The Desorption of Heavy Metal by Modified Chinese Walnut Shell

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Keywords: Desorption, Modified chinese walnut, Heavy metal.

Abstract: Modified chinese walnut shell is a kind of adsorbent, this study using the adsorption of Cu^{2+} , Cd^{2+} , Hg^+ , Cr^{6+} metal ions modified chinese walnut shell, on the desorption studies. The acid treatment of modified Chinese walnut shell, heavy metal desorption rate is above 90%. Show that H^+ play an important role in the process of desorption, is likely to be completed with hydroxyl ion exchange adsorption reaction. Regeneration after modification of pecan shell adsorbent particles found no apparent damage, this suggests that the adsorbent has certain mechanical strength. With the increase of ionic strength, WCWS adsorbent for the adsorption of Cu^{2+} , Hg^{2+} , Cr^{6+} rate increase; The changes of the ionic strength of the 120 min of Cu^{2+} and Cd^{2+} , Cr^{6+} plus the influence of the adsorption rate is relatively.

Introduction

Many Adsorption methods are applicated in water treatment, but adsorption material may cause secondary pollution to the environment after the adsorption^[1, 2]. So, the adsorption of heavy metal ions on adsorption material must be desorption, recycling heavy metal; On the other hand, a lot of wasted material containing heavy metals will produced, resulting in secondary pollution^[3, 4]. The desorption research is helpful to the regeneration process of desorption adsorbent regeneration, recycling and metal recycling, providing the basis for continuous adsorption of industrialization.

Chinese walnut shell had been a good adsorption. In order to make the test whether modified chinese walnut shell can be repeatedly used, keeping its adsorption properties, preventing pollution, this study washing Cu^{2+} , Cd^{2+} , Hg^{2+} , Cr^{6+} from modified chinese walnut by adding several adsorbent. Modified chinese walnut shell have high regeneration rate is one of the factors that determine good adsorption materials. At the same time, the study of the desorption mechanism has a great help to understand the adsorption process.

Materials and Methods

Waste Chinese walnut shell(WCWS) was obtained from some experiments ^[5, 6]. WCWS was washed by deionized water and then dried at 110° C for 2 hours.

Batch Desorption experiments were carried out in 100ml conical flask in with a shaking speed of 150 rpm for 120 min. In every experiment . 10ml,0.1mol/L solutions(HCl, NaOH, KCl)) were added to 0.25g CW powder. The studied pH values of metal solution ranged from 1 to 6.

Result and Discussion

The character of desorption Cu²⁺ on modified Chinese walnut

The results are shown in figure 1. The results showed that 0.1 mol/LNaOH/KCl processing modified chinese walnut shell desorption rate is the lowest, is almost zero, can be ignored. By 1 mol/LKCl processing modified chinese walnut shell, desorption rate of about 20%. And 0.1 mol/LHCl processing modified chinese walnut shell desorption rate is above 90%.

Desorption experiment results show that the modified pecan shell with Cu^{2+} ions of chemical bonding force is weak, are easy to be destroyed. H⁺ play an important role in the process of desorption, and thus explains the modified chinese walnut shell adsorption mechanism of Cu^{2+} ions.





Sodium hydroxide as the adsorbent, mainly by increasing the pH of the solution. Using sodium hydroxide and the effect of potassium chloride desorption becauseSodium hydroxide and adsorbent of heavy metal cations are precipitated^[7].

The character of desorption Cd2+ on modified Chinese walnut

Desorption studies is helpful for the adsorption process. The result is shown in figure 2. The results show that the modified chinese walnut shell treated by KCl, desorption rate less than 20% minimum.



Fig.2 Effect of different desorbing agents on desorption

NaOH treatment of modified chinese walnut shell desorption rate is a little higher than KCl, about 40%. NaOH desorption agent mainly by increasing the pH of the solution, the heavy metal cations in alkaline condition are precipitated and desorption from the surface of the adsorbent. Alkali agent, adsorbent and inorganic acid desorption on the surface of the adsorbent of the original structure will produce damage, can also make stripping of heavy metal cations^[8].

The character	of d	lesorption	Hg2+	on modified	Chinese	walnut
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HCl (mol/L)	Desorption rate (%)
1	54
2	72
3	83
4	97
5	98
6	99

Table.1 Desorption of Hg²⁺ of different HCl concentration

Test results such as table 1 shows that 60% of desorption occurred in 1 mol/L HCl concentration, 98% when the desorption occurred in 4 mol/L HCl concentration, the result is similar to some research^[9]. All desorption occurred in 4-6 mol/L HCl concentration and H⁺ to play a key role in the affiliated high school of desorption, in the process of adsorption, is likely to be completed with Hg²⁺ ions on ion exchange adsorption process.

The character of desorption Cr6+ on modified Chinese walnut

The result is shown in figure 3. Results show that after 90 minutes of KCl \ NaOH treatment modification pecan shell, desorption rate is low (< 20%). And HCl treatment modification pecan shell desorption rate is above 90%, that H⁺ play an important role in the process of desorption, and modified pecan shell with Cr^{6+} key in the key can lower. Modified pecan shell with deionized water after cleaning, cleaning fluid no obvious Cr^{6+} ions. Explain the process of modified adsorption Cr^{6+} pecan shell ions do not belong to the physical adsorption. Desorption experiment to identify the functional groups of modified pecan shell - OH, - COOH and possible Cr^{6+} ions complexation or ion exchange adsorption process^[10].



Fig.3 Desorption of different desorpting agents

Conclusion

The acid treatment of modified Chinese walnut shell, heavy metal desorption rate is above 90%. Show that H^+ play an important role in the process of desorption, is likely to be completed with hydroxyl ion exchange adsorption reaction. WCWS reused four times, the adsorption efficiency drops is a certain degree, but has high adsorption rate. Through dynamic desorption studies show that heavy metal ions can quickly be acquitted, when stripping time of 140 min, ion concentration of effluent respectively to check out the lower limit value, showed that desorption column desorption

completely. Regeneration after modification of pecan shell adsorbent particles found no apparent damage, this suggests that the adsorbent has certain mechanical strength. With the increase of ionic strength, WCWS adsorbent for the adsorption of Cu^{2+} , Hg^{2+} , Cr^{6+} rate increase; The changes of the ionic strength of the 120 min of Cu^{2+} and Cd^{2+} , Cr^{6+} plus the influence of the adsorption rate is relatively

Acknowledgements

The authors thank The Doctor Research Projects of Harbin commercial university (Project Number: 13DL009) for the financial support to this project.

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