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REMOVAL OF HEAVY METALS FROM WASTE WATER OF SUGAR INDUSTRY BY ELECTROCOAGULATION PROCESS -A REVIEW

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Abstract: The purpose of this paper is to cover the whole research occurs over a period of 2006 to 2020 through literature review. In this research we take the review on the removal of heavy metals from sugar industrial wastewater through electrocoagulation process. This work is done to see the effect of Electrocoagulation process on various properties through previous research completed during the above period.

Index Terms *- Electrocoagulation process, Electrode, Current, sugar industry wastewater.*

I. INTRODUCTION

Waste material (Effluents) are commonly come from the industry and they affected the aquatic life adversely. In this paper we consider the effluents along with waste water from the sugar industry as well as industrial waste and it polluted the water ultimately. As the pollution is increasing continuously and affect the aquatic life. At present time there is lots of method to solve this problem like Ion's exchange, Catalytic oxidation, absorption method, Ultrafiltration technique, membrane filter method, electrocoagulation and coagulation. Sugar waste water changes the temperature, pH, biological oxygen, demand and suspended solids also. Waste water from sugar industry must be treated as before discharging in the river. Copper, zinc, unbalanced pH, nickel, Sulphur, Phosphate, Cadmium, arsenic, Mercury, lead, temperature etc. are found as impurities, and to treat this polluted water electrocoagulation method may be used.

II. ELECTROCOGULATION PROCESS

Electrocoagulation is one of the cheap but complex method to remove the various harmful content from the sugar waste water as well other industries like slaughterhouse waste water, olive mills, Nitrate industry waste water. The process of electrocoagulation can illustrate as in figure 1. In the mechanism of electrocoagulation, the solution that want to treat is filled in reactor and treated it and Electrodes are immersed into the solution and categories as anode and cathode. The power supplied in the solution through electrodes with the help of power source. Aluminum and iron are processed and mechanism occurs. The medium of electrocoagulation isn't completely known because of its complex response. The result to be treated by electrocoagulation is filled in the reactor. Electrodes of analogous or different material are dipped into the result and classified as anode and cathode. These electrodes are connected to the power source, through which the current is passed into the result. When current is passed through aluminum and iron

anodes Al3 and Fe2 ions, independently, are formed. At cathode hydrogen gas and hydroxide ions are released at the same moment of time. These hydroxide ions combine with the Al3 and Fe2 ions in result and formed aluminum and iron hydroxides, independently, which act as a coagulant. Aluminum and iron are generally used electrodes in electrocoagulation process. In the iron electrode, two mechanisms have been proposed

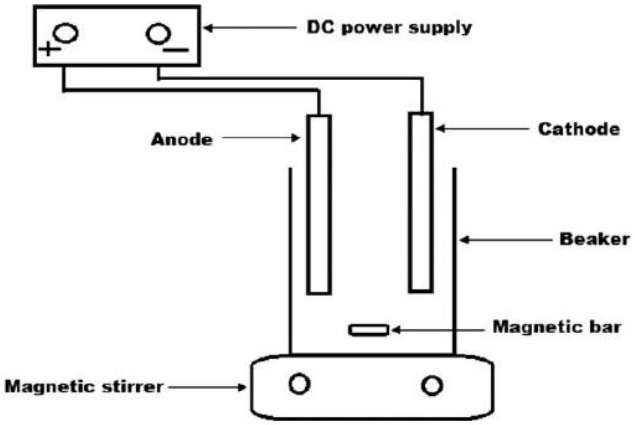

Fig.1 Electrocoagulation System

Mechanism 1:

Anode: $4Fe \rightarrow 4Fe^{+2} + 8e^-$

$4Fe^{+2} + 10H_2O + O_2 \rightarrow 4Fe(OH)_3 + 8H^+$

Cathode: $8H^+ + 8e^- \rightarrow 4H2$

Overall: $4Fe^{2+} + 10\,H_2O + O_2 \rightarrow 4Fe(OH)_3 + 4H_2$

Mechanism 2:

Anode: $Fe \rightarrow Fe^{+2} + 2e^-\ Fe^{+2} + 2OH^- \rightarrow Fe(OH)^2$

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

Overall: $Fe + 2H2O \rightarrow Fe(OH)_2 + H_2$

III. Literature Review

P. Krystynik, et. al. (2019) expressed the importance of this method for removal of chromium from the industrial waste water using pilot scale in laboratory. Effluent from the industrial waste 96 % chromium has removed by this method. Pilot scale unit used is very common unit to find long term trail analysis for focused on the removal of effluents. On waste water pilot scale continuously operated ($0.5m^3/h$) to remove the long-term effluents, and 0.24 kWh/m^3 power consumed in the process. Some other contaminant also removed below their reduction limit.

Fatih Ilhan, et. al. (2019) discusses the electrocoagulation method and used iron and aluminium electrode to precipitation through pH value adjustment it also observed that removal was fast during first min and goes slow but efficiently removed the metal and current not varied very much. Iron electrode are 10% more effective to that of aluminium. Cu, Cr, Zn, Ni also removed by this EC method.

Umarn Tezcan Un and sadettin Eren Ocal (2015) studied that process to removal of nickel (Ni), Cadmium (Cd), and Copper (Cu) from waste water through iron reactor has characterised by different condition like pH, current intensity and heavy metal concentration as

Table-1 Removal of metal concentration

pH	Current mA/cm^2	Remove metal
7	50	30
3	30	10
5	40	20

In their study it was clear that the maximum Ni (99.98%), Cd (99.78%), Cu (98.90%) had removed after 90min through the electrocoagulation method.

Edris Bazrahan, et. Al. (2014) studies about the efficiency of EC method with the help of the electrode (Aluminum) red dye from waste water. In this study six aluminum electrodes are joined in parallel. To calculate the efficiency of EC method applied voltage pH, time duration of process, concentration of dye,

conductivity was studied. An electrochemical method is also used to find the dye removal efficiency. Using this method in 50V at the concentration of 50mg/l at pH 7, conductivity 3000µS/cm during the time period of 60min , removal efficiency of dye is 97.7%.

Riyad H. Al Anbari, et. al, (2008) studied and introduced the concept of electrocoagulation, using the perforated tube and iron electrodes. The identified the different materials like zinc trivalent chromium and cadmium, coppers, nickel with the help of iron anode material. Also, pH, current intensity heavy metal concentration is measured to achieve high removal capacity by EC method

IV. CONCLUSION

In this review paper disused about the complete method of electrocoagulation to removed heavy metals from sugar industry as well industrial waste. Some chemical reaction occurs on electrode and give significant change of pH, energy, electrode consumption, electrode material, temperature, zinc, coppers, voltage variation. In this it also found that this EC method is used as very powerful technique as compared to other technique to remove the heavy metals from waste and industrial water. Its efficiency is good as compare to other technique.

REFERENCES

1. Krystynik, P., Masin, P., Krusinova, Z., Kluson, P. (2019). “Application of electrocoagulation for removal of toxic metals from industrial effluents”, International Journal of Environmental Science and Technology, August 2019, Volume 16, Issue 8, pp 4167–4172
2. Iwanti, R. (2019). “Lab Scale Study of Iron Removal from Industrial Wastewater by Electro-Coagulation Process: A Case Study”, International Journal of Engineering Research & Technology, Vol. 8 Issue 09.
3. Abbas, S.H., and Ali, W.H. (2018). “Electrocoagulation Technique Used to Treat Wastewater: A Review”, American Journal of Engineering Research (AJER), Volume-7, Issue-10, pp-74-88.
4. Jagwani, M.,(2018). “Lab Scale Study of Electro-Coagulation Process for Zinc & Iron Removal from Metal Plating Industrial Waste-Water”, Journal Of Industrial Pollution Control Board.
5. Al-Shannag M., Al-Qodah Z., Bani-Melhem K., Qtaishat M.R., Alkasrawi M. (2015). “Heavy metal ions removal from metal plating wastewater using electrocoagulation: Kinetic study and process performance”, Chemical Engineering Journal 260 (2015) 749–756.
6. Bazrafshan E., Mahvi A.H., Zazouli M.A. (2014). “Textile Wastewater Treatment by Electrocoagulation Process Using Aluminium Electrodes”, Iranian journal of health sciences 2014; 2(1):16-29.