New polymer gels for targeted drug delivery on the horizon

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Physicists from the Lomonosov Moscow State University have advanced the development of new polymer gels for targeted drug delivery. They have published their results in the *Journal of Chemical Physics*.

"The major outcome of the work is that for the first time a theoretical model was proposed, which laid the basis for analyzing the conformational behavior of the hydrophobically modified (HM) polymer gels in a solution of the surface-active agents (surfactants)," says Elena Kramarenko, professor at the Lomonosov Moscow State University Physics Department. "Our hydrophobically modified gels contain a small proportion of strongly grafted links. These may associate and form additional physical cross-links in the gel, which leads to a significant decrease in its volume. Addition of the molecules of a surfactant that embed within hydrophobic associations in the gel and change its structure can lead to significant changes in the gels volume. The developed theory explains a number of experimentally observed phenomena in such systems. Hydrophobic modification of polymers opens up new ways to control gel susceptibility to changes in the external environment—in particular, the surfactant concentration."

The study invokes a coherent combination of the self-consistent field approximation and the method of scaling. Precise calculations were carried out numerically. The proposed theory and the complete analysis of the system's behavior comprise the contribution of the Lomonosov Moscow State University's scientists.

"The hydrophobically modified polymer gels are highly sensitive materials that demonstrate a significant response to a small change in external conditions, due to the reversibility of the hydrophobic aggregate formation in the gel. Controlling volume and absorption properties of the gel is conducted with easy techniques. One is the addition of a surfactant molecules, another is, for instance, changing the acidity of the solution, resulting in the ionization of the gel and the destruction of hydrophobic aggregates.

One more prospective solution is the introduction of the photosensitive groups in the gel subchains that changes their hydrophobicity when irradiated with the light of certain wavelengths. As a result, it is possible to control the size and absorption properties of the gel by means of light. Such systems are being actively developed in the collaboration with the experimental group of German scientists. They are promising for use in the drug delivery systems, as well as self-healing materials," Elena Kramarenko concludes.

More information: Yulia D. Gordievskaya et al, Polymer gels with associating side chains and their interaction with surfactants, *The Journal of Chemical Physics* (2016). DOI: 10.1063/1.4948730

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