

Kinetics of humic substances uptake by higher plants

Kulikova NA^{1*}, Badun GA², Tyasto ZA², Korobkov VI², Perminova IV²

¹Department of Soil Science, Lomonosov Moscow State University, Russia

²Department of Chemistry, Lomonosov Moscow State University, Russia

*knat@darvodgeo.ru

Keywords: humic substances, uptake, wheat seedlings

Humic substances (HS) are the natural organic compounds comprising 50 to 90% of the organic matter of peat, lignites, and of the non-living organic matter of soil and water ecosystems. The beneficial effects of HS on living organisms have been numerous reported. The mechanism of their action remains unclear, and the ways of HS usage by higher organisms are also sophisticated. Several studies on the uptake of HS by higher plants have been performed. Earlier work relied on the colour changes in the plant organs as an indication of HS uptake. The recent study used ¹⁴C-labeled HS for this purpose. However, a particular care should be exercised on interpreting the results using the labeled HS. The latter are usually prepared from the substrate incubated with ¹⁴C-labeled straw. The extracted HS are not identical to the naturally occurring materials. Some methods of the direct labeling of HS were therefore developed including labeling of HS with ³H. The main advantage of the direct labeling of HS is an opportunity to produce a broad spectrum of isotope-labeled native humics varying significantly in both their origin and properties. The objective of the study was to estimate kinetics of uptake of HS by higher plants using tritium labeled preparation. Six-days old seedlings of wheat *Triticum aestivum* L. (cv. Inna) were used for the experiments. A time course study for the accumulation of coal HS from a solution containing 50 mg/l was conducted. Obtained results showed that concentration of coal HA noticeably decreased after first 5 min of interaction with plants followed by further lowering humics concentration in the solution. The time course could be resolved into an initial linear rapid phase of uptake into the root cell apoplasm, followed by decrease rate of accumulation. The linear phase of accumulation (0-60 min) could be interpreted to represent transport across the plasmalemma, while the further reduction in the rate of accumulation could be attributed to efflux of radiolabel and/or translocation of radiolabel to the shoots. The latter was also confirmed autoradiography analysis. Autoradiograms showed continuous increase in HA amount in the wheat roots along with accumulation period. Significant amount of coal HA in shoots (exceeding film fogging) however was observed only when plants interacted with humics for 24 h or more. However, to describe that processes in details, additional efflux experiments must be conducted. This research was supported by the Russian Foundation for Basic Research (#06-04-49017a).