

Offshore Polluted Water treatment by biocomposites flocculation

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Short Communication

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Rui Zhang^{1,2*}, Yu Liu³, MeiRong Sun⁴, Honglian Zhang², Zhihui Zhao³, Hui Du², Yan Liao², QinHua Hou²,

¹Shenzhen Institute of Guangdong Ocean University, Shenzhen, 518108, P. R. China

²The Centre of Modern Biochemistry, Guang Dong Ocean University, Guang Dong ZhanJiang. 524088,, P. R. China

³College of Agriculture, Guangdong Ocean University, Zhanjiang, Guangdong 524088, P. R. China

⁴Shenzhen GuiBao Scinese Science and technology co., LTD. Shenzhen, 518101, P. R. China

CORRESPONDENCE AUTHOR

Rui Zhang

Email: zhangr1168@163.com

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ABSTRACT

Shenzhen, a highly urbanized and rapidly developed coastal city in the past 40 years.

Water of Shenzhen western coastal is heavily polluted, with a DO of 0.3-1.0 mg/L and turbidity of 13. Moreover, the water is in black color with sedimentary silt and bad smell. Therefore, Coastal water purification, silt clearance and smell expelling are necessary in order to recover the offshore ecology. It is urgent to find efficient, cost-effective and environmentally-friendly methods for the coastal sewage treatment. In this paper, the wastewater collected from Chiwan Bay and Qian Hai Bay was treated using various biological flocculants. The results showed that the removal rate of turbidity was 70.1~79.2%, and ammonia nitrogen (H4N+-N) was 40.8~49.6%. TN was 50.4~56.5%, COD was 70.1~76.3%, TP was 49.3~52.7%, and the removal rate of harmful marine vibrio was 79.9.3~96.6%. The results showed, the biological flocculants could be used to effectively treat the coastal wastewater.

Key words: polluted water, Shenzhen western offshore, biocomposites flocculation, treatment

1. INTRODUCTION

Shenzhen, a coastal city of southern China's Guangdong province, is highly urbanized and has rapidly developed in the past 40 years. The heavy pollution of coastal water is a serious problem all over the world. So is Shenzhen western offshore water [1-3]. Coastal pollution has a negative effect on ocean ecology, the surrounding residents. There were some methods to be used to restore the pollution. A sustainable plant-based repair method has been introduced in Europe [4], and coastal mud flat wetlands have a specific optimisation function [5-8]. In the mean time, The salt tolerance and restoration mechanism of these plants have been investigated. The restorative plants can reduce the concentration of nitrogen, phosphorus and other nutritive salts [9-11], the technology was applied in a bio-floating bed [12-15]. But it is costly and spent so long times. Recently, microbial communities were used to reduce discharge of coastal sewage [14-22]. But it had many unstabilizing factors, because of its mobility and openness. Flocculation precipitation technology has been widely used as the main technology of sewage treatment.

Especially biological polysaccharide-based materials used as adsorbents in wastewater treatment is a simple and environment-friendly way [23-25]. But it is seldom used in treatment of coastal pollution water.

2. MATERIALS AND METHODS

Chiwan Bay sewage (black smelly wastewater) was collected in Jan.-Feb., 2018 at Chiwan Bay, locating at E115 degree (113,89', 41.78'"); N23 degree (22,47' 29"). (H: 3.9 m, precision: 4.2 m). And Qian Hai Bay polluted water was sampled at Qian Hai Bay Mar.-April., 2018 locating at E114 degree (114,48', 35.21'"); N22 degree (22,57' 40"). (H: 4.5 m, precision: 4.3 m).

Shenzhen western offshore wastewater was treated using different flocculants (Table 1), including (A) chitosan acetic acid solution, (B) carboxymethyl chitosan, (C) cation starch, (D) double tenth eight dimethyl ammonium chloride, (E) chitosan quaternary ammonium salt hydroxypropyl, (b) sodium alga (sodium alginate) and (d) sodium carboxymethylcellulose (CMC), polymerize ferric sulfate (PFe). Wastewater that untreated was used as the negative control.

Table 1. Different ratios and dosages of environment friendly composites used in processing aquaculture wastewater (10ppm respectively)

number	1	2	3	4	5	6	7	8	9	10	11	12
ratios	Ab	Bb	Cb	Db	Eb	Ad	Bd	Cd	Dd	Ed	PFeb	Negative

The A, B, C, D, E was added to 10 L wastewater respectively and mixed well. After 10 minutes, b or d was added to the mixture and mixed well. flocculation and sedimentation started to show up after one hour. Then Water quality was detected. Water quality include dissolved oxygen (DO), Chemical Oxygen Demand (COD), ammonia nitrogen (NH₃-N), total nitrogen (TN) and total phosphate (TP) and harmful marine vibrio.

3. RESULTS

In the present investigation, the wastewater collected from Shenzhen western offshore wastewater was treated using various biological flocculants. Among those

flocculants, group1(Ab) and group11(PFeb) showed the best results, by which the DO of polluted water was improved up to 6.3~7.2 mg/L and the turbidity was reduced to 2~3. The removal rate (RR) of turbidity was 66.1~78.6%, and The removal rate (RR) of ammonia nitrogen (H₄N⁺-N) was 44.2~50.9%. The removal rate (RR) of TN was 49.8~53.2%, The removal rate (RR) of COD was 69.6~64.3%, The removal rate (RR) of TP was 47.5~51.2%, and the removal rate of harmful marine vibrio (HMV) was 81.3~93.8%. In addition, Ab and Eb were optimum for reducing the turbidity and harmful marine vibrio and TP. Ab was optimum for removing TN and COD (Figure 1). So Ab was the optimum composite.

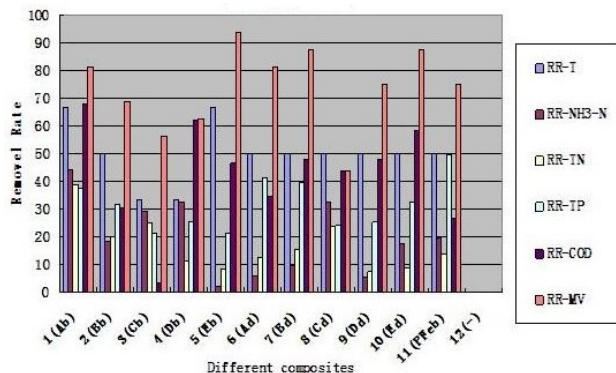


Fig 1. Removal Rate of polluted water by compounded flocculants

4. DISCUSSION AND CONCLUSIONS

Polysaccharide-based materials such as chitosan molecules consist of abundant groups of amino and hydroxyl, resulting in their excellent ability of adsorption and coordination. Polysaccharide-based materials used as adsorbents in wastewater treatment WAS developed quickly in recent. Therefore, chitosan is widely used in the treatment of polluted water in foreign countries. For example, 500 tons of chitosan are consumed annually in Japan for the wastewater treatment, and chitosan is mainly used for the purification of feedwater and drinking water in USA. Flocculation precipitation using compounded bioflocculants is a promising direction in the sewage treatment.

Chitosan flocculants treat metal ions in the water, the main reactions are modified chitosan acromolecules react with heavy metal ions and produce flocculation, or chitosan flocculation adsorb, chelate heavy-metal ions, sometimes two reactions happen at the same time. Treat polluted water with flocculoreaction, flocculants have high COD removal rate in the process of decoloration, the COD removal rate of negative ion dye is more than 95%, the COD removal rate of other dyes is also more than 92% [26, 27]. They are contrary to development strategic target of “western Shenzhen-front Haida airport” new center. It is necessary to treat western neritic zone pollution for the social and economy development of Shenzhen[28, 29,30]

However, few studies have thoroughly compared bio-flocculants, organic and inorganic flocculants as well as their compounded flocculants for the treat-

ment of neritic zone wastewater. Our data provided a scientific basis for the application of compounded bioflocculants for the coastal sewage treatment.

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