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Evaluation of the Loading Capacity and Releasing Efficiency of Graphene Oxide Based Nanocomposites Loaded with Natural Bioactive Compounds

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Graphene-based nanocomposites have been recognized as effective drug delivery systems due to their unique properties such as two-dimensional structure, biocompatibility, easy surface modification, and high efficacy in drug loading and releasing. Vanillin, gallic acid, and quercetin are natural bioactive compounds that exhibit a variety of pharmacological properties. The objective of the present study is to evaluate the loading capacity and releasing efficiency of vanillin, gallic acid, and quercetin in PEGylated nano-Graphene Oxide (PEG-nGO). Nano-graphene oxide was synthesized using a modified Hummer's method followed by ultrasonication and PEGylation. Then vanillin, gallic acid and quercetin were separately loaded into PEG-nGO in different ratios (1:1, 1:10, 1:100, 1:1000 of PEG-nGO: bioactive compound). The prepared nanocomposites were studied for loading efficiency, loading capacity, and releasing efficiency. Among different nanocomposites, the 1:1 ratio of quercetin-loaded PEG-nGO showed the highest loading capacity of 37.79±0.016%. Vanillin (3.80±0.005%) and gallic acid (2.68±0.012%) exhibited comparatively lower loading capacity in the nanocomposites with a 1:10 ratio. Compared to the other two bioactive compounds (vanillin: 39.54±0.005% and gallic acid: 27.53±0.012%) the loading efficiency was also considerably high in quercetin (60.74±0.016%) loaded nanocomposite. Further, quercetin showed the highest releasing ability with an initial rapid release within the first 06 hours (65.89±0.001%) followed by gradual release within the next 72 hours (95.22±0.001%), while vanillin (67.25±0.001%) and gallic acid (46.79±0.04%) exhibited a comparatively less release within 72hours. The results of the present study revealed that PEG-nGO loaded with quercetin could be used as an efficient nanocomposite for the development of smart pharmaceutical products.

Keywords: *graphene oxide, nanocomposite, quercetin*