The role of humic acids in the transport of riverine suspended matter

Lasareva E.V., Parfenova A.M.

Lomonosov Moscow State University, Moscow, Russia, parf_07@mail.ru

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The study of the mechanisms of riverine suspended matter (RSM) transport is an important topic due to the increasing anthropogenic load on aquatic ecosystems. The developed surface area of suspended and colloid particles contributes to the sorption of substances of different nature on the mineral surface, which influence the RSM behavior under changing salinity in the river-sea barrier zone. The loss of aggregate stability of RSM results in their sedimentation in coastal zones, while the stabilization of mineral particles leads to their transport to marine environment [1]. The aim of our research was to study the behavior of mineral components of river runoff under changing salinity and the influence of humic acids (HA) on this process.

The mineral components of RSM were modeled by clay substances (kaolinite, montmorillonite) and calcite. HA potassium salt separated from brown coal (leonardite) (Powhumus, Humintech, Germany) served as a model of transformed dissolved organic matter of river water, and cationic polysaccharide chitosan (Ch) (83 kDa, 82% degree of deacetylation in chloride form, Bioprogress, Shchelkovo, Russia) was used as a model of a labile organic flocculant. The salinity (1-30‰) was modeled by adding sodium chloride to the suspension.

The mineral suspensions (2 g/L) were prepared by adding weighted clay or calcite samples in distilled water at room temperature. Modification of mineral particles by HA (10 mg/L) was carried out by their adsorption on minerals for 3 days. The suspensions were shaken for several minutes (after three days of swelling for clays) and the absorbance was measured at 535 nm using an Agilent spectrophotometer (USA) and the turbidimeter HI 93703 (Romania).

It was shown that the modification of mineral particles by HA leads to the stabilization of mineral suspensions over the whole range of investigated salinity. Conversely, a sharp decrease in the stability of such suspensions is observed in the presence of Ch, compared with unmodified minerals. The study of adsorption of phenols (the substances that are included in HA) showed that phenol is better absorbed on activated carbon (BAU) — 7.6×10^{-5} mol/g, while its adsorption on kaolinite, limestone and calcite were 1.8×10^{-5} ,

1.2×10^{-5} and 1.1×10^{-5} mol/g, correspondently. Comparison of the adsorption of phenols showed that the increasing number of phenolic hydroxyl groups leads to an increase in the phenol adsorption on minerals [2].

Thus, the transport function of HA in the barrier zone and the ability of HA to increase the efficiency of the mineral flocculation process in the mixing zone were shown.

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References

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