Electrochemical DBS Wastewater Treatment Research

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Abstract. The treatment of anion surfactants in wastewater with the electrochemical reactor is studied in this paper. Factors affecting the removal rate were investigated,such as anode material、electric current density、electrolyse time、electrolyte and pH etc.At the optimal conditions of electric current density 30 mA/cm2,electrolyse time 45min, and pH 7-8,the removal rate of anion surfactants can be more than 97%. Infrared spectrum analysis results show that the activated carbon adsorption removal of no direct contribution to DBS.

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Introduction

Commonly used at home and abroad of anionic surfactant linear alkyl benzene sulfonic acid sodium (DBS) is one of the main pollutants of water body. Research and development of economic and practical methods of alkyl benzene sulfonic acid sodium removal, has very important practical significance. Law of electrochemical oxidation ability is strong, high degree of control, simple equipment, easy operation, less land, etc. Using electrochemical treatment of wastewater in the DBS homemade electrochemical reactor was studied, the experiment of anode, electrolyte, current density, electrolytic time and wastewater pH conditions on the DBS electrolytic removal effect, the optimal processing conditions were determined.

Experimental section

Experiment device. Electrochemical reactor mainly by the homemade electrolytic cell, electricity plate and dc power three components, cell capacity of 15.0 x 3.0 x 7.0 cm^3. The experiment chooses in the treatment of activated carbon particles for filling particles electrode, to increase the increment of the electrode surface area in the unit, and strengthen the electrode in the mass transfer process.

Experiment method . Will the plate electrode surface do appropriate treatment, in experiments in the device. Will be processed packing particle electrode filling to experiment device inside, join to deal with the simulation of the waste water, switch on the power, voltage, electric conductivity and set the condition such as pH value, reaction time sampling and analysis, the treatment of the remnants of the DBS concentration and COD. Use UV-VIS8500 uv-vis spectrophotometer and FTS-135 Fourier transform infrared spectrometer product characteristics are analyzed.

The results and discussion

Anode materials . Under the same experimental conditions, graphite and titanium base RuO_2, titanium base SnO_2 three kinds of the anode electric catalytic oxidation degradation of DBS processing results. Data show that the titanium base RuO_2 and titanium base SnO_2 processing effect is better, the degradation of DBS rate are above 94%, COD removal rate has reached 81.4% and 81.4% respectively.

Table 1 Different anode materials for DBS treatment effect

anode materials	residual DBS (mg/L)	DBS removal rate (%)	COD removal rate (%)	COD (mg/L)
itanium base RuO2 plate	4.1	95.9	38.6	81.4
itanium base SnO2 plate	5.4	94.6	57.7	72.2
graphite plate	13.2	86.8	58.1	87.2

From DBS degradation rate and the removal rate of COD, three kinds of electrodes to DBS removal rate than COD removal rate of wastewater, this suggests that the study of three electrodes oxidation wastewater DBS also experienced multistep reactions, the results are shown in table 1.

Current density and the influence of electrolytic time

As shown in the process, any current density, concentration of DBS and COD values are increased with the increase of electrolytic time is reduced, removal rate increase with the increase of time. In 45 min, 10 mA/cm^2, 20 mA/cm^2, 30 mA/cm^2, under the current density of 40 mA/cm^2, the removal rate of DBS can reach 91.2%, 93.9%, 95.7% and 93.9% respectively, the removal rate of COD can be up to 71.2%, 74.6%, 80.7% and 74.6% respectively. And after DBS concentration, COD removal efficiency value and the change is not obvious.

According to the mechanism of the method of electrochemical oxidation of the • OH groups, can be explained as follows, in response to 30 min, this period of time due to high concentrations of organic matter, in the solution, OH groups quickly, make the • OH groups oxidation reaction of the organic matter to occur rapidly. At the same time, in the main electrodes of activated carbon filled conductive performance is good, accumulated a lot of molecules on the surface, the concentration of a solution of concentration is higher than that each particle can form a pair of double polarity microelectrode, amounts to a lot of tiny cell, separately on each particle of the positive and negative oxidation and reduction reaction, effective use of the space of electrolysis, have the effect of improved electric field, improve the efficiency of the electrolytic.

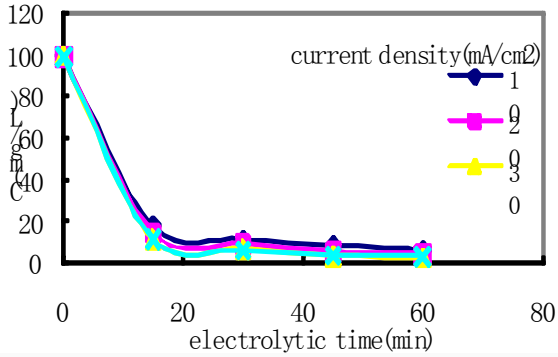

Figure 1 DBS concentration curve with electrolytic time

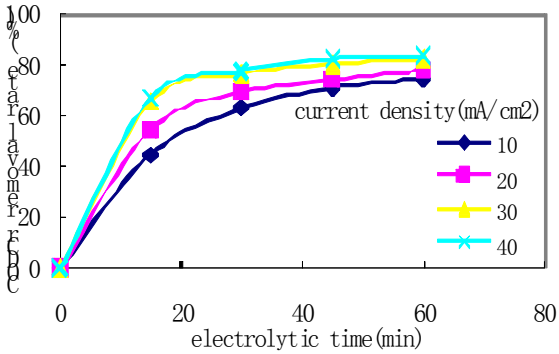

Figure 2 COD removal rate curve with electrolytic time

Pruning the influence of the electrolyte

By the figure can be seen, to join the NaCl treatment effect is adding Na_2SO_4 treatment effect is better, but in the treatment of 50 min is flat. Explanation is as follows: in the process of electrolysis, chloride ion in anode discharge main producing chlorine gas, the hydrolysis of the chlorine on the anode plate quickly, at the anode area produce hypochlorous acid, hypochlorous acid and ionization produce hypochlorous acid root. Thus in the electrolyte hypochlorous acid by electrolysis and hypochlorous acid root. These strong oxidizing chloride can be oxidation of organic compounds in aqueous solution, to a certain extent, improve the treatment effect, but the reaction is not dominant. And, after adding NaCl electrolyte, solution of Cl - may react with organic matter in waste water and generate other refractory organic matter, therefore, this study only USES the Na_2SO_4 to adjust the conductivity of the effluent.

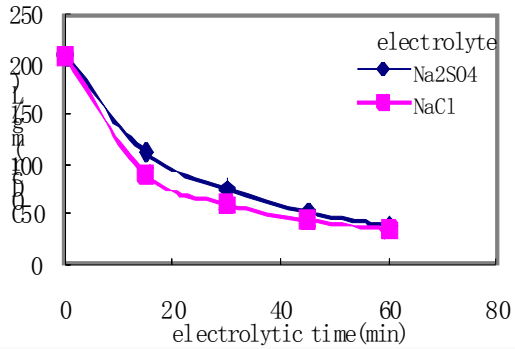

Figure 3 COD value comparison to join different electrolyte

Radar echoes captured the influence of wastewater pH value

The solution of the pH value can not only make some changes REDOX reaction happened potential of mobile, and it will also change the electrode surface charge of electric properties, thus affecting the adsorption of organic matter in the electrode surface and the reactions. Figure 4 reaction is in different pH value conditions DBS wastewater electrolytic effect.

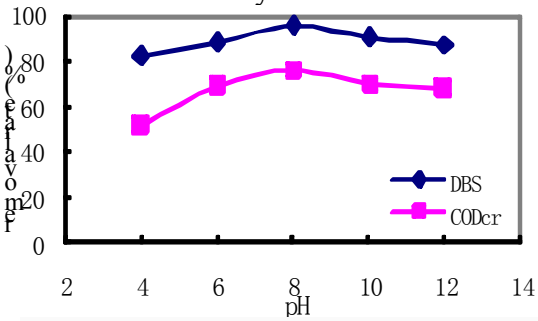

Figure 4 pH value on the DBS electrolytic effect

Infrared spectrum (IR) analysis

To verify that is used as a filler electrode of active carbon adsorption removal of DBS without direct contributions, after taking electrolytic DBS about activated carbon residue, after vacuum drying, with KBr again according to the quality for the production of 1:100 tablet, then using Fourier transform infrared spectrometer, FTS - 135 in the wave number range of 400 ~ 4000 cm - 1 scan, observe its infrared absorption. Results as shown in figure 5 and figure 6, it can be seen that after electrolytic after analyzing the infrared absorption spectrum of activated carbon filter residue and has not been used as the filling of the infrared absorption spectra of activated carbon electrodes are basically identical. "Accordingly, no adsorption on activated carbon DBS and its breakdown products, pieces of oxidative decomposition of organic matter by electricity mainly exist in the water phase, and illustrates the activated carbon adsorption removal of no direct contribution to DBS.

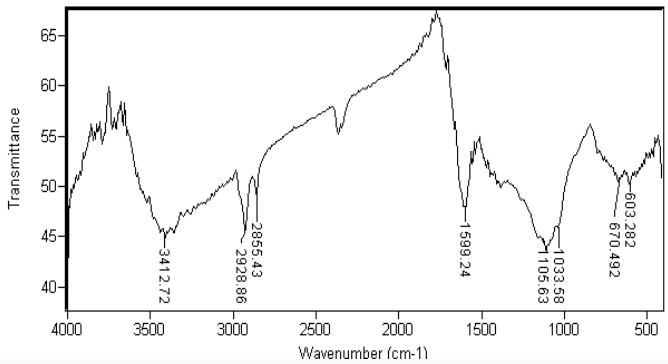

Figure 5 Electrolytic former infrared spectrogram of active carbon

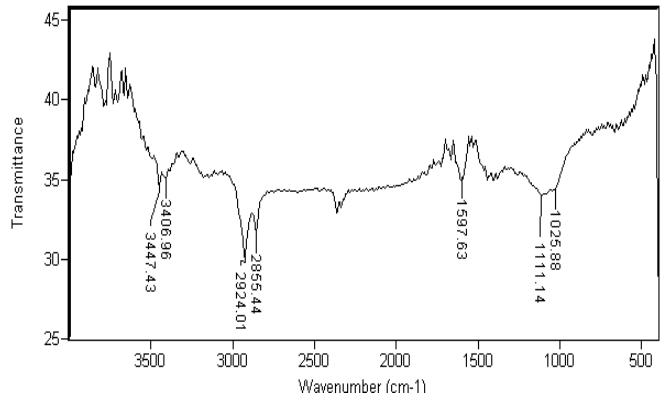

Figure 6 After electrolytic infrared spectrogram of active carbon

Conclusions

Through the experiment found the electrolytic treating of anionic surfactants in the best condition of waste water for current density of 30 mA/cm^2, electrolytic 45 min, waste water conductivity time 1100 μs/cm, pH value between seven to eight. In the condition of experiment, anionic surfactant total concentration for 103 mg/L of wastewater, the electrochemical treatment, a residue of 2.9 mg/L concentration, removal rate is 97.18%, can meet the national discharge standards. Infrared spectrum (IR) analysis results show that the adsorption on activated carbon DBS and its breakdown products, pieces of oxidative decomposition of organic matter by electricity mainly exist in the water phase, and also explains the activated carbon adsorption removal of no direct contribution to DBS.

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