

PREPARASI Fe₃O₄/SiO₂/Co-TiO₂ SEBAGAI FOTOKATALIS UNTUK DEGRADASI BIRU METILEN (*METHYLENE BLUE*-MB): PENGARUH KONDISI REAKSI TERHADAP AKTIVITAS FOTOKATALIS

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INTISARI

Preparasi Fe₃O₄/SiO₂/Co-TiO₂ sebagai fotokatalis untuk degradasi biru metilen (*methylen blue*-MB) telah dilakukan. Penelitian ini bertujuan untuk mempelajari karakteristik Fe₃O₄/SiO₂/Co-TiO₂ serta menentukan aktivitas Fe₃O₄/SiO₂/Co-TiO₂ dalam proses degradasi MB yang ditunjukkan melalui penurunan konsentrasi MB (%). Preparasi Fe₃O₄/SiO₂/Co-TiO₂ dilakukan dengan preparasi Fe₃O₄ melalui metode kopresipitasi dan sonikasi, kemudian dilapisi dengan SiO₂ dan TiO₂ melalui metode sol-gel, ditambahkan prekursor Co(NO₃)₂.6H₂O sebagai prekursor Co dan dikalsinasi pada suhu 500 °C selama 3 jam. Fotokatalis dikarakterisasi dengan FTIR, XRD, TEM, SEM-EDX Mapping dan SR-UV. Fotokatalis digunakan untuk degradasi MB pada variasi pH (7, 8, 9, 10, 11, 12), massa fotokatalis (5,10,15, 20, 25, 30 mg), waktu (15, 20,25, 30, 35 menit) dan konsentrasi awal MB (1, 3, 5, 7, 9 ppm).

Fotokatalis Fe₃O₄/SiO₂/Co-TiO₂ telah terbentuk dilihat dari spektra FTIR adanya ikatan Fe-O, Si-O-Si dan Ti-O serta muncul puncak dari Fe₃O₄, amorf dan TiO₂ *anatase* pada difraktogram XRD. Analisis SEM-EDX menunjukkan adanya unsur Fe, Si, Ti dan Co serta morfologi fotokatalis Fe₃O₄/SiO₂/Co-TiO₂ berupa partikel berbentuk bulat. Fotokatalis Fe₃O₄/SiO₂/Co-TiO₂ memiliki sifat kemagnetan sehingga dapat dipisahkan dari media cair. Penambahan logam Co menyebabkan fotokatalis responsif pada sinar UV dan tampak serta memiliki bandgap sebesar 2,98 eV. Uji aktivitas fotokatalis Fe₃O₄/SiO₂/Co-TiO₂ menghasilkan penurunan konsentrasi MB (%) optimum pada sinar UV dan tampak sebesar 47,8 dan 55,86% dicapai pada pH 11, massa fotokatalis 15 mg, waktu penyinaran 30 menit dan konsentrasi awal MB 5 ppm.

Kata kunci: biru metilen, fotodegradasi, fotokatalis

PREPARATION OF $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{Co-TiO}_2$ AS A PHOTOCATALYST FOR METHYLENE BLUE (MB) DEGRADATION: EFFECT OF REACTION CONDITION TOWARD PHOTOCATALYSIS ACTIVITY

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ABSTRACT

Preparation of $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{Co-TiO}_2$ as photocatalyst for degradation of methylene blue (MB) has been done. The aims of this experiment were to study the characteristics of the $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{Co-TiO}_2$ and determine the activity of the $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{Co-TiO}_2$ in the MB degradation process as indicated by the decrease in MB concentration. Preparation was carried out by preparation of Fe_3O_4 through coprecipitation and sonication, then coated with $\text{SiO}_2/\text{TiO}_2$ through sol-gel method, added $\text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ as a Co precursor and continued with calcination at 500°C for 3 hours. Photocatalyst were characterized by FTIR, XRD, TEM, SEM-EDX Mapping and SR-UV. Photocatalyst was used for degradation of MB at pH (7, 8, 9, 10, 11, 12), photocatalyst mass (5, 10, 15, 20, 25, 30 mg), time irradiation (15, 20, 25, 30, 35 minutes), and MB initial concentration (1, 3, 5, 7, 9 ppm).

Photocatalyst $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{Co-TiO}_2$ had been formed considered from FTIR spectra Fe-O, Si-O-Si, Ti-O bond, and peaks of Fe_3O_4 , amorphous, and TiO_2 anatase on XRD diffractograms. SEM-EDX analysis showed the presence of Fe, Si, Ti, and Co elements and the morphology of the photocatalyst was spherical. Photocatalyst have magnetic properties so they can be separated from liquid media. The addition of Co causes the photocatalyst to be responsive to UV and visible light and has a band gap 2.98 eV. The photocatalyst activity test resulted in a decrease in MB concentration (%) under UV and visible light respectively 47.8 and 55.86% at pH 11, 15 mg photocatalyst mass, 30 minutes time irradiation, and 5 ppm methylene blue initial concentration.

Keyword: methylene blue, photocatalyst, photodegradation.