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рассмотрев тезисы конференции «Nanoparticles based on organic conjugated donor-acceptor molecules for cancer phototherapy», авторы: Yu.A. Isaeva, A.N. Efremov, I.V. Dyadishchev, D.O. Balakirev, M.E. Stepanov, R.A. Akasov, E. V. Khaidukov, Yu.N. Luponosov для открытого опубликования в Сборнике тезисов конференции IFSOE2024 (1 стр.)

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Nanoparticles based on organic conjugated donor-acceptor molecules for cancer phototherapy

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Donor-acceptor (D-A) organic compounds are of significant importance in the field of modern organic electronics[1] and photonics[2], due to the high mobility of charge carriers, photo- and hole conductivity, and efficient absorption in a range of spectral regions. These materials are employed extensively in the development of organic transistors, light-emitting diodes, solar cells and sensors. One of the principal advantages of D-A compounds is their capacity for structural modification, which enables the customisation of their optical and electronic properties in accordance with the specific requirements of the intended application. The use of D-A compounds in biomedicine is a recent and promising area of interest. Their low toxicity, high biocompatibility and tunable absorption, including in the near-infrared range, offer significant potential for the development of new materials for the diagnosis and treatment of diseases such as cancer. [3]

In this study, a series of D-A molecules based on triphenylamine (TPA) were synthesised. The high purity and given structure of the compounds were proved by a complex of modern physicochemical methods of analysis. An investigation into the relationship between the molecular structure and properties of these compounds will facilitate an enhanced efficacy in phototherapy and an improved specificity of their effects on cancer cells. This study examined the impact of the structural characteristics on the optical and electrochemical properties, phase behaviour and thermostability of the synthesised compounds. Then, aqueous dispersions of nanoparticles were prepared both based on the synthesized molecules and in combination with amphiphilic polymer matrices. The impact of encapsulation into the polymer on the size, stability and cytotoxicity of the nanoparticles was investigated. In some cases, the encapsulation of molecules into amphiphilic polymers resulted in an improvement in photodynamic properties, as evidenced by a change in the values of the half-maximal inhibitory concentration (IC_{50}) and the phototoxic index (PI). The obtained systems have been demonstrated to possess a promising set of properties for photodynamic therapy, including efficient light absorption, photothermal conversion and heating, and high toxicity towards cancer cells. A confocal laser scanning microscope was employed to obtain fluorescence images, which demonstrated the generation of reactive oxygen species in cells using dichlorodihydro-fluorescein diacetate (DCFDA).

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