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Steady-state and pulse radiolysis study of selected alkaloids in aqueous DNA and human serum albumin (HSA) systems

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Isoquinoline alkaloids widely coexist in many Chinese herbal medicines, e.g. Rhizoma Coptidis and Caulis Mahoniae. They possess antimicrobial, antidiarrheal and cardiovascular activities, and recently have been also suggested as potential drugs for treatment of the Alzheimer disease and as photo- or radiosensitizers in cancer therapy [1].
Small molecules bind to the DNA and HSA in different manners. Intercalation, groove binding and electrostatic intercalation are three major noncovalent binding modes of small molecules to DNA [2]. Human serum albumin (HSA) is known to have reversible binding to a large number of drugs, hormones and other small solutes in three homologous domains (named I, II and III). This binding is important in determining the transport and metabolism of such substances in the body [3].
Our spectroscopic and viscometric studies indicate that berberine is a partial intercalator, coralyne and sanguinarine are classical DNA intercalators, while binding to HSA is effective only for neutral (enolic) form of sanguinarine.
In connection to the latter possibility we have undertaken steady-state and pulse radiolysis study of selected alkaloids: berberine, coralyne and sanguinarine in aqueous DNA and HSA (human serum albumin) systems. The main objective of our work was to determine reactivity of hydrated electrons and OH radicals towards the alkaloids embedded in DNA or HSA, and transient absorption spectra of one-electron reduction and oxidation products. Following reactivity of radiation-generated radicals towards isoquinoline alkaloids in aqueous systems of DNA and HSA, we inferred about the alkaloid binding to biomacrolecules.
In the present work we report on rate constants of reactions of hydrated electrons with selected alkaloids embedded in DNA or HSA, and transient absorption spectra of one-electron reduction and oxidation products (formed due to reaction with OH radical and other species generated in the aqueous phase). The effect of steady-state e-beam irradiation on absorption spectra of the examined systems is also presented. The results are compared with those obtained for homogeneous alkaloid/water solutions.
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