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Hydrothermal synthesis, characterization and seed germination effects of green-emitting graphene oxide-carbon dot composite using brown macroalgal bio-oil as precursor(Article)

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Abstract

BACKGROUND: Bio-oils can be effectively used for the preparation of bio-based materials owing to their chemical compositions. In this study, brown macroalgal-derived bio-oil was used for the synthesis of graphene oxide-carbon dot composite by a simple hydrothermal process. RESULTS: A simple and facile hydrothermal process was explored for the preparation of green-emitting graphene oxide-carbon dot (GO-CD) composite from brown macroalgal biomass-derived bio-oil as carbon source in water medium at 170 °C for 4 h. An aqueous solution of the prepared GO-CD composite exhibited green emission under ultraviolet (UV) radiation exposure. Raman spectroscopy and transmission electron microscopy analyses confirmed the successful formation of GO-CD composite. Physicochemical characterizations such as phase structure and optical properties of the GO-CD were investigated by X-ray diffraction, UV–visible and photoluminescence analyses. The effects of the GO-CD composite on the seed germination of mung bean were studied. It was found that, compared with the control (100/0 vol% water; total length of plant ~20 cm), the 75/25 vol% water/GO-CD ratio treatment resulted in better plant growth (total length of plant ~25 cm) under the studied conditions. Further increase in GO-CD concentration above the optimum level resulted in a decrease in plant growth but did not have a significant effect on the mass, root and leaf mass development. CONCLUSION: Brown macroalgal bio-oil-derived graphene oxide-carbon dot composite were explored for the seed germination of mung bean and the results showed that a low concentration enhanced the plant growth. © 2019 Society of Chemical Industry. © 2019 Society of Chemical Industry

Author keywords

bio-oil | brown macroalgal | graphene oxide-carbon dot (GO-CD) composite | green emission | hydrothermal | seed germination

Indexed keywords

Engineering controlled terms: Chemical industry | Cultivation | Graphene | High resolution transmission electron microscopy | Optical properties | Phase structure | Physicochemical properties | Plant life extension | Seed | Water treatment

Engineering uncontrolled terms: Bio oil | brown macroalgal | Green emissions | hydrothermal | Seed germination

Engineering main heading: Hydrothermal synthesis

EMTREE drug terms: biooil | carbon nanoparticle | graphene oxide | nanocomposite | oil | unclassified drug | water

EMTREE medical terms: aqueous solution | Article | biomass | brown alga | carbon source | concentration (parameter) | controlled study | germination | macroalga | microbial biomass | mung bean | nonhuman | photoluminescence | physical chemistry | plant growth | plant leaf | plant root | precursor | radiation exposure | Raman spectrometry | synthesis | transmission electron microscopy | X ray diffraction

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