The Biological Properties of Lignin-Contained Compounds

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The investigation of biological properties of lignin-contained compounds (LCC) as multitonnage wastes of woodworking industry is very actual from the viewpoint of estimation of their treatment on ecosystems. The purpose of this work was to study the relationship between macromolecular, mutagenic and growth-regulating properties of LCC. LCC in water medium and in swelling state (at moisture ≥ 60%) behave as polyanions and/or neutral molecules according to value of pH, whose action on biological objects is connected with competition mechanisms. They disturb the structural-functional systems of cells: genetical, membraneous, ferment-protein. The influence of molecular mass value both natural LCC and fractions of technical LCC, prepared by different methods (fractionating by solvents, neutron irradiation, electrical gas discharge) on their mutagenic properties was proved by the cytogenetical testing. The dividing limit of biological properties of LCC on molecular mass value is 4000-7000. The oligomers with molecular mass mentioned above induce the chromosomal aberrations in sexual cells of males *Benedictia baicalensis* (Baikal lake mollusc) and root cells of plants at concentrations more than 0.1 g/l and 0.016 g/l, respectively, regardless of the LCC nature and mode of preparation. Relationship between logarithm of molecular mass and mutagenic effect on molluscs is approximated as linear equation and may be used both for estimating and prediction of LCC influence on hydrobionts. LCC with medium-mass molecular mass below 4000, but above 1000, had not cytogenetical effect on molluscs and plants. The increasing of hydrophobicity and toxicity was however observed at the relationship C_{alk}:C_{ar} = 3...5:1 (content of carbon atoms in aliphatic chain is more than 10). The increasing of oxidization value of aromatic rings at increasing of content of quinonoid and of methylenequinone structures as result of LCC transformation by the action of biogenic and abiogenic factors causes the enhance of toxic and mutagenic properties. The frequency of chromosomal aberrations in sexual cells of molluscs was increased in response to more oxidated high-molecular fractions of LCC, but the reduction of LCC (by neutron irradiation amoth another methods) decreased their mutagenic activity. A comparing between macrogeterogeneity, calculating on the basis of potentiometric titration data and biological activity showed its influence on the mutagenic and growth-regulating activity. The fractions of LCC with molecular masses 4000-7000 and narrow distribution factor revealed the high growth-regulating activity depended on content of carboxylic, hydroxylic groups and density of negative charge on macromolecule. The laboratory experiments have showed the increase of the power of germination of maize seeds by the action of destroyed hydrolisic lignin with molecular mass 4000-7000 by criteria: percent of germinated seeds and length of main root. The microfield tests carried out on humusless woodland soils allowed to obtain the increasing of the harvest of cereal cultures (wheat, barley) on 10-30% as a result of both presowing treatment of seeds and applying to soil in the dry form. Thus the biological properties of LCC are determined by the content of labile fractions and active functional groups, density of negative charges on macromolecule and depend both on value of molecular mass and molecular-mass distribution of LCC and conditions of environment, favoured to the transformation of macromolecules and inactivation of reactive groups.