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Comparative characterisation of humic substances obtained from anaerobic digestate of horticultural residues

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Abstract

Currently, agriculture has as one of its main objectives the reduction of the use of agrochemicals, since their constant application causes damage to the environment and human health. Among the products that have been used to increase crop yields are bio-stimulant products. Humic substances have been recognised for their bio-stimulant action and direct impact on plant physiology. One of the ways of obtaining humic substances is from the anaerobic digestate obtained by anaerobic digestion. Compared to commercial products, humic substances from anaerobic digestate contain a wider variety of organic substances, more lipids, more nitrogen and a lower degree of oxidation. In this study, the humic substances obtained from anaerobic digestate of horticultural crop residues for their use in agriculture were characterised. Anaerobic digestate samples were subjected to a basic treatment with sodium hydroxide (NaOH) at concentrations of 0.1 mol, 0.5 mol and 1.0 mol that allowed the separation of humic and humin substances. For this purpose, three solid/liquid fraction ratios (1/8; 1/10; 1/12) were used. Then, the separation of humic acid and fulvic acid by acid extraction with hydrochloric acid (HCl) was performed. The physicochemical characterisation of the humic substances showed the high potential fertiliser value due to their contents of N, P, K, and micronutrients. However, the proportions of N-P-K in both humic substances were widely variable; meanwhile, the micronutrients were below the recommended limits for the concentrations of potentially toxic elements. In conclusion, the humic substances obtained from the anaerobic digestate showed substantial differences in terms of nutrients and physicochemical characteristics. Future perspectives indicate that nutrient variability in bio-based fertilisers will be one of the greatest challenges to address in the future utilisation of these products.

Keywords: Anaerobic digestate, horticultural residues, humic substances