

Novel Photosensitizers Based on Polysaccharides

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There is a growing interest in the development of novel polymeric photosensitizers. Because of the environmental concerns the possibility of using the systems based on natural polymers is considered. We have chosen polysaccharides as the most abundant natural polymers in biosphere. They have a lot of advantages; they are cheap, can be easily modified and are biodegradable. Polysaccharides such as cellulose, dextran, starch and chitosan were modified by covalent attachment of required chromophores: naphthalene, anthracene, Rose Bengal, porphyrin and chlorophyll [1-7] The lecture describes the synthesis, characterization, photophysical/photochemical properties of these photosensitizers as well as their potential applications. All the photosensitizers are soluble in water. Due to the presence of hydrophobic substituents, the modified polysaccharide chains adopted a pseudomicellar conformation in the aqueous solutions allowing an efficient solubilization of hydrophobic compounds sparingly soluble in water. The obtained photosensitizers absorb light from the near UV-visible spectral region, including solar light. Photophysical studies demonstrated that the attachment of the chromophores to the polymeric chain does not influence considerably their properties. The aggregation of chromophores is limited while the efficiency of the energy migration is high and the energy transfer to the suitable acceptors is efficient. It was found that these photosensitizers can induce various photochemical reactions. The mechanisms of these processes are dependent on the type of chromophore present in the system and the type of reactant. Two main mechanisms of the primary photochemical process were identified and utilized in our studies: the photoinduced electron transfer from the electronically excited chromophores of the photosensitizer to the reactant (molecule of organic compound and/or oxygen) and energy transfer to the molecule of reactant (molecule of organic compound and/or oxygen). These processes result in the formation of very reactive species such as radical-ions, hydroxyl radicals or singlet oxygen which induce secondary photochemical reactions. It was demonstrated that the photosensitizers based on polysaccharides can induce the oxidation of pollutants and toxins present in water such as polynuclear aromatics, chlorinated organic compounds, cyanides, or pesticides. Finally, the fate of the photosensitizers after their prolonged irradiation in aqueous solution was studied. It was found that they undergo slow photo-assisted degradation.

Keywords: photosensitizers, polysaccharides, pollutants

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