tropical climate of two distinct seasons. Material of water collected near the site of industries from bore well and dugs. The water material collect from different water sources near the industries were collected in different bottles and labeled as Sample Point A, B, & C. For this study some chemicals, indicator, measuring meters and water testing equipment necessary for laboratory testing of effluent water. We have followed the testing rule of BIS for water testing procedures. These test were done in laboratory for the determination of different Physio-chemical parameter (pH, BOD, COD, TSS and TDS).

A. Sampling points

Near Cement industries sources like dug and bore well, Water for all industrial activities for the running of the day to day activities of the Cement Industry is extracted from this station. Human activities here include laundry works and bathing. Flora composition is chiefly grasses, herbs and shrubs. This station is surrounded by grasses, herbs and shrubs. Major agricultural activities take place here including farming.

B Water Sampling

The study was carried out in months between November 2014 and April 2015. The period corresponded to water levels in sources. Samples of water were collected from the experimental sample points. Collections were carried out using 5 liter plastic bottle sand 250 ml reagent bottles. The 5 liter bottle and 250ml. bottles were immersed below the water surface and filled to capacity, brought out of the water and sealedproperly. It is necessary to check that no air is trapped in the sample bottle. The samples were straight away stored on ice in a dark colour box and transported to the laboratory for analyzing within 24 hours of collection. All the analysis was based on standard methodsas prescribed in the BIS standard norms for each water quality parameter.

C Analysis of Physico-chemical Parameters

The air and water temperatures were measured at the sampling sites using mercury glass thermometer. For air temperature, the thermometer was held up right in the air with the fingers and with the lower part exposed to the air for about 5 to 6 minutes. For water temperature, the thermometer was immersed in water 8 cm below the water surface and left to stabilize for about five minutes. The average temperature of air and water was recorded in degrees centigrade (˚C). Digital pH meter (3880) was used for pH test of the samples. Dissolved oxygen was determined by the use of the modified Winkler's Azide method. In order to determine the biological oxygen demand of water samples of this study, the water sample was put in an incubator at a temperature of 20˚C for seven days after which the dissolved oxygen level was determined again. The difference in the dissolved oxygen values before and after incubation described the Biological oxygen demand (BOD5). Chemical oxygen demand (COD) determination was carried out by refluxing using potassium dichromate $K_2Cr_2O_7$ as the oxidant in the presence of $HgSO_4$ and H_2SO_4 reagent and then titrating excess $K_2Cr_2O_7$ against $Fe(NH_4)_2 \cdot (SO_4)_2 \cdot 6H_2O$ using ferroin indicator. For the total suspended solid test; the settle able solids were removed first and the Total Suspended Solid test conducted.

In this study, 100 ml of the filtrate from the TSS test was measured and poured into an initially pre-weighted evaporating dish in order to carry out the TDS test. The sample was evaporated to dryness and the mass of the dish measured and recorded. The TDS (in mg/l) was then calculated.

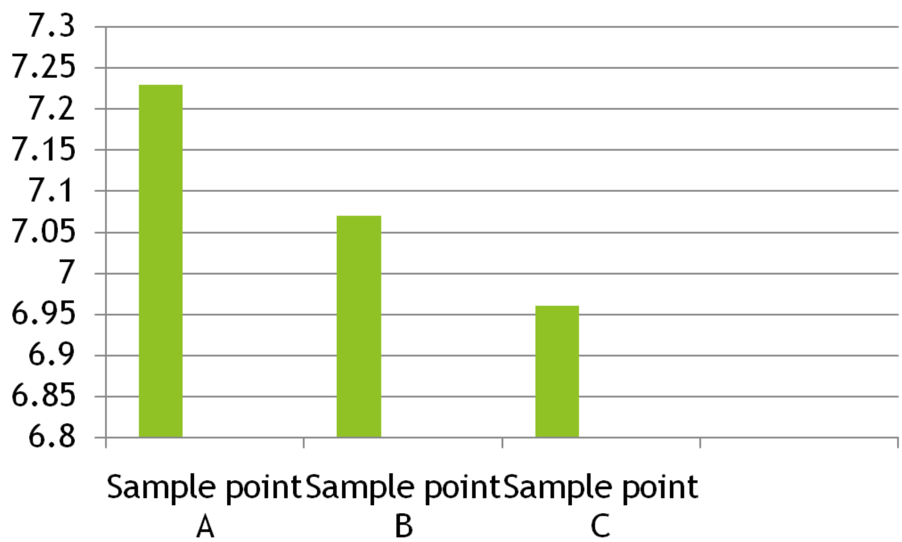
D Analysis of data

The data obtained were subjected to statistical analysis. These tests determine with the standard water quality norms from BIS and observing the difference in results also analysis effect of low & high amount of physio-chemical parameters in water, On the basis of water quality parameter measurements give effect on human according to natural science.

3. RESULTS AND DISCUSSION

An indication that water pH from industries has increased drastically from slight acidity toward alkalinity. This sudden rise in pH could be attributed to the effects of release of untreated cement industry's waste at sample point B, which is composed mainly of calcium carbonate. Hydroxide carbonates, and bicarbonates are the dominant sources of natural alkalinity. Also, the similar increase recorded at sample point A and C may be attributed to the unprecedented increase in the anthropogenic activities along the water body. The water pH values for all stations were identical. Similar pH for all sample point of study including the Industrial zones. Recorded that the pH of the upstream water sample did not vary from the pH of the downstream but both varied from the pH of the discharge point of cement mill effluent The pH values recorded for the study may be attributed to the similarity in effluent composition at Point B (calcium carbonates) and the soil content of sample point A and sample point C plus the degree of similarity in human activities in all sample point Fig. 1.

Fig 1. pH level in different water samples



The results of all DO, BOD, COD, TSS and TDS for all the samples is recorded in Table No. 1 The biochemical oxygen demand (BOD5) recorded in the study was significantly different ($p < 0.05$) across the sampling points and between the months. BOD5 values ranged from 2.15 - 2.96 mg/l throughout the study with a mean ± standard error value of 2.80 ± 0.03 (2.7 - 2.96) mg/l, 2.70 ± 0.03 (2.4 - 2.88) mg/l and 2.14 ± 0.03 (2.15 - 2.23) mg/l for Point A, B and C respectively. Results recorded for the present study indicates that theBOD5 values of the different stations took the following trend: sample point A >sample point 2 >sample point 3. Based on BOD5 classification: unpolluted (BOD < 1.0 mg·L−1), moderately polluted (BOD between 2 - 9 mg/l) and heavily polluted (BOD > 10 mg/l). The results are in agreement with the reported work [3]. There was significant variation ($p < 0.05$) in COD across the different stations and between the study months. Chemical oxygen demand values varied from 12.8 to 19.56 mg/l in effluent water. The highest value (19.56 mg/l) was recorded at sample point A and the lowest at sample point C. The overall mean ± standard error COD for the study was17.19 ± 0.15 mg/l. The fluctuation pattern in COD values is in the following other with regards to sampling stations: sample point A>sample point B>sample point C. This implied that COD may not be as a result of the contributory effects of chemicals but as a result of the high presence of inorganic substances in water and also the activities of micro-organisms which decomposes the massive inflow of organic waste brought about by wind and run off [4]. The total suspended solid value obtained at sample point B (60 mg/l) (discharge point) was higher than that of sample point A (48 mg/l) and sample point C (51.6 mg/l). TSS value was significantly different ($p < 0.05$) across the sampling stations and between the months throughout the study. The slight varying value for all stations and thus, closer were indicative of industrial pollution at its onset [5]. In addition, the unprecedented increase in TSS for station B could also be due to the fact that cement effluent discharged into water bodies are usually untreated and contain organic and inorganic compounds, and/or micro-organisms [6].The total dissolved solid fluctuated between 55.8 to 180 mg/l for this study. Results showed a significant variation ($p < 0.05$) across the sampling sites and no differences ($p > 0.05$) for the sampling months. Sample point A and C had similar TDS values when compared with the results for sample point B. This similarity in the upstream and downstream areas, from the discharge point, indicates possible pollution effects posed by the cement industries. Waste water to the receiving water body. This rise in total dissolved solid value at sample point B may be due to inorganic materials such as rocks which forms the basement of the bore well and the presence of calcium bicarbonates a byproduct of cement industry waste [7].

Table 1. DO, BOD, COD TDS and TSS level in water samples

Sr.No.	Parameters	Sample point A	Sample point B	Sample point C
1	DO (mg/l)	6.63 ± 0.09** (6.54 - 7.38)	6.11 ± 0.02** (6.42 - 6.87)	6.39±0.05** (6.47 - 6.6)
2	BOD5 (mg/l)	2.80 ± 0.03** (2.7 - 2.96)	2.40 ± 0.03** (2.5 - 2.88)	2.14 ± 0.03** (2.15 - 2.23)
3	COD (mg/l)	18.56±0.18** (18.2 - 19.56)	14.37 ± 0.21** (13.6 - 15.02)	13.01 ± 0.07** (12.8 - 13.2)
4	TDS (mg/l)	56.42 ± 0.21* (55.8 - 57)	107.57 ±0.29* (107 - 180)	60.67 ± 0.32* (60 - 62.6)
5	TSS (mg/l)	46.47 ± 0.51** (48 - 50)	52.37 ± 0.48** (56 - 60)	50.23 ± 0.46** (48.9 - 51.6)

Effluent water in cement industries and the main sources of environmental pollution in cement industries is showing harmful effect on human and surrounding water sources. The review carried out here shows techniques which are in practice in present to treat the waste water generated from cement industry including co-processing and pollution control at each stage of cement production. Several countries, including India, have introduced strict ecological and environmental standard for cement industries. With more strict controls expected in the future, it is essential that control measures be implemented to minimize effluent problems. It is also show about working efficiency in cement industry effluent sulphate, iron and silica found which slightly down the efficiency of effluent water treatment plant and also dispute the machinery of industries. This machinery purchasing cost is very high so reducing of effluent water production much needed. Around the world have been investigating the use of reclaimed water in concrete. However, not many have studied the use of sewage treatment plant effluent water in concrete. This research topic is also a challenge in terms of public health, when human contact with effluent treatment water is considered. Public education and close interaction with government agencies and policy makers is a key when presenting the applicability of effluent treatment water in industries, especially when human handling and exposure is a possibility.

4. CONCLUSION

The quality of water coming out as waste from cement plants is containing impurities due to which the property of water have been observed to be affected. This contaminated water affects the nearby water resources that lead to alter the composition of ecosystem. The surrounding organisms are directly facing health hazards of due to this polluted water. With more strict controls expected in the future, it is essential that control measures be implemented to minimize effluent problems

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CONFLICT OF INTEREST

The authors have no conflict of interest.

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