SYNTHESIS AND PROPERTIES OF MODEL HUMIC SUBSTANCES DERIVED FROM ELLAGIC ACID

Litvin V. A.[1], Njoh R. A.[2], Ozivska I. O.[1], Kovalenko D. O.[1]
[1]Bohdan Khmelnitsky National University, Department of chemistry and nanomaterials science, Cherkasy, Ukraine
[2]Institute of Health Sciences, Department of Toxicology, Near East University, Nicosia, North Cyprus
litvin_valentina@ukr.net

Humic substances are dark brown natural organic compounds, widely distributed in various natural objects: in soils and peat, in coal and shale, in marine and lake sediments, in the waters of rivers and lakes. The growing interest to humic substances is driven by their valuable physico-chemical and therapeutic properties. However, humic substances extracted from natural sources are characterized by heterogeneity, polydispersity, dependence of properties on the source and the method of their extraction, which significantly limits their use. Synthetic polymer products, with properties that simulate natural humic substances, have significant advantages over natural materials, which is due to controlled and reproducible properties. In particular, the possibility of selecting a phenolic precursor, varying and controlling the synthesis conditions allows solving the problem of standardization of the properties of natural humic substances. However, despite almost a century of research, few synthetic humic substances models have been developed. Therefore, the urgent task is to improve the existing and develop new methods of obtaining synthetic humic substances.

We have proposed a new method of producing synthetic humic substances by oxidizing ellagic acid with pure oxygen under conditions of excess alkali (Fig. 1). The oxidation process was carried out at room temperature and normal atmospheric pressure. The progress of the process was monitored volumetrically. Under these conditions, the reaction is completed within 60 minutes. In order to translate the obtained humates into the acid state, the mixture was passed through a cation exchange column in H-form. The solubility of this product at any pH is one of the confirmation that synthetic fulvic acid was obtained. To confirm the similarity of the structure and properties of the resulting product with natural humic substances, a complex study of their physicochemical and spectral characteristics was carried out.

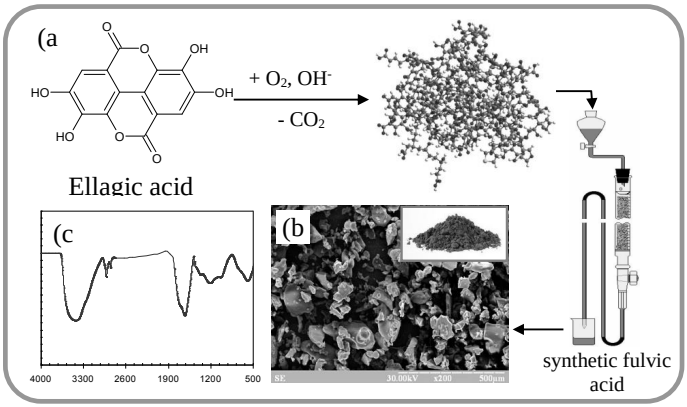

Fig. 1. Schematic illustration of the process of obtaining synthetic fulvic acid (a); CEM image of the surface (b) and IR spectrum of synthetic fulvic acid