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TREATMENT OF HOSPITAL WASTEWATER USING ELECTROCOAGULATION – A REVIEW

Aashima Sharma[1], Shweta Verma[2]

[1]Student, M.E, [2]Assistant Professor, Civil-Environmental Engineering DYPCOE, Pune (India)

ABSTRACT

Hospitals are the significant consumers of water. The wastewater generated by the hospitals may contain pathogens, bacteria, viruses, pharmaceuticals etc. In this paper, review has been done for the treatment of hospital wastewater containing harmful ingredients using electrocoagulation, the reuse of the same water after treatment. According to literature, this method is the one of the effective method for the treatment of Industrial wastewater. Because of its low operation and maintenance cost, high efficiency, time saving, lower sludge production without any addition of chemicals. The efficiency of electrocoagulation method mainly depends on the treatment time, conductivity of the solution, distance between electrodes and the current density.

Keywords*: *AC current, Electrodes, Electrolysis, electrochemistry, Hospital wastewater

I. INTRODUCTION

Wastewater originate from domestic, industrial, commercial, agriculture activity may create threat to human life. Municipal wastewater, hospital wastewater usually conveyed in combined sewer or sanitary landfill and treated at wastewater treatment plant. This may create heavy load to the wastewater treatment units. The wastewater generated from hospitals contains solids, toxic pollutants, metal oxides, hazardous liquid waste from various units, pharmaceuticals, radioactive waste, bacteria, viruses, blood, fluid. High BOD and COD is due to presence of solids and bacterial in it. If not treated properly, it may create threat to human life as well as environment. Therefore it is necessary to treat wastewater before discharge in to natural stream. The most important goal of wastewater treatment is to control pollution, prevention of infectious, chronic, hazardous diseases, protecting environment, reusing water for gardening and agriculture purpose. Some conventional methods are available for the treatment of waste water like, ion exchange, adsorption, coagulation – flocculation, chemical oxidation, reverse osmosis, filtration, ultrafiltration etc. these are expensive methods. Electrocoagulation is one of them. This method is highly accepted for the treatment of water and wastewater. This is used for the treatment of water and wastewater. Due to its low cost, easy in operation, low sludge production, low operational and maintenance cost, high efficiency, low chemical consumption, good settling capacity of sludge, electrocoagulation method is used worldwide.

Properly treated hospital wastewater can be reused for agriculture and gardening purpose. It can also be used in toilets for flushing purpose, for floor cleaning and washing purpose.

The objectives of the study are:

1. to evaluate the feasibility of the electrocoagulation process for the hospital wastewater treatment,

2. to find out the factors affecting different parameters for the removal efficiency of Total solids, BOD and COD.

II. ELECTROCOAGULATION MECHANISM :

Electrocoagulation technology is a treatment in which electrical current is used for the treatment of wastewater without adding any coagulant. When electric current is supplied in the reactor, electrocoagulation occurs. The metal ions from anode loses electrons and gets combined with the ions present in wastewater. The reaction between ions takes place, results in the formation of floc. Some settles at the bottom while some moves upward due to formation of hydrogen and oxygen bubbles at cathode. This hydrogen gas helps in the upward movement of water containing pollutants. The reaction between ions and the wastewater depends on the conductivity of the solution. Which impart the efficiency of the treatment. On the other hand, the cathode gains electron and gets reduced. Thereby making water better treated. The metal ions which forms at anode with (OH^-) ions from the water to form highly charged coagulants which diminishing the stability of suspended particles, so that Al^{3+} reacts with OH^- to form Al $(OH)_3$ i.e. aluminum hydroxides, which is also an efficient coagulant. The elecetocoagulation reactor is shown in figure 1. The various reactions involved in Electrocoagulation process are:

General reactions at anode :

$M \rightarrow M^{n+} + ne-$

$2H_2O \rightarrow 4H^+ + O_2 + 4e^-$

General reactions at cathode :

$M^{n+} + ne^- \rightarrow M$

$2H_2O + 2e^- \rightarrow H_2 + 2OH^-$

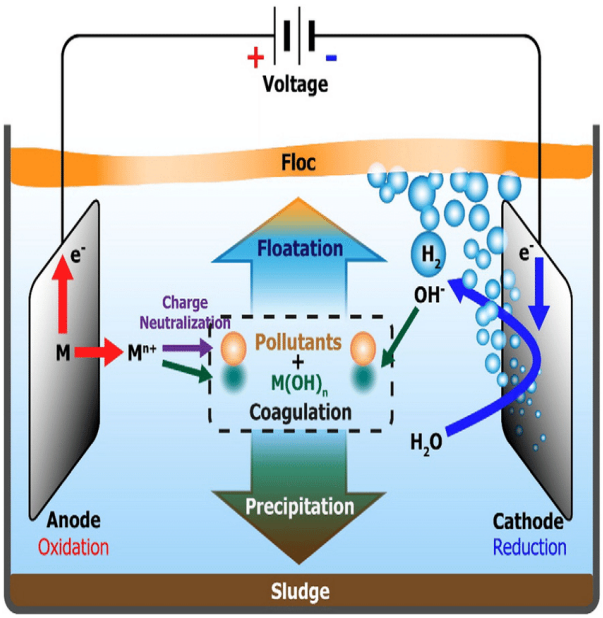

Figure 1: Electrocoagulation mechanism

III. LITERATURE REVIEW

A significant amount of research work on various aspect of Electrocoagulation for wastewater has been studied. Most of studies mainly focused on the parameters those affects the electrocoagulation process.

Mohammad Emamjomeh et al. [1] investigate the effect of different parameters such as, current density (6.25 – 31.25 A/m^2), electrolysis time (5 – 60 min), electrolyte pH (5.5 – 8.5), electrical conductivity (100 and 1000 µmhos/cm) on removal efficiency of fluoride from aqueous solution in batch reactor. He states that, the electrocoagulation process is effective process for defluoridation of potable water supply as well as defluoridation of industrial wastewater.

Kushal A. Mehta et al. [2] performed batch electrocoagulation process for the treatment of pharmaceutical wastewater. Four samples are taken from the batch reactor at 30, 60, 90, 120 min. of contact time. The maximum efficiency is achieved at 1A of applied current. EC is found effective at initial pH of 4 and contact time of 120 min. the degradation of COD, TKN, TDS, TSS, color is observed.

Mansooeh Dahghani et al. [3] found that, the removal efficiency is increased by 6.2 % with decreasing pH from 11 to 3 at optimum condition of 30 V and 60 min. operation time. By increasing the reaction time from 30 min. to 60 min. at voltage (10, 20 and 30 V), the removal efficiency is increased from 32.2 to 87.1%.

Subramanyan Vasudevan et al. [4] compare effects of alternating current and direct current on electrocoagulation process. Generally D.C. current is used in electrocoagulation process. An impermeable oxide layer is formed on the surface of the cathode. As well as corrosion may occur on the surface of anode due to loss of electron. This prevents the effective current transfer between electrodes. This disadvantage can be replace by using Alternating current. The removal of efficiency of 97.5 % and 96.2 % is achieved by using AC and DC current respectively.

Thirugnanansambandham Karichappan et al. [5] examine the effects of electrode distance on EC process. It is observed that removal efficiency of TSS, TDS, COD is increased by increasing the electrodes distance up to 5 cm. but beyond that, the efficiency is gradually reduce.

N. Modirshahla et al. [6] studied that, Electrocoagulation with Fe/Al (anode/cathode) is more effective for the decolorization of Tartrazine (a synthetic yellow azo dye) than Fe/Fe electrode pair**.**

IV. CONCLUSION

From the above literature it can be concluded that the electrocoagulation is the effective method for the treatment of hospital wastewater for the removal of solids, color, turbidity, BOD, COD. The various factors affecting the process are low operation and maintenance cost, high efficiency, time saving, lower sludge production without any addition of chemicals. application of AC current instead of DC may increase the efficiency of the process.

REFERENCES

[1.] Mohammad Emamjomeh Muttucumaru Sivakumar, Andrea Schefer, Fluoride removal by using a batch electrocoagulation reactor., Environmental sustainability through Multidisciplinary integration (pp. 143-152) Australia.

[2.] Kushl A. Mehta, Neha patel, Sejal M.Patel, Treatment of Pharmaceutical waste water by Electrocoagulation, International Journal of Scientific Research and development, Vol.3, issue 03,2015.

[3.] Mansooreh Dehghani, Hassan Hashemi, Treatment of hospital waste water by electrocoagulation using Aluminium and iron electrode, Article January 2014.

[4.] Subramanyan Vasudevan, Jothinathan Lakshmi, Ganapathy Sozhan, Effects of alternating and direct current in electrocoagulation process on the removal of cadmium from water, Journal of hazardous material, 192 (2011) 26-34.

[5.] Thirugnanansambandham Karichappan, sivakumar Venkatachalam and Prakash Maran Jaganathan, Journal of Environmental health science and engineering, vol 12,2014.

[6.] N. Modirshala, M.A. Behnaiady, S. Kooshajjan, Investigation of the effect of different electrode connections on the removal efficiency of Tartrazine from aqueous solutions by electrocoagulation, volume 74, issue 2, 2007 pg no.249-257

[7.] Bukhari AA. Investigation of the electrocoagulation treatment process for the removal of total suspended solids and turbidity from municipal wastewater, 2008 Mar;99(5):91421. Epub 2007 May 11.

[8.] Deepak Sharma, Treatment of dairy waste water by electrocoagulation using aluminum electrodes and settling, filtration studies, International journal of chemTech Research, Vol. 6, No. 1, pp 591-599, Jan-march 2014.

[9.] Murat Eyvaz, Treatment of Brewery Wastewater with Electrocoagulation: Improving the Process Performance by Using Alternating Pulse Current, International Journal of Electrochemical Science, 11 (2016) 4988 – 5008, doi:10.20964/2016.06.11.

[10.] Prasanna N., Manivasagan, V. Pandidurai, S. & Sundaram, T.T., Treatment of Industrial effluent by Electrocoagulation method, Interntional Journal of Science and nature, vol. 5 (4) 2014:603-607.

[11.] Prayitno, Zaenal Kusuma, Bagyo Yanuwiadi, Rudy W Laksmono, Study of Hospital Wastewater Characteristic in Malang City, International Journal Of Engineering And Science Issn: 2278-4721, Vol.2, Issue 2 (January2013), Pp 13-16.

[12.] Saad Khorfan, Removal of turbidity and suspended solids by electro coagulation to improve feed water quality of reverse osmosis plant, article in Desalination, march 2011.

[13.] Sri Malini Adapureddy and Sudha Goel, Optimizing Electrocoagulation of Drinking Water for Turbidity Removal in a Batch Reactor, International Conference on Environmental Science and Technology, IPCBEE vol.30 (2012) © (2012) IACSIT Press, Singapore.

[14.] Omprakash sahu, Treatment of wastewater by electrocoagulation, Environ Sci Pollut Res (2014) 21:2397-2413, DOI 10.1007/s11356-013-2208-6.