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Different elixir and different additive way for metal ions removal efficiency of research

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ABSTRACT

This study investigated the PAC + Magnetic + PAM co-dosing and diatomite + magnetic co-dosing method for metal ions $Zn2^{+}$, $Cu2^{+}$, Pb^{+} removal in order to facilitate urban sewage treatment works in the Parameters of target dosing.

KEYWORDS

Magnetic powder;
Diatomite;
Metal ions;
Removal rate.

INTRODUCTION

The stirring condition determined in the test is 300r / m × 60s in rapid stirring phase, 200R / m × 180s in slow mixing phase and 200R / m × 210s in PAM adding phase, PAC and diatomite should be added in rapid mixing phase, imagnetic particle in slow mixing phase, and PAM at the last stage.

EXPERIMENT CONTENT

To observe the removal effect of metal ions by adding magnetic particle solely.

The objective of this test is to observe the removal effect of metal ions by adding magnetic particle solely.Select Zn^{2+}, Cu^{2+}, Pb^{+} as the targets to measure. The concentrations of $ZnSO_4$, $CuSO_4$ and $PbNO_3$ in raw water were 2 mg/L, 2 mg/L and 0.5 mg/L respectively.

As we can see from Figure 1, the removal rate of each index climb up with the adding of magnetic powder solely. Among them, the removal effect of Cu^{2+} is best with the maximum removal rate up being 2.12%, Zn^{2+}secondly,with the maximum removal rate being 2.01%, Pb^{+} is the worst whose removal rate is 1.79%.

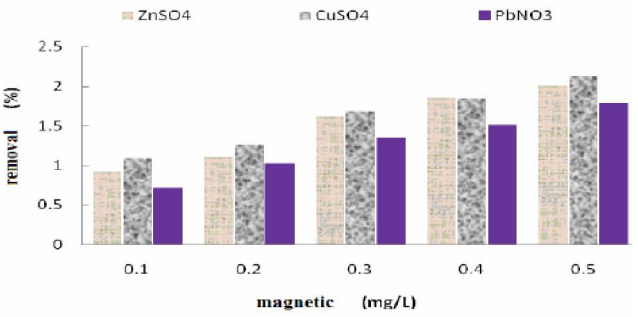

Figure 1 : The removal of the all parameters

Investigation PAC + magnetic powder + PAM for metal ions removal effect

Dissolve 2mg, 10mg and 20mg $ZnSO_4$ in 1Ldistilled water respectively to get $ZnSO_4$ solution,which fit for $CuSO_4$,and he quantity of $PbNO_3$ is not the same as, respectively, 0.5mg, 1mg, 2mg. Condition parameters in the test stay the same, namely 300r / m × 60s, 200R / m × 180s, 200R / m × 210s, then precipitate for 10minin. In the slow mixing phase, magnetic particle

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should be added, and the dosage is 0.5 g/L, PAC is 150 mg/L, and PAM is 2 mg/L.The removal effects are shown in TABLE 1.

We can get the conclusion from table1 that the average removal effect of Zn^{2+},$Cu^{2+}$and Pb^{+} has keeped in 97% - 99%while $Cu^{2+} > Pb^{+} > Zn^{2+}$.According to the" Cities Sewage Treatment Plant Pollutant Discharged Standard" (GB189182002)we can see that the project limit of Zn^{2+} is 1.0mg / L,Cu^{2+} is 0.5mg / L and Pb^{+} is 0.1mg / L.Visiblly, Zn^{2+}, Cu^{2+} and Pb^{+} can meet the project requirementin.

Study on removal efficiency on $ZnSO_4$ by diatemite and powder jiont adding.

Select $ZnSO_4$ as the research object,.The concentration of Zn^{2+}($ZnSO_4$) is below 1.0 mg/L at least.

In this stage the concrete removal rate on $ZnSO_4$ by diatemite and the concentration of $ZnSO_4$ in effluent are show in TABLE 2.

TABLE 1 : Removal efficiency on metal ions by PAC and PAM Joint adding

the indx measured	limit (mg/L)	raw water (mg/L)	effluent (mg/L)	removal rate (%)	row water (mg/L)	Effluent (mg/L)	removal rate(%)	Row water (mg/L)	Effluent (mg/L)	removal rate(%)
Zn^{2+}	1.0	2.0	0.0526	97.37	10	0.1726	98.27	20	0.5225	97.39
Cu^{2+}	0.5	2.0	0.0327	98.37	10	0.1422	98.59	20	0.4273	97.86
Pb^{+}	0.1	0.5	0.0117	97.66	1.0	0.0186	98.14	2.0	0.0392	98.04

TABLE 2 : Removal effect of $ZnSO_4$

Diatomite dosage (mg/L)		100	200	300	400	500	600
concentration of $ZnSO_4$ in raw water 2mg/L	removal rate(%)	58.99	81.40	88.97	89.63	91.42	99.15
	effluent concentration (mg/L)	0.8201	0.3721	0.2207	0.2075	0.1716	0.0171
concentration of $ZnSO_4$ in raw water 10mg/L	removal rate(%)	66.73	80.33	91.67	96.68	96.02	99.05
	effluent concentration (mg/L)	3.3266	1.9673	0.8326	0.4320	0.3979	0.0951
concentration of $ZnSO_4$ in raw water 20mg/L	removal rate(%)	69.64	86.95	95.02	96.71	98.45	99.01
	effluent concentration (mg/L)	6.0726	2.6102	0.9952	0.6576	0.3102	0.1907

As show in TABLE 2, For raw water with $ZnSO_4$ concentration of 2mg / L,when the diatomite dose is 100mg / L, the project limit (1.0mg/L)of the"Cities Sewage Treatment Plant Pollutant Discharged Standard"can be meted.As the dosage increase to 600mg/L, the effluent concentration of $ZnSO_4$ reduced to 0.0171 mg/L,and the removal rate increased to 99.15%.For raw water with $ZnSO_4$ concentration of 10 mg/L or Zn^{2+} concentration of 20 mg/L the diatomite dose of 300 mg/L can meet the requirement. The diatomite dose of 600 mg/L can reduced raw water with $ZnSO_4$ concentration of 10 mg/L to1.0 mg/L,and 20 mg/L to 0.2 mg/L.

Study on removal efficiency on $CuSO_4$ by diatemite and powder jiont adding.

The removal efficiency of $CuSO_4$ by Diatomite is similar to $ZnSO_4$. In this stage, taking $CuSO_4$ as the research object,the concentration of Cu^{2+} ($CuSO_4$) is below 0.5 mg/L.Lat least according to the" Cities Sewage Treatment Plant Pollutant Discharged Standard" (GB189182002).

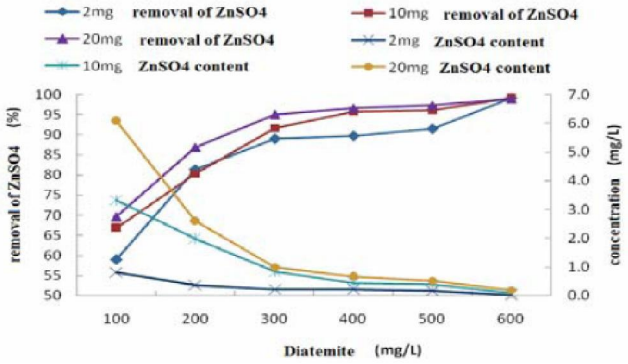

Figure 2 : The removal effect on ZnSO4

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In this stage the concrete removal rate on $CuSO_4$ by diatemite and the concentration of $CuSO_4$ in effluent are show in TABLE 3.

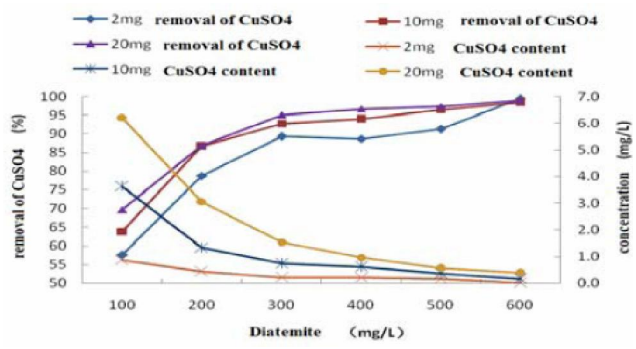

Figure 3 : Removal effect of $CuSO_4$

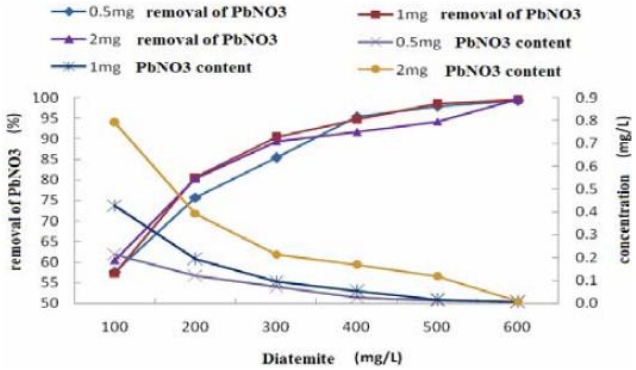

Figure 4 : Removal effect of $PbNO_3$

TABLE 3 shows that for raw water with $CuSO_4$ concentration of 2 mg/L,when the diatomite dose is 200 mg/L, the effluent water quality can meet the discharge standard(0.5mg/L)with the effluent concentration of 0.4257mg/L. As the dosage increases to 600 mg/L, the effluent concentration of $ZnSO_4$ reduced to 0.0123 mg/L.

Compared to $ZnSO_4$ the removal cfficiency of $CuSO_4$ is slightly worse. But both of them can reach the removal rate of 99% in case that diatomite dosage reach 600 mg/L, In addition, to ensure the $CuSO_4$ effluent concentration of 0.5 mg/L, the diatomite dosage must reach 600 mg/L while diatomite dosage of 300 mg/L can do it to $ZnSO_4$.

Study on removal efficiency on $PbNO_3$ by diatemite and powder jiont adding.

In this stage, taking $PbNO_3$ as the research object,the concentration of Pb ($PbNO_3$) is below 0.1 mg/L at least according to the" Cities Sewage Treatment Plant Pollutant Discharged Standard" (GB189182002).

The concrete removal rate on $PbNO_3$ by diatemite and the concentration of $PbNO_3$ in effluent are show in TABLE 4.

TABLE 3 : Removal effect of $CuSO_4$

Diatomite dosage (mg/L)		100	200	300	400	500	600
concentration of $CuSO_4$ in raw water 2mg/L	removal rate(%)	57.57	78.72	89.33	88.67	91.27	99.39
	effluent concentration (mg/L)	0.8487	0.4257	0.2135	0.2267	0.1746	0.0123
concentration of $CuSO_4$ in raw water 10mg/L	removal rate(%)	68.83	86.64	92.74	93.90	96.38	98.38
	effluent concentration (mg/L)	3.6172	1.3362	0.7259	0.6103	0.3625	0.1618
concentration of $CuSO_4$ in raw water 20mg/L	removal rate(%)	69.64	86.95	95.02	96.71	98.45	99.01
	Effluent concentration (mg/L)	6.2106	3.0578	1.5365	0.9618	0.5526	0.3829

TABLE 4 : Removal effect of $PbNO_3$

concentration of PbNO3 in raw water 0.5mg/L	removal rate (%)	57.48	75.75	85.39	95.44	97.95	99.24
	effluent concentration (mg/L)	0.2126	0.1213	0.0731	0.0228	0.0103	0.0038
concentration of PbNO3 in raw water 1mg/L	removal rate (%)	57.21	80.68	90.38	94.64	98.61	99.45
	effluent concentration (mg/L)	0.4279	0.1932	0.0963	0.0536	0.0139	0.0056
concentration of PbNO3 in raw water 2mg/L	removal rate (%)	60.49	80.37	89.37	91.64	94.19	99.59
	effluent concentration (mg/L)	0.7903	0.3926	0.2133	0.1673	0.0826	0.0082

From table4 we can see that only when the diatomite dosage reachs 500mg/L, can $PbNO_3$ concentration in effluent be controlled in 0.1mg/L (item limit), other dosage cannot satisfy the requirements.

Compareing the removal effect of these metal ions in case of the metal ion concentration of 2mg/L in raw

water, it can be concluded:that $Pb^{+} > Zn^{2+} > Cu^{2+}$,but there is so much difference.

CONCLUSIONS

For diatemite and powder jiont adding,to meet the" Cities Sewage Treatment Plant Pollutant Discharged Standard" (GB189182002) that is the concentration of $CuSO_4$ in effluent is below 1.0 mg/L,$CuSO_4$ below 0.5 mg/L and $PbNO_3$ below 0.1 mg/L,the diatomite dosage should reach 300 mg/L,600 mg/L and 500 mg/L respectively.When the diatomite dosage is 600mg/L, the removal rate of each metal ion have reached 99%. The concentration of Zn^{2+}, Cu^{2+} and Pb^{+} in effluent can meet the" Cities Sewage Treatment Plant Pollutant Discharged Standard" (GB189182002) by PAC (150mg/L) + powder (0.5g/L) + PAM (2mg/L) joint dosing in the condition parameters in the test.

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