Effect of solvent acidity on fluorescent properties of carbon dots

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Today, in nanotechnology, in the diagnostics of various nanosystems, in biomedicine, research is actively being carried out aimed at the creation and development of optical sensors for determining various physical and chemical parameters of the environment. Carbon dots (CD) are one of the most promising materials for solving nanosensor problems due to such properties as stable intense photoluminescence in the visible range, nontoxicity, biocompatibility, low cost, ease of synthesis, and a wide variety of precursors. The spectral characteristics of CD depend on such environmental parameters as acidity/basicity, temperature, the strength of hydrogen bonds between the surface groups of CD and solvent molecules, etc. To develop effective nanosensors based on CD, it is necessary to study the mechanisms of formation of fluorescence of nanoparticles upon interaction with molecules of the environment and mechanisms of influence of changes in the characteristics of the environment on the optical properties of CD.

In this work, we study the spectral characteristics of CD synthesized by the hydrothermal method from citric acid and ethylenediamine in solvents with different acidity and basicity parameters. To study the mechanisms of influence of interactions of CD with the molecules of the solvents on the fluorescent properties of nanoparticles, the dependences of the characteristics of the absorption and photoluminescence spectra of CD suspensions on the acidity, basicity, and relative polarity of the solvent were obtained. An analysis of the obtained results showed that the Stokes shift and quantum yield of CD photoluminescence increase with an increase in the acidity and relative polarity of the solvent, but decrease with an increase in basicity. This result is explained by the change in the structure of the electronic levels of the functional groups on the CD surface with a change in the parameters of the solvents.

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