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Preparation and Characterization of Dendrimer Graphene Oxide Nanoparticle for Carboplatin Delivery

Sara Kaveh [1], *Elham Tazikeh-Lemeski* [*2]

[1,2*] *Department of Chemistry, Gorgan Branch, Islamic Azad University, Gorgan, Iran*
** Email:elham.tazikeh@gorganiau.ac.ir*

Introduction

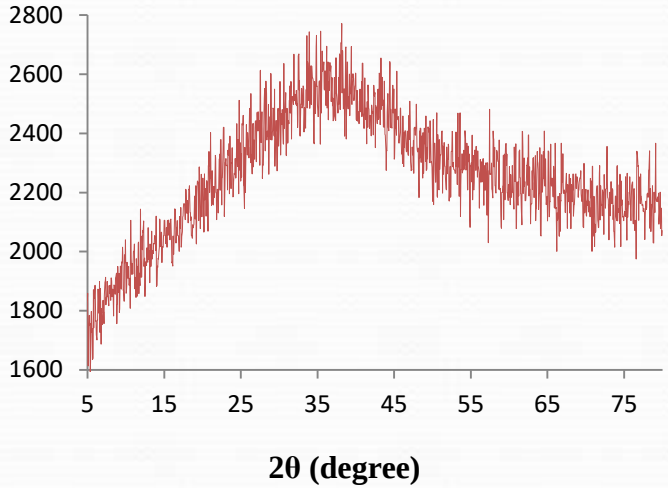
The use of nanoparticles as drug delivery systems is one of their applications, targeting a zone of interest [1,2]. Nanoparticles play a key role as a carrier for anticancer drugs, decreasing the side effects of the drugs and delivering a proper unit of the drug to the tumor cells [3]. Polymers have a substantial role in drafting efficient drug delivery systems [4]. The nanoscale particle graphene oxide has been applied as an effective nanocarrier in drug delivery [5,6]. Graphene oxide and modified graphene oxide with organic compounds and ligands [7], as well as covalent bonds [8-9], have been applied in drug delivery systems in several methods, loading the drugs onto the graphene sheets via π-π bonding and electrostatic interactions. In this project, the adsorption and release of carboplatin is studied using the synthesis of new graphene oxide nanoparticles and coating by a pH-sensitive polymer.

Experimental

The effective parameters, including pH, temperature, contact time, and the concentration of the initial drug, were checked for examining carboplatin´ s loading attributes. To this end, in each experiment, three variables were kept constant, and the impact of the fourth variable was tested. For each adsorption experiment, 10 mg of the final product (GO/dendrimer/CS) was used. carboplatin concentration was measured using UV-Vis spectrophotometer at 229 nm. Then, to investigate the drug-releasing, the final adsorbents (GO/dendrimer and GO/dendrimer/CS) were inserted into the dialyze bag. The whole system was placed once in pH = 7.4 (neutral) and pH = 5.6 buffer (acidic) at 37 ºC for 6 h.

Results and Discussion

According to the XRD pattern for GONPs-MMA/EDA, the dendrimers sit on the surface of graphene oxide, and there is no sharp peak of graphene oxide composition.



The decrease in the atomic percentage of carbon content from G1 to G5can result from the inhibition impact of polymer layers coated on the core particles through all polymerization steps.

Element	Atom % G_1	Atom % G_5	Atom % G_5/CS
C	60.63	56.50	58.16
N	17.62	21.66	13.68
O	21.75	21.84	28.16

Conclusions

In this survey, the final carrier showed a great response to pH alteration. The optimum pH for loading carboplatin by these nanomaterials was 7, and the percentage of the drug release in cancer cells at 5.6 was at the highest rate. The comparison of isotherm models indicates the Langmuir model as the best for the equivalence data. The adsorption kinetic fits in the PSO model well (R^2 = 0.998) for carboplatin concentrations of 20 (mg l^{-1}).