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Effluent quality assessment of different drains in SIDCUL industrial Area at Haridwar (Uttarakhand)

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Abstract

In the industrial era, the untreated effluents of various industries can alter the properties of surface water and may increase the pollution load in soil system and ultimately contaminate the local ground water aquifer. The SIDCUL industrial zone has been developed very fast by establishing the major industries at Haridwar in Uttarakhand. The present paper deals with the identification and estimation of the physico-chemical variables of effluents from different major industries in SIDCUL industrial area at Haridwar. The parameters, TSS, BOD and COD of the many effluents were recorded with higher values in comparison to standards. The composite effluents of different industries have contribute significantly for the degradation of surface water and soil quality of adjoining areas of industrial zone at Haridwar. The present study shows an assessment of qualitative and quantitative pollution load in the effluents drained from the different industries in the vicinity of industrial zone.

Keywords:*Wastewater, industrial effluent, water pollution, NEQS, SIDCUL*

Introduction

Recently, the rapid growth of industrialization has created negative impact on every component of environment because most of the industries have discharged their effluent without any adequate treatment. Industrial effluents contain toxic chemicals, colours, hazardous compounds, suspended solids and non-biodegradable materials. A wide variety of both inorganic and organic pollutants are present in effluents drained by various industries (Malik *et al.,* 2006). These chemicals are one of the major polluting sources, which are discharged by industries mostly without any treatment (Sial, *et. al.* 2006). When the raw materials are used in industries for the manufacturing of products than after reduction they come out as unwanted product and are released from the industries with out any dilution or treatment. Many pharmaceutical, detergent and cosmetics industries released effluent in low quantity but it is very toxic to discharge openly and when this water meets with surface water, firstly pollute the surface water after that it can pollute ground water by leaching process. The process of leaching of water depends on the types, textures of soil and substratum of soil profile. Chemical pollutants from a variety of sources including industrial wastewater, sewage, indiscriminate solid waste disposal and accumulation of waste water on surface water leached by capillary network of soil profile, ultimately degraded the quality of ground water of adjoining areas of industrial zones (Tyagi and Budhi, 2000).

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Material and Methods

State Industrial Development Corporation Uttarakhand Limited (SIDCUL) is newly established industrial area at Haridwar and developed under the newly emerging Govt. industrial policy of Uttarakhand. The SIDCUL industrial area at Haridwar was selected on the basis of large number of industries established recently very close to BHEL, Haridwar and other urban, semi-urban and rural residential areas. Geographically, Haridwar city is situated at longitude 78.13°E and latitude 29.58°N at 1550 msl in the foothills of lesser Shivalik Himalaya.

Effluent samples were collected from four different effluent drains and two sites for each drain (S-1 and S-2) were selected as upper and down parts of drainage consisting composite industrial effluents.

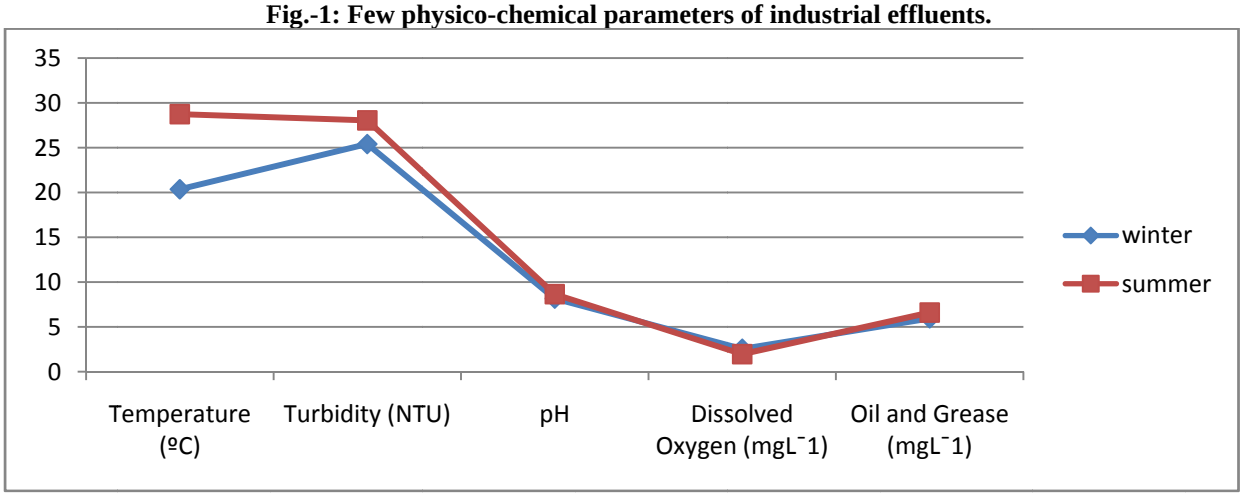
Effluent samples F1, F2, F3 and F4 were collected and analyzed in water testing laboratory according to standard methods as Trivedi and Goel (1984) and APHA (2005) and results were compared with the NEQS (National Environmental Quality Standards).

Results and Discussion

The results of various Physico-chemical parameters observed during course of study are given in fig. 1 & 2. The main source of water pollution in industrial area is discharge of untreated industrial effluents directly into the surface water bodies and injecting into ground water table resulting in serious surface and ground water pollution (Nasrullah, *et. al.* 2006). Physico-chemical characteristics impart a major role in determining the quantity of effluents. The observations were made for four wastewaters F1, F2, F3 and F4 at S-1 and S-2 SIDCUL for the physico-chemical parameters in winter and summer season.Temperature was recorded 19.9-20.8°C and 28.4-29.1°C of S-1 and S-2 during winter and summer season respectively. All the observed values of temperature come under the permissible limit according to standards given by NEQS. If the temperature increases in water body, the solubility of oxygen and carbon dioxides gas etc. have been affected and influences the chemical reactions in the water column. The variation in water temperature may be due to different timing of input load of heated industrial effluents and some effects of seasonal variations (Jayaraman*et al*., 2003). Total dissolved solids were observed 2172.8-2247.0 and 3006.4-2935.4 mgL^{-1} at S-1 and S-2 during winter and summer season. All the observed values of TDS come under the permissible limit. Total dissolved solids concentration usually associated with high concentration of ion that increased the conductivity of the water. Total suspended solids observed 240.9-263.2 and 293.2-273.5 mgL^{-1} at S-1 and S-2 in winter and summer season respectively. The observed values of TSS were high in all samples in comparison to NEQS standards. Total Suspended Solids inhibits the light penetration and responsible for depleting the dissolved oxygen level in aquatic system. The turbidity of all samples at S-1 and S-2 during winter and summer season was recorded 25.8-25.0 and 29.0-27.1 NTU respectively. High value of turbidity represents the high values of TDS and TSS in all samples. On both sites pH value of all samples during winter and summer season were recorded 8.0-8.3 and 8.7-8.6 respectively. Water with extreme high or low pH (below 3 or above 11) deadly effected the survival of living organisms in aquatic system (Krull*et al.* 2004). Total Hardness of samples at S-1 and S-2 during winter and summer were observed 644.5-598.7 and 587.3-579.0 mgL^{-1} respectively. Hardness parameter is determine the quality of drinking water, uses in industrial processes of water and increases the boiling point of water. Hardness is due to the presence of divalent metallic cations like Calcium, Magnesium, Strontium, Ferrous iron and Manganese ions. Ferric iron and Aluminum ions can also contribute to rich hardness, but the concentration is normally negligible due to their limited solubility (Sundary*et al.,* 2008). The values of Calcium in all samples at S-1 and S-2 during winter and summer season were observed 393.9-373.6 and 378.0-339.3 mgL^{-1} respectively. Generally, Calcium and magnesium maintain a state of ionic equilibrium in water column. Magnesium in the samples was recorded 252.3-256.1 and 209.5-264.6 mgL^{-1}at S-1 and S-2 during summer and winter season respectively. Alkalinity of the samples at S-1 and S-2 during summer and winter season was observed 389.1-325.3 and 393.5-397.6 mgL^{-1} respectively. Alkalinity is a measure of the capacity of water to neutralize acids. Alkalinity of water is due to the presence of bicarbonate, carbonate and hydroxide ions and strongly correlated with pH value, if pH of any sample is high than alkalinity is also high and pH value is low than alkalinity will be low or nil (Phiri*et al.,* 2005). The dissolved oxygen values of samples at S-1 and S-2 during winter and summer season were observed 2.6-2.5 and 2.0-1.9 mgL^{-1} respectively. Dissolved oxygen level of all samples found very low at both site. DO is one of the most important parameter to assessing water quality and reflect physical, chemical and biological characteristics prevailing in the water bodies (Nanda and Tiwari, 2001). BOD values of waste water samples were recorded 418.8-370.1 and 574.2-568.8 mgL^{-1} at S-1 and S-2 during winter and summer season respectively. BOD represents the amount of oxygen required for the microbial decomposition of organic matter in water. BOD value of the waste water samples was high in comparison to standards given by NEQS and showed high organic matter load in industrial effluent as also reported high value of BOD and

COD in composite industrial effluents (Hasmi, 2005). COD value represents the amount of oxygen required for the chemical decomposition of organic matter in water. The COD values of all samples at S-1 and S-2 during winter and summer season were observed 883.7-761.1 and 962.0-889.5 mgL^{-1} respectively. COD values are found very high in comparison to standard given by NEQS. The most common toxicity is from chloride in the irrigation water. Chloride occurs naturally in all types of waters. In natural freshwater, however chloride's concentration remains quite low. The most important source of chloride in water is the discharge of domestic sewage and liquid waste. Therefore, the chloride concentration has served as an indicator of pollution by sewage industries are also important source of chloride in water (Malik and Bharti, 2010). The Chloride values of both sites were observed 367.1-395.4 and 402.9-326.5 mgL^{-1} during winter and summer season respectively. Oil and grease has mixing with industrial effluents due to use of lubricants, grease in different machinery parts of industries and intermixing with water used in industrial processes. The other sources of these oily liquids are automobile industry, washing and repairing of commercial vehicles. These oil and grease contents makes a thin layer on the surface of wastewater and industrial effluents and contribute a lot for degrading the water quality and dreadful role for the survival of aquatic organism in the existing ecosystem. The oil and grease values of all samples at S-1 and S-2 during winter and summer season were observed 6.2-5.7 and 6.4-6.8 mgL^{-1} respectively. Observed values of oil and grease

Fig.-1: Few physico-chemical parameters of industrial effluents.



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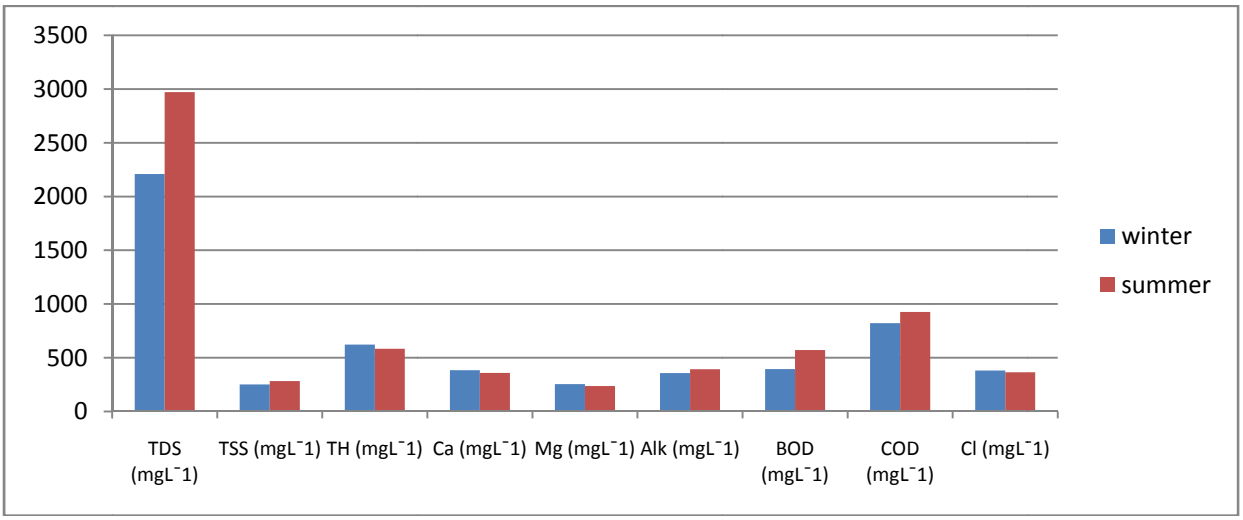

come under the standard values given by NEQS.

The surface water as well as ground water quality has degrading continuously in terms of foul smell, taste, colour and other characteristics of drinking water quality. This loss of water quality is causing health hazards in human beings, livestock and aquatic organisms and adverse effects on agricultural soil quality of agricultural fields in surrounding rural areas. This problem is aggravated by lack of installation of common treatment plant and implementation of environmental laws prescribed by different govt. agencies as CPCB, MOEF and especially state pollution control board. The results of present study concluded that although the characteristics of effluents of industries have changing very fast on negative scales as per the safe limits of NEQS. But toxic level of harmful materials can mix up with surface water by coagulation process if no precautionary measures taken in future for treatment of industrial effluents in SIDCUL industrial area at Haridwar. It created serious problems as high level of surface water pollution as well as ground water problems in the industrial area of Haridwar.

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