

Relative analysis of functional groups of humic acids of peloids

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Nowadays there have been established a large number of positive effects of humic substances on living systems. An adaptogenic, regenerative, anti-toxic, immunotropic effect of humic acids of different origin has been detected in several studies. As natural environmentally friendly substances, humic acids of peloids (HAs) are characterized by non-specific universal pharmacological action. The probabilistic character of substance organization, its heterogeneity, heterofunctionality and polymolecularity create considerable obstacles for using humic peloid products in medical practice.

The purpose of this work is a comparative analysis of infrared and ultraviolet spectra of humic acids (HAs) of peloids and magnesium, calcium, zinc and silver (I) humicates, as well as a qualitative analysis of the products of HA hydrolysis using the method of high performance liquid chromatography (HPLC).

In order to justify the interpretation of the results of the spectral analysis and to identify individual components, an HA solution with 1.0 % (mass) concentration was exposed to acid hydrolysis. The products of hydrolysis were extracted with the help of chloroform, carbon tetrachloride, ethyl acetate and diethyl ether. Derived eluents were exposed to HPLC with the preliminary derivation using the liquid chromatograph Diotronic.

The products of acid hydrolysis of HAs contain a considerable amount of components, which differ slightly depending on the extractant. According to the time of sample emergence, the following compounds can be identified: caprylic, octanoic, pelargonic, vanillic, myristic, azelaic, palmitic, oleic acids, dehydroabiatic acids, cyclohexanol, glycerol, 18-methyl-nonadecanol, hexadecanol, octadecanol, 2-octyldodecanol, tetracosane, heptacosane, cholesterol and squalane.

The infrared absorption spectrum of free humic acids of peloids has a profile typical of the class of compounds under study. The positions of intensity peaks of the absorption bands prove that the substance under study is an HA. In order to justify the assignment of bands, the spectra of metal humicates which have a similar look were obtained. A considerable increase of the band intensity within the frequency interval of $1623\text{-}1605\text{ cm}^{-1}$ and the band transformation at 1709 cm^{-1} into a small shoulder at the peak of a fluctuation band of a free group -COOH is observed in humicate spectra. The noted changes allow to state that the peaks within the frequency interval of $1623\text{-}1605\text{ cm}^{-1}$ are mostly conditioned by fluctuations of the bonds of carboxylate ion. The spectra were analyzed by calculating the ratio of relative intensity of bandwidths at 1615 and 1710 cm^{-1} . The results of calculations showed the inverse ratio of optical density of the bands with the mentioned frequencies. Based on these calculations, a relative quantitative assessment of the level of free and ionized carboxylic group in the samples under study was made.

The obtained experimental results of spectral analysis and the component structure of the products of hydrolysis allow assessing the functional structure of HA peloids with more precision.