THE MARINE ORIGIN OF MUCILAGINOUS AGGREGATES OF THE NORTHERN ADRIATIC

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Abstract

The chemical composition of mucilaginous aggregates sampled during summer 2000, 2001 and 2002 in the North Adriatic Sea was studied. The aggregates were mainly composed by organic matter and secondarily by inorganic elements. The C_{org}/N ratio of the aggregates changes with their morphology, dimension and age . To investigate nature of organic fraction of the aggregates the extraction of humic, fulvic and humin fractions substances was carried out. The origin of the humic compounds have been studied by UV-VIS and FT-IR spectroscopy. The 270/407 nm ratio have been used in order to differentiate the marine and terrestrial humic acids in the aggregates. In order to differentiate humic acids from fulvic acids the slope of absorption spectra, S, derived by exponential fitting, was measured and compared to terrigenous and marine sediments.

Keywords: Aggregates, humic acids, Northern Adriatic , UV-VIS spectra

The chemical composition of mucilaginous aggregates sampled during summer 2000, 2001 and 2002 in the North Adriatic Sea depends on the nature of organic matter during aggregation, on the environmental conditions of the site of formation and on the transformations during aging.

The aggregates sampled in the water column were mainly composed by organic matter and secondarily by inorganic elements. Elemental analysis indicates 12.5-32.2 % of organic carbon, 0-7.3 % of inorganic carbon and 1.0-3.7 % of nitrogen. The C_{org}/N ratios of most aggregates are between 7.5 and 12.6, values close to those found in the suspended matter, higher ratios were found in large size (>5 m) aggregates which were probably older.

The C_{org}/N ratio of aggregates changes with their morphology, dimension and age in the following sequence: ribbons ⇒ cob webs ⇒ false benthos ⇒ clouds ⇒ sedimented clouds.

The extraction of humic, fulvic and humin fractions by XAD 2 column allows the characterisation of organic substances constituting the aggregates. The humin (fraction insoluble in acid and basic media) was present in all mucilage samples pointing out the refractory nature of a part of the organic matter.

The humic acids were characterised by the presence in the UV-VIS spectra of a peak around 407 nm, not present in the terrestrial humic acids. The 407 nm peak could be due to covalent bond between humic acids and degradation pigments of chlorophyll, while in those of terrestrial humic acids the interaction is only adsorptive (1) .

The 270/407 nm ratio can be used in order to differentiate marine humic acids and terrestrial humic acids in the aggregates . Higher values of the ratio can be attributed to a terrestrial origin of the humic acids (1). Terrestrial samples had higher values (>3.4) than marine ones (<1.9) whereas the coastal humic acids had intermediate values ranging from 2.4 to 3.1 (Fig. 1). Most part of the Adriatic aggregates sampled showed a marine origin, in particular the clouds and the false benthos, while the surface aggregates evidenced a coastal origin due to higher contribution of organic substances of fluvial origin.

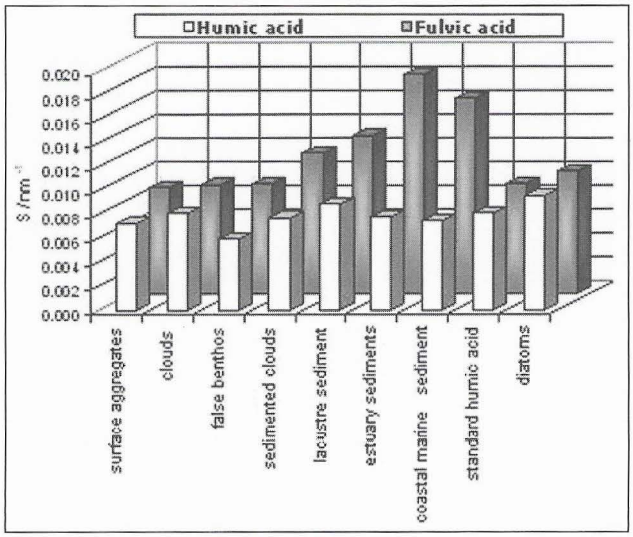

Fig. 1. Spectral slope of the absorption spectra for humic and fulvic acids of different origin.

In order to differentiate humic acids and fulvic acids found in the aggregates the slope of absorption spectra, S, derived by exponential fitting, was measured and compared to terrigenous and marine sediments (2). The S for the fulvic acid absorption spectra were nearly twice as large as those for humic acids (3) (Fig. 2).

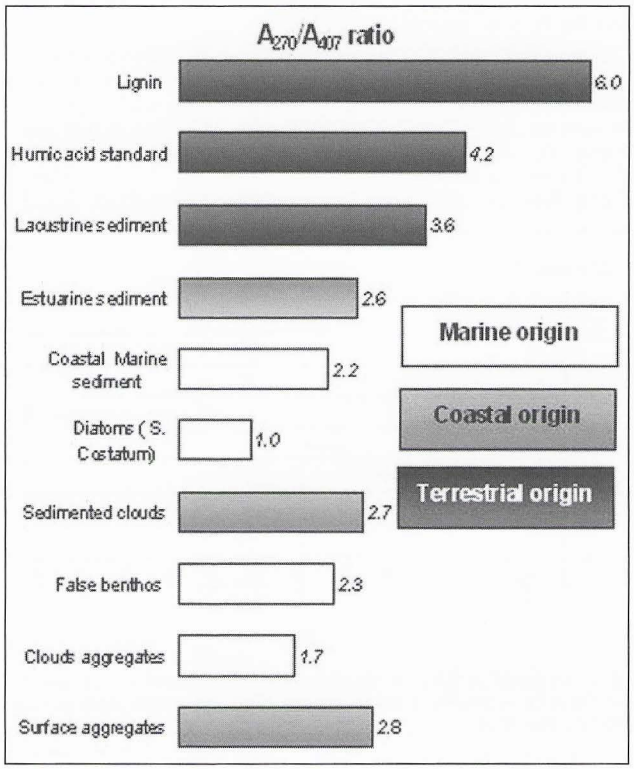

Fig. 2. Absorbance ratio A_{270}/A_{407} for humic fractions extracted by mucilaginous aggregates and sediments of different origin.

The FT-IR spectra of mucilage and humic fractions showed the absence of aromatic structures, typical of terrestrial humic acids (Bottura, pers. Comm.), confirming the marine origin of these aggregates .

References

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