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Use of Activated Sorbent for Wastewater Treatment

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Abstract: It was found that to increase the sorption capacity, the activation process uses the addition of ammonium carbonate to an aqueous suspension of betonies before centrifugation. It was found that purified activated montmorillonite can be further processed by ion exchange to add important cations that promote the reaction, for example, Fe+2 ion as an oxidation accelerator.

Key words: Sorbent, activation, purification, sorption, wastewater, technology, clay, bentonite.

Activated purifying clays of bentonite origin are capable of removing cations, anions and organic substances from wastewater from oil and gas processing industries. As is known, by activation, bentonite clays are subjected to physical or chemical changes to increase the selective sorption capacity [1]. It should be noted that the activation of clays with high sorbent properties mainly depends on the composition of the manufacturers' wastewater and on their skills in developing complex active clays that meet new and stringent requirements. The main part of activated bentonites is produced to increase the degree of wastewater treatment. New methods of activating bentonite clays are facilitating a wider range of uses. As a result of chemical activation of clays, the sorption properties of the sorbent used in wastewater treatment increase, namely:

1. Modification of hydrophobic-hydrophilic properties and increasing available surface area in non-aqueous systems, thereby improving sorption capacity and the ability to remove pollutants from wastewater.
2. High purity of active clay with maximum removal of major impurities.
3. Increased selective sorption capacity in aqueous systems.
4. Selective chemical activity such as oxidation or hydrolysis.

This property is an important factor for the removal or modification of certain organic substances in wastewater. Bentonite clays, suitable for complex wastewater treatment, contain the main mineral montmorillonite clay, as well as significant inert impurities. Activation of montmorillonite by acid leaching involves partial dissolution of the octahedral layer. The level of activity achieved depends on the concentration of montmorillonite. Highly active clay cannot be obtained by acid activation of bentonite containing a low percentage of montmorillonite. Removing inert impurities from bentonite to concentrate montmorillonite is a method of increasing the activity of sorbing clays. A simple method that can be used to concentrate some montmorillonites is dispersion and centrifugation. Sodium bentonites are easily dispersed and lend themselves well to centrifugal separation. This process is not suitable for the most important calcium-magnesium bentonites, from which most activated sorbent clays are obtained. These bentonites require special chemical treatment to make them suitable for centrifugal concentration. To increase the sorption capacity, the activation process uses the addition of ammonium carbonate to an aqueous suspension of bentonite before centrifugation [2]. Additional purification methods may be applied to acid activated montmorillonite. For example, ion exchange resins can be used to remove some of the petroleum impurities remaining after the acid dissolving and washing procedure. Purified activated montmorillonite can be further processed by ion exchange to add important cations to promote the reaction, such as Fe+2 ion as an oxidation accelerator. Wastewater treatment is the most promising future application of activated clays. Pollution control requires effective and cost-effective methods for removing pollutants from industrial wastewater. Dissolved or colloidal and organic contaminants present in low concentrations are particularly difficult and expensive to remove. Many of these contaminants can be cost-effectively removed using activated sorbent clays. Bentonites sorb or react with certain organic molecules to form organo-montmorillonite complexes. Salts of primary, secondary and tertiary amines, as well as quaternary ammonium salts, form organo-montmorillonite complexes through cation exchange. These organo-montmorillonite complexes usually form flocculent sediments in water and are easily removed from suspension by filtration, centrifugation or settling. Montmorillonite or activated bentonites are capable of reacting with very dilute solutions of these organic substances. Thus, clay acts as an economical sorbent and offers a method for purifying large volumes of contaminated water. Activated clays are also capable of removing colloidal contaminants from a suspension. This is important because many industrial effluents contain colloidal particles. Bentonite or activated bentonites are anionic and readily react with positively charged colloids. More importantly, they are also capable of flocculating negatively charged colloids. However, it has been proven that this type of flocculation does not occur in the absence of the appropriate cations. One explanation is that complexation occurs in the electrical double layer adjacent to the bentonite particles in suspension, where the concentration of counterions is higher than in the bulk. Complex formation is then followed by the attachment of bentonite to the surface of the colloid and the formation of bridges, causing flocculation.

Conclusion

Experimental results have shown that bentonites and some activated clays are not effective in reducing COD sufficiently. This was a result of the use of clays that were not specifically designed to absorb and react in aquatic systems containing organic pollutants. Both the type of bentonite and the activation method are important in determining the degree of COD reduction.

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