Effect of Aeration Time on Preserved Wastewater Treatment of Activated Sludge Process

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ABSTRACT

The effects of aeration time on the COD removal rate, turbidity removal rate, pH, conductivity, SS removal rate, absorbance and decolorization rate were investigated by using activated sludge process treatment of a high concentration of preserved wastewater. The results showed that with the extension of the aeration time, the wastewater quality improved gradually. The treatment effect was the best after the activated sludge treatment of the preserved wastewater for 32 h. Meanwhile, the COD removal rate, turbidity removal rate, pH, conductivity, SS removal rate, absorbance and decolorization rate of the preserved wastewater were 94.2%, 42%, 5.68, 0.247x10^4, 57.8%, 0.429, and 51.5%, respectively. The effluent quality has reached the three-level standard of "The Integrated Wastewater Discharge Standard" (GB8978-1996).

INTRODUCTION

Preserved fruits which are a traditional food with national characteristics in China, as a tourism and leisure food and local specialties, are popular among consumers due to the good taste, easy to carry [1]. Preserved fruits using fruits and vegetables as raw materials and are processed using the preservation effect of high concentration of sugar solution. Preserved fruits can eat directly, and can be added to other foods as embellishments or improving the special flavor, while some preserved fruits even have a therapeutic effect. Therefore, the preserved fruits market is great, Guangdong Province have several thousands of sizable preserved fruits production and processing enterprises [2]. But some environmental problems have arisen, when preserved fruits bring considerable economic benefits. Preserved wastewater often discharged into rivers directly without treatment, leading to serious pollution, emitting a foul smell [3]. Therefore, it is significant to find a quick, effective, and low cost technology to deal with the high concentration of preserved wastewater.

At present, there are various methods to deal with wastewater, such as ion exchange method [4], Fenton method [5], and activated sludge process [6]. Activated
sludge process is an aerobic treatment method to dispose organic wastewater by using microbial floc of suspended growth, and the microbial floc is called activated sludge. Activated sludge process has many merits, covers small footprint, less investment in infrastructure, short hydraulic retention time, strong anti-shock loading capacity, less sludge discharge, stable effluent quality, good treatment effect, and flexible operation, which can dispose the wastewater with high concentration of organic pollutants and certain strength of suspended matter [7, 8], suiting for treatment of preserved wastewater.

Investigating the aeration time on the COD removal rate, turbidity removal rate, pH, conductivity, SS removal rate, absorbance, and decoloration rate of the preserved wastewater by using activated sludge process as the treatment method.

MATERIALS AND METHODS

Experimental Materials

The wastewater used in the experiment was came from a preserved fruit factory in Chaozhou, while the digested sludge without dehydration used in the experiment was came from dewatering workshop pipeline of a sewage treatment plant in Chaozhou. The wastewater qualities were shown in Table 1.

<table>
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<th>TABLE 1. RAW WATER QUALITY PARAMETERS.</th>
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<td>COD (mg/L)</td>
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<td>3175.4</td>
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From Table 1, the COD, turbidity, and SS concentration of the raw water was 3175.4 mg/L, 112.6 NTU, 800 mg/L, respectively, which were relatively high.

Experimental

The preserved wastewater which has been anaerobic treated for 2 days and the sludge which has been domesticated were mixed evenly (the wastewater and sludge volume ratio of 2:1), adding ammonium chloride and potassium dihydrogen phosphate with the nutritive proportion of COD: N: P=100: 5: 1, ensuring nutrition and adequate oxygen for the aerobic microorganisms, and then aerated continuously, investigating the effects of aeration time on wastewater quality indexes.

RESULTS AND DISCUSSION

Effects of Aeration Time on COD and COD Removal Rate of Wastewater

The effects of aeration time on the COD and COD removal rate of the preserved wastewater were shown in Fig.1. After treated by activated sludge process, the treatment effect of the preserved wastewater was obvious. With the increase of the aeration time, COD gradually reduced, while the COD removal rate gradually increased. The COD removal rate of the preserved wastewater changed significantly
when the aeration time was 0~24 h and the COD removal rate decreased gradually. The COD and COD removal rates were 185.7 and 94.2%, respectively after aerated for 32 h.

![Figure 1. Effects of aeration time on COD and COD removal rate of wastewater.](image1)

**Effects of Aeration Time on Turbidity and Turbidity Removal Rate of Wastewater**

The effects of aeration time on the turbidity and turbidity removal rate of the preserved wastewater were shown in Fig.2. After treated by activated sludge process, the turbidity of the preserved wastewater decreased gradually, while the removal rate of the turbidity increased gradually, and the rangeabilities of the turbidity and turbidity removal rate were small at 0~16 h, after that, the rangeabilities of which increased. The turbidity reached 65.3, and the turbidity removal rate reached 42% after aerated for 32 h.

![Figure 2. Effects of aeration time on turbidity and turbidity removal rate of wastewater.](image2)

**Effects of Aeration Time on pH and Conductivity of Wastewater**

The effects of aeration time on the pH and conductivity of the preserved wastewater were shown in Fig.3. The pH and conductivity of the preserved wastewater were decreased with the extension of the aeration time, and the pH and conductivity of the preserved wastewater decreased rapidly at 0~16 h, but after 16 h, the downward trend of the pH and conductivity tended to be gentle. The pH and conductivity of the preserved wastewater were 5.68 and 0.247x10^4, respectively after
aerated for 32 h. Meanwhile, in the process of biochemical treatment, the growth and reproduction of microorganisms were carried out under the condition that the pH range was 6.5~9, so it was necessary to regulate the pH in the process of treatment.

Figure 3. Effects of aeration time on pH and conductivity of wastewater.

Effects of Aeration Time on SS and SS Removal Rate of Wastewater

The effects of aeration time on the SS and SS removal rate of the preserved wastewater were shown in Fig.4. After treated by activated sludge process, the removal effect of the suspended matter was significant, when the aeration time was 0~16 h, the rangeability of the SS removal rate was relatively large, after 16 h, the change of the SS and SS removal rate were relatively small. The final SS removal rate was 57.8%, and the SS concentration was 338.444 mg/L, showing a good removal effect.

Figure 4. Effects of aeration time on SS and SS removal rate of wastewater.

Effects of Aeration Time on Absorbance and Decolorization Rate of Wastewater

The effects of aeration time on the absorbance and decolorization rate of the preserved wastewater were shown in Fig.5. After treated by activated sludge process, the decrease of the chroma for the preserved wastewater was obvious, and the decolorization rate increased with the increase of the aeration time. The absorbance and decolorization rate of the preserved wastewater were 0.429 and 51.5%, respectively after aerated for 32 h.
Effects of Activated Sludge Process on the Treatment Effect for Wastewater

From above we can know, with the extension of the aeration time, the wastewater qualities improved gradually, the effluent quality reached the three-level standard of "The Integrated Wastewater Discharge Standard" (GB8978-1996). In the activated sludge process, the aeration equipment was used to provide oxygen for the growth and reproduction of microorganisms, and the organic pollutants in the sewage was removed by the aggregation, adsorption and oxidation of microorganisms in activated sludge.

CONCLUSIONS

(1) With the extension of the aeration time, the wastewater quality improved gradually.
(2) The COD removal rate, turbidity removal rate, pH, conductivity, SS removal rate, absorbance and decoloration rate of the preserved wastewater were 94.2%, 42%, 5.68, 0.247x10^4, 57.8%, 0.429, and 51.5%, respectively after aerated for 32 h.
(3) The effluent quality has reached the three-level standard of "The Integrated Wastewater Discharge Standard" (GB8978-1996).

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REFERENCES

