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Nanocomposites of layered clays and graphene/graphene oxide for drug delivery

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Layered Double Hydroxides (LDHs) and graphene (G) and graphene oxide (GO) are combined to prepare a hybrid nanocomposite to use in drug delivery. These composites combine the useful properties of both types of structures: high interacting surface area, controlled release and biocompatibility, useful for good drug loading capacity and sustained drug release system. These nanocomposites were tested for the loading and release of alendronate sodium, an osteoporotic drug with gastrointestinal adverse effects and low bioavailabilty (<1%). The prepared hybrid nanocomposites incorporated 2% w/w of G or GO with a 3:1 M^{2+}/M^{3+} ratio of Zn-Al LDH in its nitrate form. Alendronate sodium was loaded into the hybrid nanocomposites as well as the pristine LDH by co-precipitation and ion exchange and all samples were characterized by powder x-ray diffraction, infrared spectroscopy and zetasizer analysis. The amount of drug loaded and released was determined by UV/Vis spectroscopy. The co-precipitation samples showed successful intercalation of the drug in a bi-layered arrangement within the LDH interlayer space. In spite of the intercalation of the drug in the pristine LDH by ion exchange, hybrid nanocomposite samples with G or GO did not exhibit drug intercalation. Drug loading for these samples seems to have been limited to surface adsorption on the LDH. Drug loading amounts ranged from 22.4% to 50.5% w/w, with noticeable increase in nanocomposites with G or GO prepared by co-precipitation. This increase is due to the additional surface area provided by the G or GO for drug loading. A significant loading amount was observed for the pristine LDH sample prepared by ion-exchange due to the longer contact time with the drug during preparation. The drug release was highly sustained over 24 hours with minimum amounts released, and total release percentages at 24 hours ranging from 2.5% and 4.2%. This sustained release behavior is due to the strongly attached drug anions, embedded in the interlayers of the positively charged brucite-like layers. The observed variations in drug loading and release behavior is explained in terms of the charge on the brucite layers of the LDH and the different interactions between the drug and the G and GO present.

Biography

Nada Mahmoud Hegazy has completed her Master's degree in January 2016, from the American University in Cairo, in Nanotechnology, and in the process of publishing the thesis work, and a Bachelor's degree in May 2009 from the Faculty of Pharmacy, Cairo University. He has recieved a Diploma in Total Quality Managment (TQM), in February 2011 from the American University in Cairo and a Clinical Diploma from Cairo University. He has been a former Research and Development Specialist in a pharmaceutical company for one year, and currently a Quality Control Analyst in the National Organization for Drug Control and Research.

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