Notice of Retraction

After careful and considered review of the content of this paper by a duly constituted expert committee, this paper has been found to be in violation of IEEE’s Publication Principles.

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Factors Optimization of Bio-contact Oxidation Techniques in River Remediation

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Abstract: The biological purification device that combined the aeration-ship technology and biological contact oxidation was applied to the eutrophic river water treatment of Dongfeng channel in Zhengzhou city, Henan province. The effects of dissolved oxygen (DO) and hydraulic loading on the combined packing performance had been studied in previous paper [1]. In this paper, Factors of reaction pH value and temperature were optimized using single factor test to find out the preferable treatment effect. Results showed the removal rates of CODcr, BOD5, NH3-H and TP were better when the operating pH value was 7.1~8.5 and the reaction temperature was 20°C~27°C.

Keywords: bio-contact oxidation, river restoration, pH, temperature

1. Introduction

The utilization of biotechnology to manage sewage is attracting an increasing interest due to its characteristic of both activated sludge and bio-membrane. It is easy to manage, has anti impulsion load as well as treatment effect. It has been widely used both in China and abroad [2]. In this study, a cylinder filter bed which has good water permeability was used in the river restoration experiment with biological contact oxidation technique. The water was from Dongfeng channel in Zhengzhou and the cylinder filter bed that equipped with water-erosion resistant and corrosion-resistant filler was fixed in one section on the river to accelerate river restoration by enriched bio-membrane surface [3].

2. Materials and Methods

2.1 Experimental equipments

The experimental device was plotted in Fig.1.

![Bio-contact oxidation devices](image)

1. elevated water tank 2. air pump 3.rotation 4. rotameter(combined packing) 5.contact oxidation tank(elastic packing) 6.clarification pool effluent

Fig.1 Bio-contact oxidation devices

2.2 Materials

Combined packing ring was made of polyethylene with strong acid-proof alkalinity. Stereo flexible filler was made of polyamide and had high acid and alkali resistant. Contact oxidation water tank was made of plexiglass. Air compressors and aeration head were used to supply oxygen and rotameter to control aeration volume. Influent flowmeter was LZB-4WB which was made in Chengfeng flow meter Co., Ltd in Changzhou. Polluted river water was conserved in water tanks which has an effective volume 500L.

2.3 Experimental procedure

The influent water came from sedimentation tank effluent in this study. Pollutions were removed by bio-membrane adsorption-oxidation in the reactor. The water quality of samples was tested at per interval 24h. The experiment was begun in Aug.20 and ended in Dec.12 in the year of 2008. Designed pH range was 5.5~9.0 and water temperature was 13.4°C~30.4°C.
2.3 Analytical methods
Chemical oxygen demand (COD) was determined by potassium dichromate method. NH4+-N was determined by Nessler’s reagent spectrophotometry. Total phosphorus (TP) was determined by molybdenum-antimony anti-spectrophotometry.

3. Results and discussion
3.1 Effect of reaction pH on the treatment system
As was well known the pH value had great relationship with the metabolism of microorganism. Three different pH ranges of 5.5~6.5, 7.1~8.5 and 8.5~9.0 were performed in the experiments and every pH range was maintained for ten days. Results were showed in Fig.2, Fig.3, Fig.4, Fig.5 and Fig.6. It could be seen from Fig.2 that when the influent pH was between 5.5~6.5, the effluent pH was between 7.6~8.3, which implied the treatment system had great anti-shock capability.

As showed in Fig.3 the COD removal rate increased with the augment of pH values. When the pH range was 5.5~6.5, the COD removal rate was around 50% and appeared downtrend. When the pH increased to 7.1~8.5, the COD removal rate rose sharply and kept around 77%. When the pH was continually improved, the COD removal rate decreased to 70%. It also could be seen in Fig. 4, Fig.5 and Fig.6, when the pH range was 7.1~8.5, the BODs, NH3-N removal rate and TP removal rate got their maximum of 80%, 76% and 65%, respectively, so the optimal pH range of 7.1~8.5 could be obtained for the treatment system. The results implied the bio-membrane in the treatment system was a little basophilia and had better performance in alkaline environment.
3.2 Effect of temperature on the treatment system

Temperature was another important factor for the activity of microorganism. It was generally recognized that the best temperature for biochemistry treatment was 20°C~30°C and the lowest one was 8°C. When the temperature was below 15°C, it was hard to form the bio-membrane. Especially when the temperature was below 10°C, the synthesis of protein was blocked and the microorganism was almost in dormant state \(^4\). In the meantime, the gaseous transfer rate also changed along with the variation of temperature in the reactor. Hence, temperature was one of the key elements in bio-membrane treatment system \(^5\).

Experiments were carried out to find the proper temperature under the conditions of HRT 3h, DO 3.5mg/L and pH 7.0~8.0. The temperature range was selected from 17°C to 31°C. The results were depicted in Fig.7, Fig.8, Fig.9 and Fig.10.

Fig.7 showed when the temperature was below 20°C, the COD removal rate was just around 57%. When the temperature was between 20°C~27°C, COD removal rate improved clearly along with the augment of temperature and the highest COD removal rate of 68.7% was obtained. When the temperature continually increased, the COD removal rate improved a little and showed downtrend at last. So the temperature of 20°C~27°C was favorable for the treatment system in this study.

The changes of COD, however, the former was a little smoother.

![Fig. 7 Changes of COD removal rate at different temperature](image1)

The changes of BOD\(_5\) in Fig.8 was similar to the changes of COD, however, the former was a little smoother.

![Fig.8 Changes of BOD\(_5\) removal rate at different temperature](image2)

When the temperature was 20°C and 28°C in Fig.9, the NH\(_3\)-N removal rate improved sharply and reached 59.6% and 72.1, respectively. The situation meant the microorganism had great activity at the temperature 20°C ~ 31°C. In general, the NH\(_3\)-N removal rate increased along with the augment of the temperature. Former research showed the nitrobacteria could survive in a wide temperature range of 4°C~45°C and when the temperature was above 10°C the NH\(_3\)-N removal rate had little change \(^6\). However, the obvious increase of NH\(_3\)-N removal rate at temperature 20°C and 28°C provided reference for study of this program.

![Fig.9 Changes of NH\(_3\)-N removal rate at different temperature](image3)

The TP removal rate in Fig.10 changed little along with the increase of temperature and results showed the quantity of phosphorus release and absorption had little relationship with the temperature.

Confirmation experiment was performed under
the optimal conditions obtained above and got the COD removal rate 78.6%, BOD₅ removal rate 82.3%, NH₃-N removal rate 73.2% and TP removal rate 58.1%. The effluent quality met the supposed criterion, which implied the good performance of the treatment system.

Fig.10 Changes of TP removal rate at different temperature

4. Conclusion
Single factor tests were carried out in this study to optimize the effect of bio-contact oxidation techniques in river remediation. The proper temperature 20°C~27°C and pH 7.1~8.5 were obtained. Results showed the combined technology of aeration-ship and biological contact oxidation had great performance under the optimal conditions.

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Reference