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Chemical properties of peat used in balneology

L. Szajdak (1) and T. Hładoń (2)

(1) Research Center for Agricultural and Forest Environment, Polish Academy of Sciences, ul. Bukowska 19, 60-809 Poznan, Poland, szajlech@man.poznan.pl, (2) Department of Inorganic and Analytical Chemistry, Karol Marcinkowski University of Medial Science, ul. Grunwaldzka 6, 60-780 Poznan, Poland, thladon@amp.edu.pl

The physiological activity of peats is observed in human peat-bath therapy and in the promotion of growth in some plants. Balneological peat as an ecologically clean and natural substance is perceived as being more 'human friendly' than synthetic compounds. Poland has a long tradition of using balneological peat for therapeutic purposes. Balneological peat reveals a physical effect by altering temperature and biochemical effects through biologically active substances. It is mainly used for the treatment of rheumatic diseases that are quite common in Poland.

Peat represents natural product. Physico-chemical properties of peat in particular surface-active, sorption and ion exchanges, defining their biological function, depend mainly on the chemical composition and molecular structure of humic substances representing the major constituent of organic soil (peat). The carbon of organic matter of peats is composed of 10 to 20% carbohydrates, primarily of microbial origin; 20% nitrogen-containing constituents, such as amino acids and amino sugars; 10 to 20% aliphatic fatty acids, alkanes, etc.; with the rest of carbon being aromatic.

For balneology peat should be highly decomposed (preferably H8), natural and clean. The content of humic acids should exceed 20% of dry weight, ash content will be less than 15 15% of dry weight, sulphur content less than 0.3% of dry weight and the amount of water more than 85%. It will not contain harmful bacteria and heavy metals.

Humic substances (HS) of peat are known to be macromolecular polydisperse biphyllic systems including both hydrophobic domains (saturated hydrocarbon chains, aromatic structural units) and hydrophilic functional groups, i. e having amphiphilic character. Amphiphilic properties of FA are responsible for their solubility, viscosity, conformation, surfactant-like character and a variety of physicochemical properties of considerable biologically practical significance.

The chemical composition of peats depends significantly on the genesis of peatlands and the depth of sampling. The chemical properties of peat fulvic acids (FA) have some genetic peculiarities due to the specific conditions of the process of humification of peat-forming plants in mires. The process of humification in mires takes place in the top-forming layer under amphibious moisture conditions. Substances of microbial origin are water-soluble and can participate in the formation of peat FA to a little extent. So a main source of structural units for the peat HA and FA is suggested to be organic constituents of peat forming plants of various botanical composition. The content of aromatic units in peat FA was shown to depend on the content of lignin in peat-forming plants and also of the aromatization of polysaccharides mainly due to the transformation of cellulose.

FA characterized lower than humic acids molecular weight (1000-30,000). FA's are composed of a series of highly oxidized aromatic rings with a large number of side chains. Building blocks are benzene carboxylic acids and phenolic acids. These are held together by hydrogen bonding van der Waals' forces and ionic bonding. FA contains larger concentrations of nitrogen. This fraction also contains a great deal of polysaccharide materials, as well as low molecular fatty acids and cytoplasmic constituents of microorganisms. These compounds are linear, flexible colloids at low concentrations, and spherical colloids at high solution concentrations and low pH values.

A more adequate knowledge of the chemical structure of humic materials will assist us in better understanding the physiological effects and also the function of these macromolecules on the health that these materials are know to exert. This improved knowledge provides us better information on chemical structure of humic substances

from peats, which are responsible for pharmacotherapeutic, pharmacokinetic and biopharmaceutical effect. This structure of FA creates proper conditions for uptake of nutrient as well as bioavailability of biologically active substances. The solubilization in water by humic materials of organic substances which are otherwise water-insoluble is a matter of considerable interest to chemist deals with the problem of the function of organic matter. There has been considerable evidence that humic substances can "complex" with several biologically active substances and so modify their physiological activity. It has been noteworthy that FA can "fix" high-molecular weight water-insoluble organic compounds and make them water-soluble. FA may so act as a vehicle for the mobilization, transport and immobilization of such substances in physiological conditions. Analysis of HA and FA carried out by several analytical methods revealed that there were no chemical interaction among biologically active substances but that latter was firmly adsorbed, possible by hydrogen-bonding, on the FA surfaces.

Amino acids account for the majority of organic N fraction in humic substances. Most of the amino acids in organic matter occur in bound form in the humino-peptides fraction. These amino acids are commonly bound to the central core of FA. These humino-peptides fraction of FA mediate in respiration and act as hydrogen acceptors, thus affecting oxidation-reaction reactions.

Thus, what is needed at this time is more fundamental research in order to solve practical pharmacological, pharmacokinetic and biopharmaceutical problem of great significance for human health.