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An Insight into Paint and Textile Effluent Treatment

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ABSTRACT

The characterization of wastewater plays important role in treatability of wastewater. The effluent from paint industry contains high chemical oxygen demand and turbidity. The waste water contains drying oil latexes, preservatives, antifoam agents etc. Conventional wastewater treatment plant contains primary, secondary and tertiary treatments. Chemical treatment for the wastewater treatment contains coagulation, flocculation and floatation. Advance oxidation processes are used as tertiary treatment methods in many applications. Studies indicated that coagulants such as aluminium sulphate (Alum) [$Al_2 (SO_4)_3.18H_2O$], and anionic polyelectrolyte are very useful for the treatment. Modified Electro-Fenton Process was found very effective by few researchers. Use of iron and aluminium salts as coagulants is also effective for the removal of pollutants. It can be observed from the review that water-based paint wastewater can effectively be treated by Fenton process with rust catalysis in the mixed reactors.

Keywords: COD, Dissolved Solids, Turbidity, Reagent.

I. INTRODUCTION

Industrial wastewater treatment needs careful attention for economical and effective operation. The characterization of wastewater plays important role in treatability of wastewater [1-4]. The effluent from paint industry contains high chemical oxygen demand and turbidity. The waste water contains drying oil latexes, preservatives, antifoam agents etc. In paint industry the effluent discharge is very high due to cleaning operations of mixers, reactors, blenders, packing machines and floors etc. Conventional wastewater treatment plant contains primary, secondary and tertiary treatments [5-7]. Chemical oxygen demand (COD) and Biological oxygen demand (BOD) are important measures of organic matter content. Chemical treatment for the wastewater treatment contains coagulation, flocculation and floatation [8-14]. Advance oxidation processes are used as tertiary treatment methods in many applications [15-20].The oxidation methods by using Fenton reagents and hydrogen peroxide dominate the research carried out on the pains and textile effluents. Also some studies on the membrane methods are also reported. Current studies provide an insight on studies and research on pain industry effluent.

II. AN INSIGHT INTO PAINT AND TEXTILE EFFLUENT TREATMENT

A work on the treatment of wastewater obtained from the resins plants was carried out by Hanafy and Elbary[21]. They conducted inspection of the existing units and evaluation of its performance. They also analysed wastewater effluent from tanks during washing process and conducted treatability study. They conducted bench scale studies and obtained the optimum dose of the coagulant. They used two coagulants namely aluminium sulphate (Alum) [$Al_2(SO4)_3.18H_2O$], and anionic polyelectrolyte. They also studied impact of adsorbent dosage on parameters such as pH, turbidity, total suspended solids and chemical oxygen demand.

According to Sindhi and Mehta, effluents from chemical and agrochemical industries, the textile industry, paints, dyes, etc. can be best treated by advanced oxidation methods[22]. In their work, they conducted the laboratory scale batch experiments to analyse the COD reduction of three different industrial wastewater samples by using Fenton Process. Low bio-degradability imposes limitation on biological treatments of these wastewaters. Short reaction time of Fenton reaction

permits treatment of high COD effluent. They obtained COD reduction in the range of 60% to 85%. 3-15 mg/L Fe was minimum threshold concentration. Optimum pH range was 3 to 6.Sadek et.al used Modified Electro-Fenton Process for treatment of effluents from paint industry[23].They carried out extensive research on the effectiveness of modified Electro-Fenton process (EF-Fere).The electrodes used were, stainless steel porous cathode and lead anode covered by PbO_2 film. They studied the effect of different parameters on the percentage of COD removal. They studied the parameters such as ferric ions concentration, initial concentration of wastewater, current density and irradiation of UV light. They obtained high COD removal efficiency of 99%.

Rebah and Siddeeg studied cactus for wastewater treatment [24]. They found that cactus enzymatic system was useful for the transformation of toxic textile dyes. In their research cactus showed very high and promising pollutant removal efficiency. Cactus worked as excellent coagulant for the reduction of pollutants. They also explored use of cactus biopolymer sludge treatment. These plants are renewable, abundant, environmentally friendly, adaptable and biodegradable. The transformation of toxic textile dyes due to the presence of cactus enzymatic system is very useful aspect. For efficient use of cactus, it is important to optimize the procedures for each wastewater independently. They felt need to evaluate technology performance at large scale in real conditions for various wastewater systems. Aboulhassan et.al. studied the combination of a chemical coagulation/flocculation step with an aerobic biological process[25]. They carried out the process in feed-batch operation; to treat real paint manufacturing wastewater.Their research indicated that the combination of coagulation-flocculation and biological process was very efficient methodology for paint manufacturing wastewater. They used coagulants namely iron chloride and anionic polyelectrolyte Chemic5161. They determined coagulant doses as well as coagulation pH for pollutant removal of turbidity and COD. They found that turbidity removal is most effective at pH range between 4.5 and 6. According to this investigation, minimum dosages of 800 mg/L of $FeCl_3$ were required for the quantitative removal of 92% of COD.

Jewell et.al. explored opportunity in reusing wash water from white, non-textured paints[26]. According to them, 65% of total effluent from the plant can be used for manufacture of lower quality paints. Different dosage levels of the coagulant can be used for reminder of wastewater. Wang et.al. carried out studies on textile dyeing wastewater treatment [27].According to these studies the textile and paint effluent is high in color. It contains residues of reactive dyes and chemicals, such as complex components, many aerosols, high chroma, high COD and BOD concentration along with much more hard-degradation materials. These studies suggested elctro-chemical oxidation of refractory organic compounds and dyes followed by biological treatment under aerobic conditions. A second electro-oxidation process can be used for colour and odour removal. A photochemical treatment can be used to removal microbial impurities. Further ion exchange treatment can be used to make the water industrially usable. Noorjahan carried out studies on physico-chemical parameters and identification of bacteria in paint industries[28]. Cleaning operations of mixers, reactors, blenders, packing machines and floors etc. are the reasons for wastewater generation in large quantities. She analysed the physicochemical parameters. Also microbes from untreated paint effluent were identified by her. The COD of untreated effluent was around 560 mg/l to 300 mg/l. These studies also confirmed presence of gram positive cocci and gram negative bacilli.

Ntwampe et.al. carried out investigation on effect of mixing on paint wastewater treatment[29].They used iron and aluminium salts as coagulants. Their investigation indicated a correlation between the pH and turbidity. Gajjar and Patel carried out an investigation on treatment of paint (emulsion) industry wastewater by electrocoagulation[30]. They carried out studies on working parameters such as pH, current density, operating time, types of electrodes and surface area. Their studies indicated that electro-coagulation with Al electrodes was more effective than MS and SS electrodes. El-Sawy et.al. used combination of methods namely radiation, coagulation and adsorption for treatment of pain industry effluent[31]. They carried out coagulation with aluminium sulphate and adsorption using granular activated carbon (GAC).They studied factors affecting coagulation such as settling time, aluminium sulphate concentration. They found optimum parameters as 10 g/L and pH 8. They achieved a

reduction in sulphate concentration 50%, COD 92% and BOD 98.5%.

According to Smidova et.al., for paint effluent most common method is the coagulation–flocculation[32].They explored possibility of using pressure membrane processes for wastewater from water-based paint industry. In their investigation, they observed that the permeate flux decreases with an increase in the concentration of particles in suspension. Kurt et.al. carried out investigation on Treatability of water-based paint wastewater[33]. They explored use of different types of reactors for Fenton oxidation process. They carried out experiments with different dimensions of the column, packing material size, reactive dosage, pH value and reaction time. According to them, the sufficient doses of H_2O_2 and Fe ions are most important factors in treatment. They concluded that water-based paint wastewater can effectively be treated by Fenton process with rust catalysis in the mixed reactors.

III. CONCLUSION

Low bio-degradability imposes limitation on biological treatments of paint and textile wastewaters. Short reaction time of Fenton reaction permits treatment of high COD effluent. Studies reveal that optimum pH range was 3 to 6 for the treatment. Use of iron and aluminium salts as coagulants is also effective for the removal of pollutants. Studies also reveal that electrocoagulation with Al electrodes was more effective than MS and SS electrodes.

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