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Synthesis of Novel Nanostructure Copper(II) Metal-Organic Complex for Photocatalytic Degradation of Remdesivir Antiviral COVID-19 from Aqueous Solution: Adsorption Kinetic and Thermodynamic Studies

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Abstract : Metal-organic coordination $[Cu(L)_4(SCN)_2]$ was synthesized applying ultrasonic irradiation, and its photocatalytic performance for the degradation of Remdesivir (RS) under sunlight irradiation was systematically explored for the first time in this study. The physicochemical properties of the synthesized photocatalyst were investigated using Fourier-transform infrared (FT-IR), field emission scanning electron microscopy (FE-SEM), powder x-ray diffraction (PXRD), energy-dispersive x-ray (EDX), thermal gravimetric analysis (TGA), diffuse reflectance spectroscopy (DRS) techniques. Systematic examinations were carried out by changing irradiation time, temperature, solution pH value, contact time, RS concentration, and catalyst dosage. The photodegradation kinetic profiles were modeled in pseudo-first order, pseudo-second-order, and intraparticle diffusion models reflected that photodegradation onto $[Cu(L)_4(SCN)_2]$ catalyst follows pseudo-first order kinetic model. The fabricated $[Cu(L)_4(SCN)_2]$ nanostructure bandgap was determined as 2.60 eV utilizing the Kubelka-Munk formula from the diffuse reflectance spectroscopy method. Decreasing chemical oxygen demand (COD) (from 70.5 mgL-1 to 36.4 mgL-1) under optimal conditions well confirmed mineralizing of the RS drug. The values of $\Delta H°$ and $\Delta S°$ was negative, implying the process of adsorption is spontaneous and more favorable in lower temperatures.

Keywords : Photocatalytic degradation, COVID-19, density functional theory (DFT), molecular electrostatic potential (MEP)
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