

Conformation of humic acids from soils of different age studied by synchrotron X-ray scattering

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Introduction

The Photon Factory Activity Report 2001 has adopted a new format for electronic publication of Users' Report. This document describes the requirements for submission of papers.

Humic acids (HA) are an important component of natural ecological systems and represent a polydisperse complex of natural biopolymers with molecular masses from several to hundreds kilodaltons. In our previous reports[1] we have shown the variability of conformations of HA of different origin. Thus, molecules in HA fractions of chernozem have preferentially a branched coiled conformation while those of compost have an elongated rod-like conformation. HA fractions from red soil had globular-like, blob-like and elongated conformations. Here we were interested in study of dependence of conformation and molecular mass distribution (MMD) on soil age. For this purpose we prepared humic substances from brown coal (10-60 million years), peat (10000 years), soil ESHA (500 years) with the new procedure including the treatment of organic material by 0.2 M ammonium hydroxide with the consequent air drying

Experimental

Synchrotron X-ray measurements were done on a small-angle camera B15-A (Photon Factory, Tsukuba). HA samples were dissolved in 0.1M NaOH.

Results

To analyse scattering data we used Guinier and Kratky plots, distance distribution function $P(R)$ and evaluated the fractal dimension from the $\log I - \log h$ plot at higher scattering angles. Kratky plot, fractal dimension and $P(R)$ indicate, at least, two phase distributions as seen from Fig.1. Conformation of such particles can be interpreted as blob-like structure more or less expanded. The values of R_g were from 8 nm to 11 nm. Strong dependence of R_g on

the maximal distance of particle indicates the possible polydispersity of system. $P(R)$ and extrapolated to zero scattering angle intensity $I(0)$ show that for rather young sources of humic substances (soil ESHA, compost) the further extractions cause the enrichment of fraction with high molecular mass molecules. At the same time the extraction of HA from peat and brown coal does not change noticeably the MMD

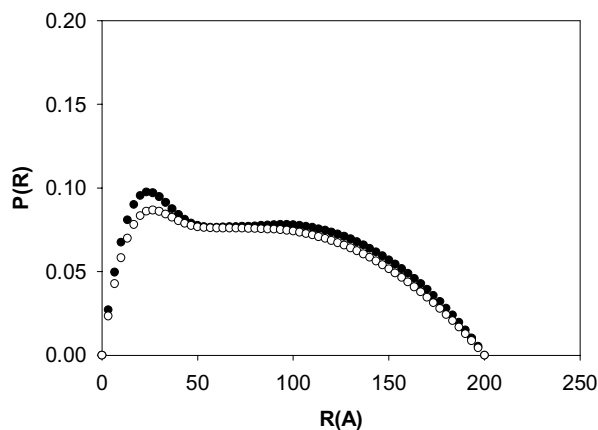


Fig.1 $P(R)$ for two extractions of peat.

References

- [1] A.A. Timchenko *et al.* PPAR(1998), 176; (1999), 182. Proposal 97-G152, 99-G275.

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