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Spectral analysis of acid and salt forms of nucleotides, their components and complexes with D-mannitol at room temperature

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Aim. The pharmacophores based on the combination of mononucleotides with biomolecules are currently being developed. It is therefore important to study both their interaction and mononucleotides themselves. One of the most common approaches is the use of spectroscopic methods, which provide important information such as electronic transition energies. However, the spectroscopic studies of the emission of aqueous solutions of nucleotides are typically carried out at 77,4 K or 4,2 K. This approach does not permit to study the nucleotides in their natural cellular state. Furthermore, the majority of spectroscopic studies of mononucleotides to date have focused on their salts. At the same time, nucleotides in their acidic form can exhibit markedly different properties from their salts. In addition, the preliminary studies in our laboratory have shown that the complexes of nucleotide acids with mannitol have anti-inflammatory, immunomodulatory, and antiviral activity. Therefore, the aim of this work was to analyse and compare their spectral properties in conditions close to biological systems. **Methods.** The absorption spectra have been obtained using a Specord 210plus instrument, while the excitation and emission spectra were obtained using a Horiba Fluoro Max4+. The aqueous solutions of bases, nucleosides, salt, and acidic forms of ribonucleotide monophosphates, as well as their complexes with D-mannitol, have been studied at room temperature. We used the solutions with a concentration of 1 mg of reagent per 1 ml of deionised water. In the case of complexes with mannitol, the masses of D-mannitol and the corresponding reagent were taken as 1:4. **Results.** The absorption, excitation, fluorescence and phosphorescence spectra of aqueous solutions of mononucleotides in acid and salt forms and their components at room temperature (293 K) have been obtained for the first time. The spectra were compared, and it was established that there were obvious differences between the spectral characteristics of acidic and salt forms of nucleotides. These differences can be explained by the presence of two sodium atoms in the salt form molecules, which change the electronic energy structure of the nucleotide. The spectra obtained made it possible to reveal the interaction of bases, nucleosides, nucleotides and their complexes with D-mannitol. In addition, in some cases the interaction of nucleotides in the acidic and salt forms with D-mannitol differed. This was found to be the case mainly for adenosine and guanosine monophosphates. The evidence of interaction between the mononucleotides and D-mannitol was also observed, which may suggest the formation of complexes. The interaction was notably evident in the excitation and emission spectra. **Conclusions.** The obtained spectra permit to reveal the interaction of bases, nucleosides and nucleotides with D-mannitol. In addition, in some cases, the interaction of nucleotides of acidic and salt forms with D-mannitol differed. It was noted that this primarily concerned adenosine monophosphate and guanosine monophosphate, which contain purine bases.

Keywords: nucleic acids , luminescence, mannitol.