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Review Article

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Review on Ink Wastewater Treatment Technology

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Abstract On the basis of the sources and harm the ink wastewater analysis, summed up the four ink wastewater treatment methods: adsorption, coagulation, chemical oxidation, biological method, and the four methods were compared. He points out the advantages and disadvantages of each method and conditions of use, the treatment effect.

Keywords environmental engineering, ink wastewater, printing and dyeing wastewater, water treatment technology

Introduction

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Treatment Methods of Ink Wastewater

In order to reduce ink waste damage to human health and the environment, the ink wastewater treatment before discharge it has been included in state law. Domestic and foreign experts and learn which pay a lot of effort and energy to study its approach. After years of development and optimization, present, domestic ink wastewater treatment methods are mainly the following methods.

(1) Adsorption

Adsorption is when water passes through porous solid adsorbent (activated charcoal, clay, fly ash, etc.) in the adsorbent surface by molecular attraction of adsorption and ion exchange, etc., so that the method in wastewater impurities are removed by adsorption. Adsorption of pollutant concentrations and low color ink wastewater treatment works well, with no mud, no chemical method is simple, low investment cost, easy operation, low operating cost advantages. However, adsorption treatment effect will be influenced by temperature, pH value, adsorption time, the adsorbent easily saturated, water quality is unstable, prone to secondary pollution adsorbent regeneration. At present, most scholars put a lot of effort in research and development and improvement of the adsorbent, the adsorbent more new applications in wastewater treatment.

Zeng Tao et al uses activated carbon adsorption decolorization mixing process after coagulation treatment of ink wastewater, when the activated carbon in an amount of 2g/100mL, the effluent decolorization rate of one hundred percent [1]. Metes et al using zeolite as adsorbent ink wastewater, wastewater color removal works well [2]. Ersu et al studied the ultrafiltration concentration ink waste, waste water and concentrated to a solid concentration of the ink is 99g/L [3-4]. Metivier-pignon et Ultrafiltration - activated carbon adsorption process coupled high chroma pen ink, waste water after the first step of ultrafiltration, color removal Chaoguo 97%, COD residual amount of 1700mg/L; after the second step after the activated carbon adsorption, and the color is completely removed, for COD adsorption capacity of 500mg/g [5].

(2) Coagulation Method

Coagulation process in the wastewater coagulant is added to the compressed electric double layer, adsorption bridging, charge neutralization and, sweep netting and roll and other ways of dye molecules, colloids and other

impurities aggregation, flocculation, sedimentation, and the formation of sediment sludge discharge. Coagulation method has simple process, flexible operation, easy management, but dyeing wastewater often contains many types of dye, while more difficult to dye the entire settlement removed. The most commonly used coagulant is divided into inorganic, organic and biological three. Traditional aluminum coagulant floc formation of small floc form stable, but slow coagulation, flocculation susceptible to temperature influence. Ferric coagulant fast response, floc large, easily precipitate. Applying a hydrophilic dye, bleaching effect is poor, dosage is not easy to control, easy to cause the water yellow, COD removal rate. When coagulant and flocculants compound used, can significantly improve the coagulation effect. At present, the development and improvement of existing and new efficient non-toxic coagulant coagulation art become the main research directions.

Wu Dunhu et al of different coagulants ink wastewater by coagulation tests found that the polymerization ferric chloride as coagulant under optimal conditions, color removal of waste water more than 97% [6, 7]. Roussy *et al* biopolymers (chitosan and tannins) coagulation treatment of wastewater containing ink, studies show, pH = 5, the chitosan concentration of 20mg/L, tannic acid concentration of 70-100mg/L, the best coagulation effect [8]. Wang Shun et al coagulation-heat curing-microelectrolysis ink printing wastewater treatment, results showed: coagulant dosage NS-1 at 22.8g/L or so, more than 50 °C heat curing allows the COD removal rate can reach 87%, after the iron filings micro electrolysis, removal of over 90% [9].

(3) Chemical Oxidation

Chemical oxidation is the use of Fe^{2+}, action of hydrogen peroxide, ozone, sodium hypochlorite and other strong oxidizing agent, the oxidation of reducing substances in waste water, the waste water in the colored group was broken ring fracture lose the ability to absorb light, and converted to organic or inorganic small molecule, making it non-toxic and harmless. The most commonly used ozone oxidation, electrolysis and Fenton reagent method. Ozone has a strong oxidizing power, enabling high molecular weight dye was broken rings, broken into small molecular weight organic or inorganic contaminants, to the loss of light absorption capability, to achieve the purpose discolored. Ozone oxidation method has an oxidation speed, clean pollution, no sludge, space-saving, easy control, but the oxidation process in great demand, and to deal with the high cost of low COD removal efficiency when the amount of waste water.

Principle Fenton oxidation process is under acidic conditions, Fe^{2+} catalysis H_2O_2 produce a strong oxidizing ·OH in catalysis. Intermediate hydroxyl radical has a strong oxidation activity, the oxidation potential of 2.73V, the point of difference in the electron transfer by way of the oxidative decomposition of organic matter, while initiated chain reaction, to produce a greater number of ·OH, catalyzed Fe^{3+} produces coagulation sedimentation remove large amounts of organic matter. Specific reflect follows:

$Fe^{2+}+H_2O_2 \rightarrow Fe^{3+}+\cdot OH+OH^-$

$Fe^{3+}+H_2O_2 \rightarrow Fe^{2+}+HO_2\cdot+H^+$

$HO_2\cdot+H_2O_2 \rightarrow O_2+H_2O+\cdot OH$

$RH+\cdot OH \rightarrow R\cdot+H_2O$

$R\cdot+Fe^{3+} \rightarrow R^++Fe^{2+}$

$R^++O_2 \rightarrow ROO^+ \rightarrow CO_2+H_2O$

Li Ying studied the experimental conditions ozone decolorization treatment of ink wastewater, the amount of ozone at 11mg per liter of wastewater decolorization effect inks best [10]. Gao Aifang et al using Fenton oxidation technology processing ink waste, identified Fenton oxidation optimal conditions: initial pH value of 2.7, the degradation effect of hydrogen peroxide dosage of 779mg/L, ferrous sulfate dosage of 806mg/L, wastewater best [11]. Sun Lingfang et al. Studied the modified TiO_2 electrode sheet electrical Fenton Degradation of Rhodamine B Wastewater. The results showed that the modified electrode can improve the Fenton reagent ·OH, improve degradation [12]. Ma et al. Studied the binding of coagulation Fenton-Degradation ink wastewater found, chroma removal efficiency of up to 100%, COD removal rate was 93.4% [13]. Canizares P et al studied the electrochemical oxidation of wastewater containing ink methylene blue and rhodamine B dye [14].

(4) Biological Method

Biological method is the use of microbial metabolic activity consume organic matter in wastewater, which is decomposed into energy, minerals, carbon dioxide and water their own needs. Under the action of microbial enzymes that can destroy the dye molecules of the unsaturated bond, loss absorbance capacity, so as to achieve the purpose of purifying sewage, there is currently a mature biological aerobic biological treatment, anaerobic biological treatment and tired-aerobic combination approach. Biotechnology is the use of aerobic aerobic microbial conversion of organic life activities absorb the energy required for their own, while generating inorganic substances excluded by the biological sludge. Aerobic microbial oxidation process of decomposition, the reaction speed is faster, higher wastewater biochemical requirements for BOD removal effect is good, the need for pre-processing means, when used alone to improve the biodegradability of wastewater. Anaerobic means under anaerobic or hypoxic environment, microbial metabolic activity of anaerobic degradation and transformation of organic and inorganic pollutants energy to purify water effect. Anaerobic have a very wide range of practical, whether it is a high concentration of organic waste water, sewage or low concentrations have very good degradation effect. Anaerobic-aerobic combined treatment method can make up for lack of aerobic and anaerobic waste water of dyes and other refractory organic matter decomposition and transformation into easily degradable small organic molecules, and finally in the metabolic activity of aerobic microorganisms degrade removed purify wastewater.

Ink high concentration of organic matter in waste water, poor biodegradability, when the ink wastewater treatment by biochemical method, generally after the anaerobic treatment of organic matter into methane, carbon dioxide and other inorganic substances, improve the biodegradability of wastewater, and then by aerobic treatment. Current common anaerobic means there is an anaerobic digester, anaerobic tower, anaerobic filter, UAS, GESB reactors and new reactor sludge bed expansion and other devices. Commonly used techniques are aerobic oxidation ditch, sequencing batch activated sludge process, A/O method, A/A/O method, BAF, biological contact oxidation process.

Cai Yanxing et al ink wastewater coagulation sedimentation degradation test and found that the effect of the water has improved significantly, up to 80% color removal, the supernatant was mixed with sewage flowing through the biological contact tank, up to the final effluent COD 80%, substantially complete removal of color [15]. Pei Guihong et al studied of individual treatments of wastewater by biological method [16]. After Sun more people and so on to carry out waste ink flotation oil, then condensation in addition to the base, and finally SBR reactor biodegradable effluent CODcr less than 150mg/L.

Conclusions

Unlike general dyeing wastewater, waste ink in the cost of pollution is very complex, both as a cyclic organic pigment, but also as an ink binder resin, there are some aids, dispersants, mainly wastewater characteristics COD is very high, generally about content 20000mg/L, chroma up to thousands of times or even thousands of times more than poor biodegradability. Depending on the pigment ink, the ink can be divided into dozens of pollutants in wastewater and the ink, there are some differences, including white ink as compared with other color inks, the pigment is rather special, the main pigment is titanium dioxide that is titanium dioxide powder, which has a strong photocatalytic properties under UV irradiation is usually used as a photocatalyst in photocatalytic field. White ink in addition to the waste water contains some basic aids, dispersants, binders, etc., but also contains a lot of titanium dioxide pigment. Several common ink wastewater treatment methods have advantages and disadvantages, choice of treatment should be determined according to the composition and technical and economic indicators of wastewater.

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