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STUDY OF PHYSICO-CHEMICAL PROPERTIES OF EFFLUENTS FROM SOAP INDUSTRY IN WARDHA

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ABSTRACT

Physico-chemical parameters of the effluents from soap industry of Wardha region had been analyzed. In this investigation physico-chemical parameters such as colour, odour, temperature, density, surface tension, viscosity, alkalinity, acidity, chloride, hardness, total dissolved solids, total suspended solid, pH, conductance, sulphate, COD, BOD, DO, pathogen had been analyzed of the effluent collected from the soap industry of Wardha region. Sodium and potassium elements were analyzed flame photometrically.

Key words: soap industry effluents, physico-chemical parameters, COD, BOD, DO.

INTRODUCTION

This paper discuss the water quality of effluent from the soap industry of Wardha region .The water coming from this source has significant impact on the quality and sustainability of the rivers. Industrial effluents, direct discharges, as well as precipitation may introduce a wide variety of pollutants into the rivers ranging from agrochemicals, heavy metals, microbial as well as persistent organic pollutants. It is noteworthy that this paper discusses the secondary data collected from soap industry and determines the water quality parameters of the collected samples. The discussion is divided into physico-chemical, chemical, metals, microbial and organic characteristics of the soap industry effluent. Water of good drinking quality is of basic importance to human physiology and man's continued existence depends very much on its availability[1]. The provision of portable water to the rural and urban population is necessary to prevent health hazards[2]. Before water can be described as potable, it has to comply with certain physical, chemical and microbiological standards, which are designed to ensure that the water is palatable and safe for drinking[3]. Potable water is defined as water that is free from diseases producing microorganisms and chemical substances deleterious to health[4]. Unfortunately, clean, pure and safe water only exists briefly in nature and is immediately polluted by prevailing environmental factors and human activities. Water from most sources is therefore unfit for immediate consumption without some sort of treatment[5].

The consequences of waterborne bacteria and virus infection; polio, hepatitis, cholera, typhoid, diarrhea, stomach cramps, etc, have been well established but nitrate contamination is just as deadly. Consequent to the realization of the potential health hazards that may result from contaminated drinking water, contamination of drinking water from any source is therefore of primary importance because of the danger and risk of water borne diseases[6]. The original source of any drinking water is rich in aquatic microbes, some of which could be dangerous if they enter the human body. Accordingly, the treatment of water for drinking involves stages where microbes are removed or destroyed before the water gets into homes. After purification the water is subjected to tests by bacteriologists to ensure the safety for human consumption. A long series of dilutions is not necessary by some samples because most water supplied are low in bacteria content, while others require long series of dilutions.[7]

In many developing countries, availability of water has become a critical and urgent problem and it is a matter of great concern to families and communities depending on non-public water supply system. Conformation with microbiological standard is of special interest because of the capacity of water to spread diseases within a large population. Although the standards vary from place to place, the objective

anywhere is to reduce the possibility of spreading water borne diseases to the barest minimum in addition to being pleasant to drink, which implies that it must be wholesome and palatable in all respects[6]. The principal objectives of municipal water are the production and the distribution of safe water that is fit for human consumption[1]. A good knowledge of the chemical qualities of raw water is necessary so as to guide its suitability for use. Thus, regular physico-chemical analysis of water at source must be carried out to determine or check the effectiveness of treatment process. This works is therefore, in an attempt to examine the soap industrial effluent of Wardha, Maharashtra for conformity to microbiological and physicochemical standards.

EXPERIMENTAL

In this study water samples have been collected in polythene bottles with necessary precaution at points at which effluents discharge into drains for laboratory analysis. Determination of parameters like colour, odour, temperature, density, surface tension, viscosi**ty,** alkalinity, acidity, chloride, hardness, total dissolved solids (TDS), total suspended solids (TSS),dissolved oxygen (DO), nitrogen, sodium, potassium and pathogens were carried out in the laboratory. pH and electrical conductance were carried out using pH-meter and conductometer respectively. Sodium, (Na) and Potassium (K) were determined by using flame photometer. Sulphate ion concentration (SO_4^{2-}) was determined by using U. V.-Visible spectrophotometer. Chemical oxygen demand (COD) was determined by the dichromate digestion method while biochemical oxygen demand (BOD) was determined by the dilution method. The chemicals used were used of AR grade. Double distilled water is used for the preparation of solutions and reagents. All equipments were checked and calibrated according to the manufacturer's specifications. The pH meter was calibrated using buffers of pH 4.0, 7.0 and 9.2; Conductivity meter was calibrated by using conductivity water. The spectrophotometers (Systronic 108 and Systronic 166) were checked for malfunctioning by passing standard solutions of all the parameters to be measured. Blank samples (deionized water) were passed between every three measurements of effluent samples so as to check for any eventual contamination or abnormal response of equipment. Reproducibility of results was regularly checked by carrying out periodic analysis of the effluent collected from one sample.

RESULTS AND DISCUSSION

Temperature, colour and odour

In the presence study, temperature ranges from 25-28^{o}C. Colour of the water is a subject of both scientific study and popular misconception. This test is usually applicable to both drinking and potable water. This test is basically carried out by comparison with known standards. Both colour and odour are often cost by organic substances such as algae and humic compounds. The presence of colour in water does not necessarily indicate that water is not potable. Colour causing substances such as tannins may be harmless. The effluent collected was found to be colourless and odourless may be due to absence of organic and human contamination.

Density, surface tension and viscosity

Higher the density greater is the surface tension. In the collected samples the density was found to be $1.120X10^3$ Kg/m^3, while the density of pure water at 28-30^{o}C should be $0.996X10^3$ Kg/m^3 approximately. The surface tension of water sample was found to be 2.49 X $10^{-2,}$ N/m. The value of viscosity was found to be $4.92X10^3$ N.s/m$^{2.}$ This is more than distilled water means the dissolved impurities were present in the studied sample.

Electrical Conductance (EC)

Conductance measurements are a rapid and practical parameter of the variation of dissolved nutrients and micro-nutrients contents of water samples. More the dissolved solids in water, more is the EC. EC of the water is the sum of ionic conductance of all the ionic constituents. The most expedient to evaluate the salinity of water is to measure its electrical conductance. The high EC values are harmful for plant growth. Water with high EC affects the soil structure, permeability and irrigation. These adverse effects known as salinity hazard which affect plant growth and crop yield considerably. EC of studied effluent was found to be 7.36 mhos.

pH

Extremely high or low pH has adverse impact on the quality of the water and may kill the aquatic organisms pH is an important index of acidity, alkalinity and resulting values of acidic- basic interactions of number of minerals and organic components. pH below 6.5 causing corrosion in pipes resulting in the release of toxic metals. The pH detected in effluent was 7.86, which is within the range prescribed by WHO (7- 8.5).

Hardness

The hardness of water is not the chemical parameters but indicates the water quality mainly in terms of Ca^{2+} and Mg^{2+} and expressed as $CaCO_3$. The hardness has no known adverse effect. It is property of water of which prevents the lather formation with the soap. The acceptable limit of total hardness is 200mg/lit which can be extended to 600 mg/lit (ISI 1982). The total, permanent and temporary hardness of effluent was found to be 360,216and 144 respectively. This hardness is well within the permissible limits of WHO standards.

Biological Oxygen Demand (BOD)

BOD was not found in studied samples.

Chemical Oxygen Demand (COD)

The COD in the effluents from soap industry was 0.032 mg/l. The high levels of COD in the effluents indicate the release of material with high chemical oxygen demand and may impact the sustainability of the discharge sources negatively if they will be continuously discharged without proper treatment. As per WHO if the COD 0.5 mg/lit. Indicate very clean status.

Alkalinity

High alkalinity is a measure of wastewater strength. It shows the capacity of wastewaters to neutralize acids, and is undesirable. The alkalinity of water may be caused due to OH^-, CO_3^{2-},HCO_3^- ions. Alkalinity is the estimate of ability of water to resist change in pH upon addition of acid. Phenolphthalein and total alkalinity as $CaCO_3$ were found to be 0 mg/lit and 3192 mg/lit respectively, while methyl orange alkalinity is 3192 mg/lit.

Total Dissolved Solids (TDS)

When the effluents are discharged into the river, heavy metals present can be adsorbed on the river's soil and sediments and during the dry season, water evaporation could expose them to the environment. During the dry season, the occasional dust re-suspension could introduce these metals into the atmosphere along with the particulates. Removal of the pollutants from these effluents is the only sure way of safer environment and this can be achieved by treatment to require level.TDS in drinking water should not exceed 500 mg/lit. High TDS values may be associated with excessive scaling in pipes, which may cause corrosion. Suspended solid, dissolved solids, total solids of the effluents found in sample were 24, 956,980 ppm respectively. The acceptable limit of TDS is 500ppm.

Dissolved Oxygen

Dissolved oxygen is of significant importance to the respiration activities of the aquatic organisms and effluents with very low DO may have a negative impact on the sustainability of the rivers in the basin. DO of the studied effluent is 7.83 ppm which is just within the permissible limit of the WHO standards.

Sulphate ion concentration (SO_4^{2-})

Sulphates cause water hardening and therefore high levels are not recommended. All industries should be encouraged to ensure that it is kept under control. All industries that omitted to report this parameter should be encouraged to analyse it their subsequent audits. Sulphate usually occurs in natural water. The presence of Na_2SO_4 & $MgSO_4$ in drinking water beyond the prescribed limit may cause cathartic action. Sulphate may undergo transformations to hydrogen sulphide depending largely upon the redox potential of water. This is also an important anion imparting hardness to the water. The SO_4^{--} ion concentration in the studied water sample was found to be 350 mg/lit. It is just exceeds the WHO permissible limit which is 200 mg/lit.

Chloride

The presence of chloride in natural water can be attributed to the salt deposits, discharge of effluents from chemical industries, sewage discharges etc. Each of these sources may cause the local contamination of both surface and ground water. Chloride content in the studied effluent was found to be 148.21 ppm. This level of chloride content is just well within the permissible limit of WHO standards. The acceptable limit as per WHO is 200 ppm.

Sodium

The presence of sodium could be attributed to sodium salts and soaps used. Sodium is a mineral found naturally in some drinking water. Too much sodium has been identified as a risk factor for high blood pressure, twenty milligrams Sodium per liter Suggested as safe. It is an important cations occurring naturally. Sewage is one of the important sources of sodium to the fresh water. Water with high sodium content is also not suitable for agriculture as it tends to determine the soils for agriculture as it tends to deteriorate the soils for crops. Sodium associated with chloride & sulphates make the water unpotable. Sodium concentration was determined to be 1 ppm flame photometrically.

Potassium

The concentration of K is quite lower than Na. It remains mostly common in solution without undergoing any precipitation. Potassium was not found in the sample.

Nitrogen

Organic nitrogen includes such natural materials as proteins, peptides, nucleic acid, urea and numerous synthetic organic compounds. Typical organic nitrogen concentration varies from a few hundred micrograms/lit in some lakes to more than 20mg/lit in raw sewage. Knowledge of nitrogen in waste water is important when it is used as an irrigant. In the investigated sample, nitrogen is not found.

Acidity

Acidity is a measure of the effects of combination of compounds and conditions in water. It is the power of water to neutralize hydroxyl ions and is expressed in terms of calcium carbonate. Water attain acidity from industrial effluents, acid mine drainage, pickling liquors and from humic acid. No phenolphthalein acidity and methyl orange acidity was found in the studied water sample.

Pathogens

The bacteriological qualities of water are good indicators of the pollution and play key roles in water borne diseases. Bacterial counts are performed by making appropriate dilution of the sample and incubating at a specified temperature and culture medium for 48 hours. The numbers of bacterial colonies on the plates were counted under a microscope. The soap water contains pathogen *E.Coli.*

CONCLUSION

In conclusion it can be stated that the different studied physico-chemical parameters such as pH, density, viscosity, surface tension, conductance, TDS, alkalinity, DO, chloride concentration, hardness, COD etc. are within the permissible limit. This may be due to improper drainage system of the soap industry. The present investigation has led us to conclude that the quality of water samples subjected to study was acceptable from majority of physico-chemical parameters while as per bacteriological standards; the water needs to be treated before using it in domestic applications. Thus as far as sample water is concerned the potential risk of getting infected by water borne diseases is always there if used without proper disinfections.

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