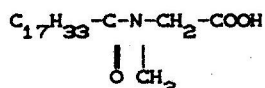


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ADSORPTION MECHANISM OF N-ACYL-N-METHYLAMINOCARBON ACIDS IN THE FLOTATION OF SPARINGLY SOLUBLE SALT-TYPE MINERALS

On the basis of the FTIR spectroscopy, possible structures of oleoylsarcosine on fluorite was described. This compound is a very selective collector in the flotation of fluorite with a relatively high calcite content.

Flotation has become an important operation for processing sparingly soluble salt-type minerals. The fluorite processing from run-of-mine ores with a relatively high calcite content belongs to the most difficult separations. The collectors widely used in fluorite flotation (oleic acid or its salts) are restricted with regard to selectivity to calcite contents as high as about 8 %. Resulting from research work at the Bergakademie Freiberg over years, this problem has been solved by introducing the collector N-acyl-N-methylaminoacetic acid [1][2]. This collector with the formula



has successfully been used in form of the technical product Cordesin O at the Fluorite Processing Plant Ilmenau/FRG.

The advantages of this collector are the following [1]:

- high selectivity
- adequate solubility
- low sensitivity towards Ca^{2+}

Fig. 1 demonstrates a remarkable selectivity of oleoylsarcosine. As to the adsorption mechanism of this compound, however, there has been no reliable ideas up to now. The aim of this project is to find new ways for the selective flotation of salt-type minerals by means of investigating the collector adsorption mechanism.

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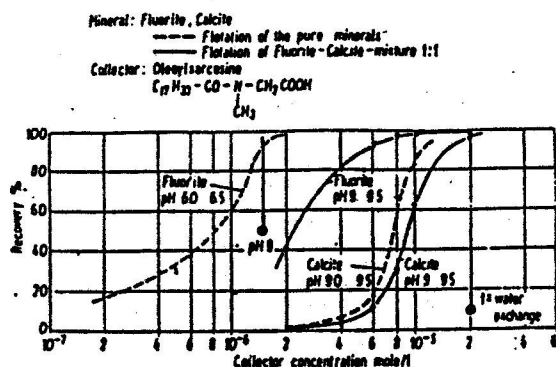


Fig. 1. Flotation of fluorite and calcite from synthetic 1:1 mixtures in the Hallimond tube

Beside the formation of simple salts, the collector can form a compound like a chelate. In that case, at least two bonding atoms (donators) are coupled to the same metal ion. With a high probability, the collector tested in this project belongs to the chelate-forming tensides because it has at least two bonding donators (amino group, carboxyl group). Fig. 2 shows the possible adsorption structures of oleoylsarcosine on fluorite.

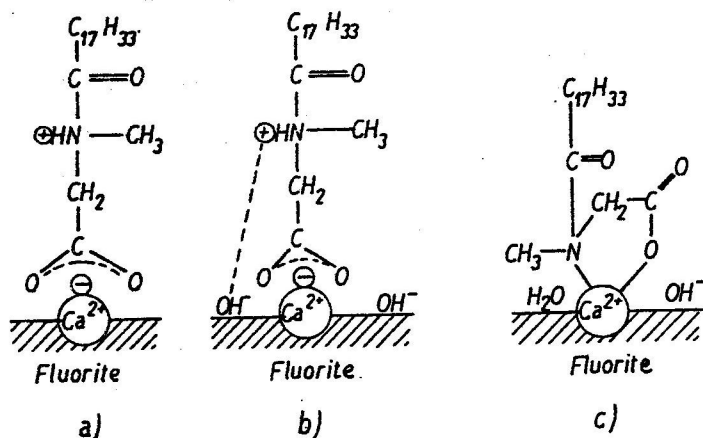


Fig. 2. Adsorption structures of oleoylsarcosine on fluorite

By means of a proton delivery to nitrogen on the negatively charged fluorite surface, the "half-chelate" form (c) can also be formed from the salt form (a). As to the investigation of the bonding mechanism in the adsorbate, the IR spectroscopy is a suitable tool. A Fourier-Transformation-IR Spectrometer (Nicolet type) was used for this

purpose. The sample preparation was carried out by means of the KBr tabletting method. For this investigation, tetradecanoylsarcosine was used, because this compound was available as a pure substance. By comparison of the spectra of the acid, the Na-, Ca- and Cu- salts and of the CaF_2 -adsorbates, one can conclude that oleoylsarcosine is able both for salt and chelate formation. This depends especially on the pH value.

For the interpretation of the spectra, above all, the valence vibrations of the COO^- group, the valence vibration θ ($-\text{C}-\text{N}-$) and the chelate bands are interesting. Especially, the splitting both of the asymmetrical valence vibration at about 1600 cm^{-1} and the symmetrical one at about 1400 cm^{-1} in two high-intensity bands in each case is a considerable hint at the existence of two bonding types in the CaF_2 -adsorbate. So, e.g. the 1602 cm^{-1} and 1407 cm^{-1} bands belong to the salt formation type, the 1610 cm^{-1} and 1395 cm^{-1} bands to the chelate formation type.

The appearance of the θ ($-\text{C}-\text{N}-$) band at about 1040 cm^{-1} both for the Ca- and Cu- salt and for the CaF_2 -adsorbate is another proof for the chelate formation, expressing a bonding between N and Ca^{+2} . The best proof for the chelate bondings in the true sense of word are the chelate bands δ (ring) + θ (Me^+-O) which lay below 700 cm^{-1} . However, these bands could be found at 647 cm^{-1} (δ -ring) and at 598 cm^{-1} ($\text{Cu}^{2+}-\text{O}$) for the copper salt only. In the case of CaF_2 , the mineral bands cover below 700 cm^{-1} the chelate bands, that is why an interpretation is impossible. In general, it can be concluded that the FTIR spectroscopy is a suitable method for the investigation of adsorption mechanisms.

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Streszczenie

Schade S., Schubert H., 1991. Mechanizmy adsorpcji kwasów N- acylo- N -metyloamino węglowych we flotacji trudnorozpuszczalnych minerałów typu soli. Fizykochemiczne Problemy Mineralurgii, 24, 217-219 (English text)

W oparciu o pomiary spektroskopowe w podczerwieni opisano sposób adsorpcji związku o wzorze $\text{C}_{17}\text{H}_{33}-\text{CO}-\text{N}(\text{CH}_3)-\text{CH}_2-\text{COOH}$ na powierzchni fluorytu. Związek ten jest selektywnym kolektorem we flotacji rud fluorytowych o podwyższonych zawartościach kalcytu.