

IRON-55 - HUMIC ACID INTERACTIONS IN SEAWATER

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Summary

Interactions of Fe-55 with humic and fulvic acids of different marine sediment origin in seawater were studied using high voltage paper electrophoresis. Experiments were performed in 10% seawater simulating estuarine conditions. The results are important for iron organic speciation in estuarine waters and for iron transport and accumulation in sedimentary deposits.

Résumé

Les interactions en eau de mer entre le Fe-55 et des acides humiques et fulviques extraits de différents sédiments marins ont été étudiés par électrophorèse à haute tension sur papier. Afin de simuler les conditions estuariennes, les expériences ont été réalisées dans l'eau de mer à 10%. Les résultats soulignent l'importance de la matière organique pour la spéciation du fer en milieu estuarien, pour le transport et l'accumulation du fer dans les dépôts sédimentaires.

The abundance of natural humic substances and their ability to form metal complexes¹ make marine humic material especially important in the transport, availability and accumulation of iron and other trace elements in marine environment². The present study deals with the interaction of Fe-55 and humic and fulvic acids of different origin in seawater. Two humic acid samples were isolated from the marine sediments from the Norwegian Sea and the Pacific - Borneo, Mahakam, and one sample of each humic and fulvic acid from lagoon sediments, Gulf of Lion - Perpignan, Canet. The seawater, originating from the Adriatic Sea, was filtered through a 0.45 μ m membrane filter. Diluted seawater was used to simulate estuarine conditions. The concentration of humic acid varied from 10 to 100 mg/l while the pH was adjusted to 8.0. The behaviour of Fe-55 was followed up by measuring its electrophoretic mobility as a function of concentration of humic acid and aging of the systems from 0 to 30 days.

Without the addition of humic acid to 10% seawater, Fe-55 gives only a zone that does not move in the electric field. By adding humic acid to seawater systems, iron becomes "solubilized" giving both anionic and cationic zones depending on the concentration and origin of humic acid, and aging of the systems. That agrees with results of Picard and Felbeck² who found that high humic acid - iron ratios increase the solubility of iron in the medium.

The anionic fraction of iron-humate is most abundant in the Canet sample, but in 30 days old systems the cationic zone is more pronounced. On the contrary, in the Mahakam humic acid

systems the anionic zone of iron is more pronounced in 30 days old systems while the cationic zone becomes negligible, although in 0 to 7 days old systems the cationic zone is the most abundant one. Concerning iron behaviour the sample from the Norwegian Sea lies between the above mentioned samples. This suggests that these humic acid samples differ in molecular weight and type of functional groups. Comparing the behaviour of fulvic and humic acid of the same origin (the Canet sediments), both cationic and anionic iron zones are more abundant in fulvic than in humic acid systems. The greatest difference appears in 30 days old systems: in fulvic acid systems the cationic zone of iron almost completely disappears while in humic acid system iron yields an abundant cationic zone.

The results reported confirm that the presence of humic and fulvic acids significantly affects iron behaviour in seawater either to form iron complexes of humic and fulvic acid or to "solubilize" iron to a great extent. Moreover, iron could be one of the trace metals responsible for the precipitation of humic acid in the estuaries, thus implicating these reactions as mechanisms for the accumulation of iron-rich organic matter deposits common in near-shore sediments³.

References

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Iron-55 humic acid interactions in seawater"

Paper presented by Lj. Musani (Yugoslavia)

Discussion

F. Gadel: Have you performed your experiments in abiotic conditions?

Lj. Musani: No, we have not.

A. Ballester: Is it possible to establish some criteria in order to interpret strong differences in the behaviour of different humic acids used?

Lj. Musani: In my opinion the differences in the behaviour of the humic acids originate from the differences in their composition, molecular weight, functional groups and the origin. Humic acids used were from marine, estuarine and lagoonal origin, but samples were taken at different places. To lesser extent their behaviour depends on the separation and isolation procedures. Mr. Cauwet could add something to this matter, because several samples used in our experiments were prepared in the Perpignan laboratory.

G. Cauwet: I would like to say something about the character of the humic acids used. Three samples have quite a different origin. The sample from the Mahakam delta is of terrestrial origin consisting of the

woody organic material rich in acidic and phenolic groups. The sample from the Canet lagoon consist of the organic material acidic and rich in nitrogen, resulting from the degradation of seaweeds. Humic acid sample from the Norwegian Sea being old and transformed by diagenesis was isolated from deep-sea sediment of a mixed origin.

