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Belgrade, December 1-3, 2021

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Antiradical activity of graphene quantum dots enriched albumin hydrogel: An EPR study

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Graphene quantum dots (GQD) are single to multilayer carbon-based nanoparticles. They possess high chemical and physical stability, high biocompatibility, low toxicity, and are easily dispersible in water. These properties make them a novel material for the therapeutical application. Due to their antiradical scavenging activity, GQD are considered to be a promising material in terms of inhibiting oxidative damage caused by the elevated level of free radicals. Serum albumin is the primary carrier of various solutes in blood plasma and is commonly used in solubilizing therapeutics. It is suitable for the production of biological hydrogels which are biocompatible and have medical significance as efficient site-located drug delivery systems. This research aims to examine the antiradical activity of GQD incorporated into the albumin hydrogel towards ˙OH radicals and their ability to induce prolonged scavenging effects. Since ˙OH radicals are short-lived species, the electron paramagnetic resonance (EPR) spin-trapping technique (and spin-trap DEPMPO) has been used for their detection. Gellation of bovine serum albumin (BSA) solution containing GQD has been thermally induced. The obtained gel has been introduced into the Fenton reaction (˙OH radicals generator) system containing the spin-trap and gently stirred. To estimate the antiradical effect arising from GQD, control experiments were performed using BSA hydrogel without GQD as well as by replacing BSA hydrogel with water. The obtained results indicate that BSA itself possesses certain antiradical activity, since it eliminated 19.84 % of ˙OH radicals from the system. However, the most significant elimination of ˙OH radicals has been observed in the system containing GQD (99.86 %), where 80.02 % of ˙OH radicals have been eliminated entirely by GQD. Our results show the significant potential of albumin hydrogels as GQD carriers, as well as the compelling anti-hydroxyl radical scavenging efficiency of the GQD. These results give a promising perspective in the light of the synergical effect of GQD albumin hydrogels as site-located radical scavengers.
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