Response Surface Methodology (RSM) untuk Uji Optimasi Degradasi Fotokatalitik Malasit Hijau Menggunakan Bio-MOF Berbasis Logam Kobalt (Co) dengan Ligan Asam L-Glutamat = Response Surface Methodology (RSM) for Optimizing Tests Photocatalytic Degradation of Malachite Green Using a Bio-MOF Based on Cobalt (Co) Metal with L-Glutamic Acid Ligands

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Abstrak

Polutan organik malasit hijau yang berasal dari limbah industri tekstil menimbulkan bahaya terutama bagi ekosistem perairan dan kesehatan manusia. Kontaminan zat warna dalam limbah dapat diminimalisir dengan metode fotokatalitik. Biological Metal Organic Framework (Bio-MOF) adalah keluarga baru Metal Organic Frameworks (MOFs) yang sedang dikembangkan aplikasinya sebagai fotokatalis. Salah satu Bio-MOF yang dapat dikembangkan sebagai fotokatalis yaitu Co-Glu. Penelitian ini bertujuan untuk mensintesis Bio-MOF Co-Glu untuk uji degradasi fotokatalitik malasit hijau serta optimasi nya menggunakan Response Surface Methodology (RSM) metode Box-Behnken Design (BBD). Bio-MOF Co-Glu berhasil disintesis melalui metode hidrotermal menggunakan pelarut aquades:TEA (22:1). Variabel independen penelitian ini adalah waktu reaksi (1, 2, 3 jam), massa katalis Bio-MOF Co-Glu (25, 50, 75 mg), dan konsentrasi zat warna malasit hijau (30, 40, 50 ppm). Karakteristik dari Bio-MOF Co- Glu menunjukkan pola XRD memiliki 4 puncak intensitas tertinggi pada nilai 2ð = 14,89°; 20,34°; 21,84°; 29,96° dengan ukuran kristal sebesar 71,86 nm. Bio-MOF Co-Glu memiliki nilai spektrum energi celah pita sebesar 2,06 eV. Kondisi optimum Bio-MOF Co-Glu dalam mendegradasi malasit hijau didapatkan pada waktu reaksi 2 jam, massa katalis 25 mg, dan konsentrasi zat warna malasit hijau 50 ppm dengan hasil kapasitas degradasi sebesar 94,71 mg/gram.

.....Malachite green is an organic pollutant originating from textile industry waste poses a danger, especially to aquatic ecosystems and human health. Dye contamination in waste can be minimized using photocatalytic methods. Biological Metal Organic Framework (Bio-MOF) is a new family of Metal Organic Frameworks (MOFs) whose applications as photocatalysts are being developed. One of the Bio-MOFs that can be developed as a photocatalyst is Co-Glu. This research aims to synthesize Bio-MOF Co-Glu for the photocatalytic degradation test of green malachite and its optimization using the Response Surface Methodology (RSM) Box-Behnken Design (BBD) method. Bio-MOF Co-Glu was successfully synthesized via the hydrothermal method using distilled water:TEA (22:1). The independent variables of this study were reaction time (1, 2, 3 hours), mass of Bio-MOF Co-Glu catalyst (25, 50, 75 mg), and concentration of green malachite dye (30, 40, 50 ppm). The characteristics of Bio-MOF Co-Glu show that the XRD pattern has 4 highest intensity peaks at a value of 2Î¸ = 14.89°; 20.34°; 21.84°; 29.96° with a crystal size of 71.86 nm. Bio-MOF Co-Glu has a band gap energy spectrum value of 2.06 eV. The optimum conditions for Bio-MOF Co-Glu in degrading malachite green were obtained at a reaction time of 2 hours, a catalyst mass of 25 mg, and a malachite green dye concentration of 50 ppm with a resulting degradation capacity of 94.71 mg/gram.