WASTE WATER TREATMENT OF INDUSTRIES USING PHYSICO CHEMICAL TECHNIQUE: A REVIEW

Samridhi1, Dr. Sanjay sharma2, Jyothi3, Divya Chaudhary4

1M.E. Scholar, 2Professor and Head of Civil Engineering Department, 3Senior Lab Assistant, 4M.E. Scholar

Civil Engineering Department

National Institute of Technical Teachers Training and Research, Chandigarh, India

Abstract: ***Industries play a vital role in economic growth of nation as well as employing workers whether skilled or unskilled. But the use of chemicals, dyes and surfactants in various processes of different industries produces massive amount of waste as sludge, fibres and chemically polluted water. This waste water degrades the quality of water when it is mixed with natural resources and its dependent habitats and environment. Waste water from industries has become nuisance for rivers and for environment. It does not only endanger the environment as well as human health. This study is a review of application of physico-chemical techniques for waste water treatment of industries. It provides a guidance to treat the industrial effluent of various industries using physical and chemical treatment. The main objective of this study is to give an overview of different parameters of waste water i.e. pH, TDS, SS, COD, BOD, Oil and grease etc. before treatment and after treatment. This paper deduces that the parameters of waste water were found satisfactory after physico-chemical treatment. Many researchers studied the effluents of industries using physico-chemical methods and analysed many parameters affecting the quality of water i.e. COD, Oil and grease, surfactants, BOD, TDS and after treatment found these parameters under limit.***

Keywords: Raw Effluent, Physico-chemical treatment, treated effluent, Effluent treatment plant.

I. Introduction

The chemical industry is utmost important in regard of adverse impact on environment. The wastewater from this industry is so vigorous in composition and may carry malignant pollutants which are not favourable to the natural resources when it is discharged. Industrial wastes usually accommodate matter which is organic and inorganic in nature in varying degrees of concentration. It holds acids, bases, environment unfriendly materials, and matter high in biological oxygen demand, having colour and high amount of suspended solids. Many materials in the chemical industry are toxic, mutagenic, carcinogenic or simply hardly biodegradable. Surfactants, emulsifiers and petroleum hydrocarbons that are being used in chemical industry reduce performance efficiency of many treatment unit operations. The best way to treat highly contaminated and toxic industrial waste at the source and is to apply onsite treatment within the production lines with recycling of treated effluent.

Literature Review

David R. Dixon et. al (1992) [1] studied on identification and measurement of organics in pulp and paper effluents before and after physico-chemical treatment. Physico-chemical treatment was done to remove colour, turbidity and total organic carbon and efficiency of treatment was determined on number of pulp and paper sample. Modern fractionation scheme and analytical techniques were used. Flow field fractionation parted high molecular weight organics and low molecular weight organics from solution. XAD resins separated the organics into hydrophilic and hydrophobic fractions. The authors concluded that Coagulation based processes removed higher molecular weight organic and hydrophobic compounds from solution but have little effect on lowest molecular weight species and activated carbon removed hydrophobic compounds as well as hydrophilic compound.

Amir Hossein et.al (2004) [2] studied for removal of anionic surfactants in detergent wastewater by physical chemical treatment. Experiments were conducted using different coagulants such as lime, alum and ferric chloride to remove surfactants. The use of lime gave 21% and 17 % COD and MBAS removal and alum gave slightly higher 37% and 28% and ferric chloride gave 89% COD and 80% surfactant removal.

Tonni Agustiono Kurniawan et.al (2006) [3] reviewed the application of various physico-chemical treatment techniques for the removal of heavy metal such as cadmium, copper, nickel, zinc from contaminated waste water in electroplating industry. Author focused on chemical precipitation, coagulation flocculation, flotation, ion exchange method and membrane filtration treatment methods. Ion exchange method removed completely cadmium, chromium, copper, nickel and zinc with an initial concentration of 100 mg/l respectively. Lime precipitation was found as one of most effective means to treat inorganic effluent with a metal concentration of higher than 100 mg/l. The author concluded that selection of suitable treatment method depends upon initial metal concentration, technical applicability and plant simplicity.

Jan Bogacki et. al (2011) [4] studied for the treatment of cosmetic waste water using physico-chemical technique and coagulants Fe_2O_3 and $Al_2(SO_4)_3$ in which flopam flocculant were used. The authors concluded that the amount of COD get reduced by 63.9 % when coagulant Fe_2O_3 was applied with flopam flocculant. The advanced oxidation process reduced COD by 80% and surfactants by 98%.

M. Yaili Kilic et. al (2012) [5] studied the physico-chemical methods, ultra filtration and advanced oxidation process on olive oil mill wastewater at pilot scale. The authors found that physico-chemical methods (acid cracking, oil separation) removed 85% of COD, Oil and Grease (>97%), Suspended Solids (>99%) and phenol (92%) from oil

mill waste water. Ultra filtration followed by physicochemical is effective in reducing suspended solids and Oil & grease with over 90 % improvements. Chemical treatment using $FeCl_3.6H_2O$ resulted in best COD and phenol removal. The study concluded that physicochemical treatment, micro filtration, ultra filtration and O_3/H_2O_2/ UV process provides the most economically viable choice for the olive oil mill waste water treatment with 99% removal of COD, phenol and TOC.

Saritha Banuraman et. al (2013) [6] studied the enhanced primary treatment of tannery effluent by chemical coagulants. The Author analyzed physico-chemical parameters of tannery effluent and the efficiency of alum and ferric sulphate and their combination. Author concluded that coagulants are effective for tannery waste water treatment and pH 8 is optimal for better efficiency of alum, ferric sulphate and their combination. At optimum dosage, there is reduction in concentration of pollutants with primary treatment with alum and ferric sulphate.

Misra R et. al (2013) [7] researched on treatment of pesticide/ agrochemical wastewater by coagulants/ Flocculation process and water was treated by physico-chemical methods using different coagulants and coagulants aids. Optimum dose of alum, ferric sulphate and poly aluminum chloride was determined and based on these optimum doses; polyelectrolyte magnafloc in different doses was tried. Alum and poly magnafloc with 300 mg/l and 0.25 mg/l reduced the COD of 55.76%. Results showed that individual alum was least effective while PAC individually gave best results. Alum in combination with poly aluminum chloride and alum with polyelectrolyte gave moderate results in removal SS, COD and BOD.

Farid Ansari et. al (2013) [8] studied the performance evaluation of effluent treatment plant for automobile industry. Effluent of automobile industry was high in suspended and total solids such as oil, grease, dye stuff, chromium, phosphate in washing products, and coloring. There was significant amount of dissolved organics, resulting in high BOD or COD loads. Primary treatment was given followed by secondary treatment. Water after treatment was being used for gardening purpose. The results revealed that the treated effluent's parameters within permissible limits of CPCB, India.

D. Sivakumar (2014) [9] assessed the groundwater quality of nearby places of tannery industry of nagalkeni, Chennai and analyzed the water for physico-chemical parameters i.e. pH, EC, TDS, total hardness and compared the selected parameters with BIS drinking water quality standard and irrigation quality indices. The author after studying the parameters concluded that water was acidic and oxidizing in nature, hence not fit for drinking purpose and was brackish for irrigation purpose and can be used after adopting proper treatment techniques.

Mohamadreza Massoudinejad et. al (2015) [10] studied on rubber wastewater treatment using combination of physico-chemical and ozonation processes. Two physicochemical processes with ozonation process were used to treat the waste water. Chemical coagulation with ferric chloride and aluminum sulphate was done and then ozonation process was applied which reduced COD 70.75% and 90.6% respectively. Authors concluded that results with aluminum sulphate ($Al_2 (SO_4)_3$) and ozonation are efficient to remove the COD up to 90.6% with low suspended solids, clear and odorless effluent. Individual and combined process is not sufficient to treat highly polluted rubber wastewater. It can be achieved by using activated sludge method.

Md. Ferdous Zaman and Most. Sharmin Akter (2015) [11] studied the treatment of pharmaceutical waste water and efficiency of Effluent Treatment Plant in context of Bangladesh. Physico-chemical treatment along with biological treatment followed by chlorination, filtration and adsorption was done to treat pharmaceutical waste water. The author concluded that this treatment was quite effective and meeting the discharge (on irrigation land) criteria of Bangladesh.

Amita Deokate et. al (2016) [12] reviewed on operation and maintenance of Effluent Treatment Plant of paper industry. Treatments like Primary clarification, Secondary Clarification, Tertiary Clarification and followed by dual filter media were done in Effluent Treatment plant. Water after treatment was being used for green belt development. Authors concluded that raw effluent having high pH, BOD, COD and TSS was brought in under limits of these parameters after physico chemical treatment which satisfies the criteria of Maharashtra Control Pollution Board (MPCB) and MoEF (Ministry of Environment and Forestry). Air quality and noise pollution parameters are identified which are all within prescribed by CPCB for industrial area.

Conclusion

THIS PAPER REVIEWED THE CONCEPT OF APPLICATION OF PHYSICO-CHEMICAL TECHNIQUE ALONE AND ALSO WITH OTHER TECHNIQUES IN WASTE WATER TREATMENT. MOST OF THE LITERATURE EXAMINED ABOVE SHOWED THAT PHYSICO-CHEMICAL TECHNIQUE WITH DIFFERENT COAGULANTS IS SUCCESSFUL IN ACHIEVING PARAMETERS I.E. BOD, COD ETC. WITHIN LIMITS. THIS STUDY HELPS TO KNOW THE EFFICIENCY OF DIFFERENT COAGULANTS TO REDUCE REQUIRED PARAMETERS OF WATER QUALITY STANDARDS.

REFRENCES

1. Dixon David R., Wood & Ronald Beckett Frederick J., "Characterization of organics in pulp and paper mill effluents before and after physicochemical treatment", Environmental Technology, vol. 13:1117-1127, 1992.
2. Mahvi Amir Hossein, Maleki A. and Roshni B., "Removal of anionic surfactants in detergent wastewater by chemical coagulation", Pakistan Journal of Biological Sciences, vol. 7 (12):2222-2226, 2004.
3. Kurniawan Tonni Agustiono, Chana Gilbert Y. S., Loa Wai-Hung and Babel Sandhya , "Physico–chemical treatment techniques for wastewater laden with heavy metals", Chemical Engineering Journal 118: 83-98, 2006.
4. Bogacki Jan, Naumczyk Jeremi, Marcinowski Piotr and Kucharska Małgorzata, "Treatment of cosmetic wastewater using physicochemical and chemical methods", CHEMIK: 96-97, 2011.
5. Kiliç M. Yalili, Yonar T. and Kestioğlu K., "Pilot-scale treatment of olive oil mill wastewater by physicochemical and advanced oxidation processes", Environmental Technology, Vol. 34(12):1521-1531, 2013.
6. Banuraman Saritha, T.P. Meikandaan, 2013 "Treatability Study of Tannery Effluent by Enhanced Primary Treatment", International Journal of Modern Engineering Research (IJMER), Vol.3 (1): 110-122.
7. R. Misra, Satyanaraya Shanta, N. Potle, 2013 "Treatment of agrochemical/Pesticide Wastewater by Coagulation/Flocculation Process", International Journal of Chemical and Physical Sciences, Vol.2: 39-51.
8. Ansari Farid, Pandey Yashwant K., Kumar P. and Pandey Priyanka, 2013 "Performance evaluation of effluent treatment plant for automobile industry", International Journal of Energy and Environment, Vol. 4: 1079-1086.
9. Sivakumar D., 2014 "Groundwater Quality Assessment around Nagalkeni Tannery Industrial Bel", International Journal of Civil and Environmental Engineering, Vol. 8 (3):324-329.
10. Massoudinejad Mohamadreza, Mehdipour-Rabori Mohsen and Dehghani Mohammad Hadi, 2015 "Treatment of natural rubber industry wastewater through a combination of physicochemical and ozonation processes", Journal of advances in environmental health Research, Vol. 3(4): 242-249.
11. Zaman Ferdous Md., Akter Sharmin Most., 2015 "Pharmaceutical Waste Water Treatment and the Efficiency of ETP in Context of Bangladesh", Proceedings of the Waste Safe 2015- 4$_{TH}$ International Conference on Solid Waste Management in the Developing Countries, Khulna, Bangladesh:126 (1-4).
12. Deokate Miss Amita and Kulkani DR.G.S. 2016 "Review paper on operation and maintenance of effluent treatment plant of paper industry", International Research Journal of Engineering and Technology (IRJET): 963-966.