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(54) Title: ANTI-BACTERIAL AND ANTI-AMMONIA BEADS

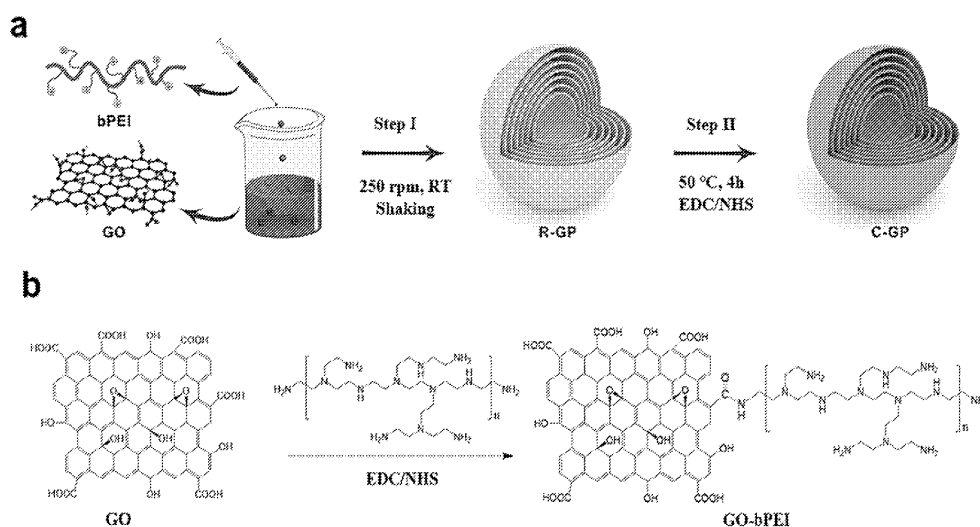


FIG. 1

(57) **Abstract:** Disclosed herein is a composite material in the form of a bead, the beads are either formed from: a polyethylenimine, graphene oxide, and zeolite nanoparticles, where the bead has a hollow core and a layered shell structure comprising a plurality of layers of graphene oxide and a plurality of layers of polyethylenimine, where any two layers of graphene oxide are separated by a layer of polyethylenimine and the zeolite nanoparticles are intercalated between the plurality of graphene oxide layers, and the polyethylenimine is crosslinked by a negatively charged crosslinking agent; or a polyethylenimine and graphene oxide, where the bead has a hollow core and a layered shell structure comprising a plurality of layers of graphene oxide and a plurality of layers of polyethylenimine, where any two layers of graphene oxide are separated by a layer of polyethylenimine, and covalent bonds are formed between the polyethylenimine and the graphene oxide to crosslink the polyethylenimine to the graphene oxide. Also disclosed herein are methods of using the composite material and its manufacture.

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