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From green remediation to polymer hybrid fabrication with improved optical band gaps (Article) (Open Access)

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Abstract

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The present work proposed a novel approach for transferring high-risk heavy metals tometal complexes via green chemistry remediation. The method of remediation of heavy metals developed in the present work is a great challenge for global environmental sciences and engineering because it is a totally environmentally friendly procedure in which black tea extract solution is used. The FTIR study indicates that black tea contains enough functional groups (OH and NH), polyphenols and conjugated double bonds. The synthesis of copper complex was confirmed by the UV-vis, XRD and FTIR spectroscopic studies. The XRD and FTIR analysis reveals the formation of complexation between Cu metal complexes and Poly (Vinyl Alcohol) (PVA) host matrix. The study of optical parameters indicates that PVA-based hybrids exhibit a small optical band gap, which is close to inorganic-based materials. It was noted that the absorption edge shifted to lower photon energy. When Cu metal complexes were added to PVA polymer, the refractive index was significantly tuned. The band gap shifts from 6.2 eV to 1.4 eV for PVA incorporated with 45 mL of Cu metal complexes. The nature of the electronic transition in hybrid materials was examined based on the Taucs model, while a close inspection of the optical dielectric loss was also performed in order to estimate the optical band gap. The obtained band gaps of the present work reveal that polymer hybrids with sufficient film-forming capability could be useful to overcome the drawbacks associated with conjugated polymers. Based on the XRD results and band gap values, the structure-property relationships were discussed in detail. © 2019 by the authors. Licensee MDPI, Basel, Switzerland.

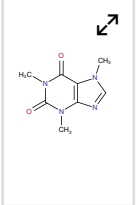
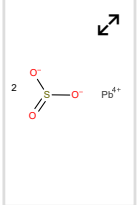
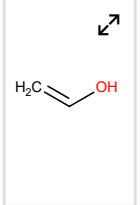
SciVal Topic Prominence

Topic: Graphene | Oxides | Graphite oxide

Prominence percentile: 99.952

Chemistry database information

Substances




copper chloride

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EMTREE drug terms: caffeine | catechin | copper chloride | copper complex | metal complex | transition element | coordination compound | copper | plant extract | polyphenol | polyvinyl alcohol

EMTREE medical terms: Article | bioremediation | electromagnetic radiation | Fourier transform infrared spectroscopy | green chemistry | hydrogen bond | nanofabrication | optics | tea | ultraviolet visible spectrophotometry | X ray diffraction | chemistry | green chemistry | infrared spectroscopy | procedures | ultraviolet spectrophotometry

MeSH: Coordination Complexes | Copper | Green Chemistry Technology | Plant Extracts | Polyphenols | Polyvinyl Alcohol | Spectrophotometry, Ultraviolet | Spectroscopy, Fourier Transform Infrared | Tea | X-Ray Diffraction

Chemicals and CAS Registry Numbers:

caffeine, 58-08-2; catechin, 13392-26-2, 154-23-4; copper chloride, 1344-67-8; copper, 15158-11-9, 7440-50-8; polyphenol, 37331-26-3; polyvinyl alcohol, 37380-95-3, 9002-89-5;

Coordination Complexes; Copper; Plant Extracts; Polyphenols; Polyvinyl Alcohol; Tea

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Universiti Malaya		

Funding text #1

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Funding text #2

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