Title: Green and Stabilized Nanogold in *Eucheuma* Seaweed for Reactive Azo Catalysis

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Abstract: Gold nanoparticles (AuNPs) possess unique properties, making them highly versatile for various applications, though their large-scale synthesis remains challenging. This article reports the biosynthesis of AuNPs using processed *Eucheuma* seaweed (PES). A sharp absorption band verified the successful formation of AuNPs at 542 nm in the UV-visible spectrum. Electron microscopy showed quasi-spherical particles with an average diameter of 11.41 ± 4.88 nm and high crystallinity (d-spacing = 0.230 nm). PES biomolecules stabilized the AuNPs, as reflected by a zeta potential of −22.1 mV and the presence of carbon, sodium, oxygen, and nitrogen in energy diffraction and elemental mapping analyses. The AuNPs demonstrated 94.3% catalytic reduction of reactive orange 1 dye, with a high regression coefficient (R^2 = 0.984), indicating excellent catalytic efficiency and suitability for dye effluent treatment.

Keywords: biogenic layer, electron micrographs, physicochemical, regression value, wastewater treatmen

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