

Nature-Inspired Iron Nanofertilizers Based on Humic Substances

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Humic substances (HS) are self-assemblies of natural polyelectrolytes occurring throughout the environment. They play important roles in plant nutrition by mediating uptake of biogenic metals. Until recently, it was believed that the major molecular mechanism of this mediation is formation of bioavailable complexes with metals, in particular, with iron. Our findings unraveled a great potential of HS in the field of matrix-assisted synthesis of metal-containing NPs, and showed the predominant formation of nanosized iron (hydr)oxide particles formation in the presence of HS as compared to molecular iron-HS complexes (1-3). The paper gives examples of those syntheses for producing slow-release iron nanofertilizers, which demonstrates potential for a transfer in technological applications. Both the formation mechanisms and functional properties of the prepared nanofertilizers were comprehensively studied by a powerful combination of instrumental methods including analytical transmission electron microscopy (TEM), Mössbauer spectroscopy, and EXAFS. We believe that these results open the opportunity for utilization of HS in novel nature-like nanotechnology products with a high added value.

References

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