Sintesis, karakterisasi dan aktivitas katalitik dari nanokomposit tio2/cuo untuk mendegradasi methylene blue = Synthesis characterization and catalytic activity of tio2 cuo nanocomposite for degradation of methylene blue

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Abstrak

Nanokomposit TiO2/CuO dengan variasi rasio Cu/Ti disusun menggunakan metode sol-gel. Sampel komposit dikarakterisasi dengan X-Ray Diffraction, Energy Dispersive X-Ray Spectroscopy, Field Emission Scaning, Brunauer-Emmett-Teller, UV-Visible Diffuse Reflectance Spectroscopy dan Electronic Spin Resonance Spectroscopy. Methylene blue digunakan sebagai model pewarna tekstil untuk mengevaluasi fotokatalitik, sonokatalitik dan fotosonokatalitik. Difraksi sinar-X dan dispersif energi analisis X-ray menegaskan bahwa hanya struktur monoklinik CuO dan struktur anatase TiO2 yang muncul di nanokomposit TiO2/CuO. Degradasi methylene blue menunjukkan bahwa penggabungan CuO di nanokomposit TiO2/CuO menunjukkan aktivitas fotokatalitik yang cukup tinggi, dan energi cahaya yang dapat dimanfaatkan lebih banyak dibandingkan TiO2 murni. Selain itu, degradasi methylene blue juga diselidiki menggunakan sistem sonokatalisis dan sistem fotosonokatalisis.
Hasil penelitian menunjukkan bahwa semua data eksperimen mengikuti model pseudo-first order tapi laju konstanta fotosonokatalisis lebih tinggi dari proses fotokatalisis dan sonokatalisis individu masing-masing. Selain itu, kegiatan fotokatalitik, sonokatalitik dan fotosonokatalitik akan berkaitan dengan sifat struktural dan optik sampel. Mekanisme kegiatan katalitik akan dibahas.
<hr>TiO2/CuO nanocomposite with different Cu/Ti ratios were prepared using sol-gel method. The obtained composite samples were characterized with X-Ray Diffraction, Energy Dispersive X-Ray Spectroscopy, Field Emission Scaning, Brunauer-Emmett-Teller, UV-Visible Diffuse Reflectance Spectroscopy and Electronic Spin Resonance Spectroscopy. Methylene blue was used as a model of textile dye to evaluate their photocatalytic, sonocatalytic and photosonocatalytic activities. X-ray diffraction and energy dispersive X-ray analysis confirmed that only monoclinic CuO and anatase TiO2 structures are present in TiO2/CuO nanocomposites. The degradation of methylene blue indicated that the incorporation of CuO in TiO2/CuO nanocomposite exhibited an appreciable higher photocatalytic activity, and more light energy could be utilized than pure TiO2. In addition, the degradation of methylene blue was also investigated using sonocatalysis and photosonocatalysis systems.
The results showed that all experimental data followed the pseudo-first order model but the rate constant of the sonophotocatalysis is higher than the respective individual photocatalysis and sonocatalysis process. Furthermore, the photocatalytic, sonocatalytic and photosonocatalytic activities will be related to their structural and optical properties. The mechanism of catalytic activities will be discussed.