

Experimental Research on Removal of UV₂₅₄ by PFS in Pi River water with low turbidity

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Abstract. Through beaker test, it was analyzed the effect on the removal of turbidity, chroma and UV₂₅₄ in PI River water with low turbidity by poly-ferric sulfate (PFS). The results showed that it has good effect on removing turbidity and chroma by adding PFS, but it was normal to UV₂₅₄, not exceed 50%, with the increase of PFS dosage, the turbidity and chroma removal trend is similar to that of UV₂₅₄. For turbidity removal, the optimal dosage of PFS was 70 mg / L, and for UV₂₅₄ removal, the optimal pH value range is not neutral, and it is speculated that PFS mainly neutralizes pollutants during coagulation in PI River water.

1 Introduction

The Pi River main canal is a national strategic high quality water source and also an important drinking water source in Lu'an and Hefei, which is related to the drinking water safety of more than 5 million people in the two cities^[1]. However, with the acceleration of urbanization construction and the rise of the central economy, in recent years the water quality has shown slow downward trend.

At present, most of the water supply plants in Pi River basin generally use PAC as coagulant. The enhanced coagulation technology is used to treat the Pi River water, which has good removal effect on turbidity and chroma, but it will lead to increased aluminum content in water, the body's excessive intake of aluminum may cause severe calcium deficiency, and the body's high residual aluminum may cause Parkinson's disease, Alzheimer's disease, hair loss and other diseases^[2]. Polymerized ferric sulfate (PFS) is widely used in the field of water treatment due to its advantages of short coagulation reaction time, low price, wide range of pH application, less residual iron ions and good dehydration performance of hydrolysate^[3]. Therefore, it is discussed the effect of coagulation treatment by the PFS coagulant for the PI river water, which are used turbidity, chroma, UV₂₅₄ as the main measurement indicators. It is provided a feasible way for Pi River Basin water production enterprises to cope with the continuous improvement of water quality, and lay a foundation for the study of coagulation mechanism of PFS.

2 Methods

The raw water is taken from the Jiefang south road bridge intake, the water quality as shown in Table 1.

Instruments: 2100P turbidimeter, HACH company; WGZ-200 colorimeter, Shanghai Xinrui Instrument Co., Ltd.; T6 new century UV spectrophotometer, Beijing Puxi General Instrument Co., Ltd.; MY3000-6F intelligent coagulation test mixer, Wuhan Meiyu Instrument Co., Ltd.; portable pH meter, Taizhou Zhengda science and education equipment factory; FA2204N electronic balance, Shanghai Qinghai Instrument Co., Ltd.

Reagents: poly-ferric sulfate chloride (PFS) performance in Table 2. Other reagents are analytical pure.

It is process used PFS as coagulant, and simulated hydraulic condition. The procedure for coagulation sedimentation test is shown in Table 3.

The superabundant is determined by 2100P turbidimeter. UV₂₅₄ in the water sample is measured by spectrophotometry. The chromaticity was measured by WGE-200 desktop colorimeter, pH value is determined by portable pH meter determination.

Table 1. Raw water quality in PI river water.

temperature (°C)	pH	turbidity (NTU)	chroma	UV ₂₅₄ (cm ⁻¹)
20~28.9	6.9~7.6	3~10	3.1~20	0.048~0.076

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Table 2. Performance parameters of poly-ferric sulfate and poly-aluminum chloride.

project	poly-ferric sulfate chloride
place of origin	Tianjin dingshengxin Chemical Co., Ltd.
character	solid
pH	/
iron content/%	18.5%
alumina/%	/
salt degree /%	9.0~14
Pb	2.0-3.0
arsenic	0.0008
lead	0.0015
insoluble matter	0.5

Table 3. Coagulation test procedures.

segment number	speed (r.min ⁻¹)	time (s)	dosing conditions
1	400	30	dosing
2	150	600	no dosing
3	80	600	no dosing
4	00	1800	no dosing

3. Results and discussion

3.1 Effect of PFS on turbidity reduction, decolorization and organic matter removal

The dosage of PFS is 40-90mg.L ,and the effect on the treatment effect is examined as shown in Figure 1.

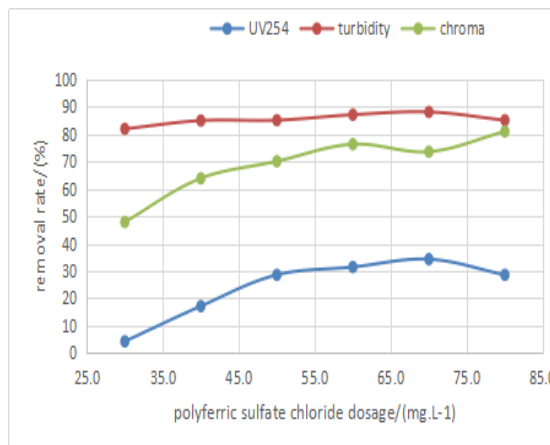


Figure1 Effect of PFS dosage on flocculation

It can be seen from Figure 1 that with the increase of PFS dosage, the removal rate of turbidity, chroma and UV₂₅₄* in Pi River water increases. When the dosage of PFS increases from 30 mg / L to 70 mg / L, the turbidity removal rate increases slowly from 81.88% to 88.05%, the color removal rate increases from 47.86% to 73.54%, and the UV₂₅₄ removal rate increases from 4.29% to 34.29%. When the dosage was increased to 80 mg / L, turbidity, UV₂₅₄ removal rates decreased slowly, color removal rate increase, it is because the PFS electric neutralization, which is conducive to the formation and growth of flocs; when the dosage of PFS is small, which can not effectively adsorb more particles in Pi River water. With the increase of PFS dosage, the adsorption sites gradually increase, so the flocculation efficiency gradually increased. In conclusion, when the dosage of PFS is 70mg / L, the flocculation effect is the best.

3.2 Effect of different raw water turbidity on turbidity reduction, decoloration and organic matter removal

The PFS dosage was 70 mg / L, raw water pH 7.4 and the results are shown in Table 4.

Table 4. Effect of raw water turbidity by adding PFS on coagulation effect

raw water turbidity /NTU	raw water chroma	raw water UV ₂₅₄ /cm ⁻¹
4.99	13.6	0.052
7.81	17.3	0.074
turbidity of supernatant /NTU	chroma of supernatant	UV ₂₅₄ of supernatant /cm ⁻¹
1.94	7.2	0.042
1.56	7.2	0.043
turbidity removal/%	chroma removal/%	UV ₂₅₄ removal/%

61.12	47.06	19.23
80.03	58.38	41.89

It can be seen from Table 4 that the raw water turbidity has impact on the coagulation treatment effect. For the coagulant PFS, when turbidity is less than 10 NTU, with raw water turbidity increase, turbidity, chroma and UV_{254} are increased, increased from 61.12% to 80.03%, from 47.06% to 58.38%, and from 19.23% to 41.89% respectively, the removal rate of turbidity and chroma is high, but UV_{254} removal rate is general, which is because that the adjustment of pH is the key to the removal of NOM. When the pH is low, the humus in the water is a kind of humic acid colloid with negative charge which is easy to react with coagulant; when the pH is high, it is transformed into humic acid salt, which increases the ionic property and solubility, so it is difficult to remove^[4,5]. A large number of surface water treatment studies show that the optimal pH range of ferric salt coagulant is low, generally between 4.5 and 6.0^[6-10].

3.3 Structural characterization of PFS

The SEM of PFS is shown in Figure. 2

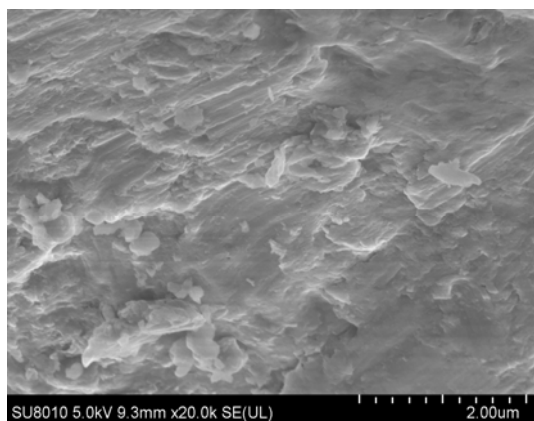
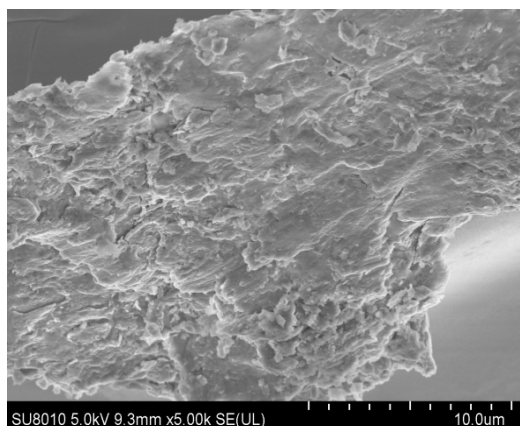


Figure.2 structural morphology of PFS

It can be seen from Fig. 2 that PFS is a kind of cloud with branches and interlacing. The surface porosity of

PFS is relatively small and smooth, the surface area between molecular particles is small, and the adsorption capacity and bridging net catching capacity are limited. So It is speculated that PFS mainly neutralizes pollutants during coagulation.

4 Conclusions

For turbidity removal, the optimal dosage of PFS is 70mg/L, for UV_{254} removal, the optimal pH value range is not neutral.

It has good effect on removing turbidity and chroma by adding PFS, but it is normal to UV_{254} , the removal rate is not exceed 50%. When the dosage of PFS increases from 30 mg / L to 70 mg / L, the removal trend of the turbidity and chroma is similar to that of UV_{254} , more than 70 mg / L, turbidity, UV_{254} removal rates decreased slowly, color removal rate increase.

Raw water turbidity has impact on the coagulation treatment effect, when turbidity is less than 10 NTU, with raw water turbidity increase, turbidity, chroma and UV_{254} are increased, and UV_{254} removal rate is general. PFS mainly neutralizes pollutants during coagulation by SEM.

In summary, it can be seen that PFS is an effective inorganic polymer coagulant and it is provided a scientific reference basis for a water plant to deal with low turbidity, high natural organic matter raw water.

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