

## **SINTESIS NANOPARTIKEL $\text{BiVO}_4$ SEBAGAI KATALIS UNTUK DEGRADASI FOTOKATALITIK LARUTAN KONGO MERAH**

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### **INTISARI**

Material  $\text{BiVO}_4$  telah disintesis dalam penelitian ini menggunakan metode *green synthesis* dengan bantuan radiasi gelombang mikro dan ekstrak kulit jeruk manis (*Citrus sinensis*) sebagai *capping agent*. Material  $\text{BiVO}_4$  hasil sintesis diuji aktivitasnya sebagai fotokatalis dalam degradasi larutan zat warna kongo merah. Penelitian ini diawali dengan preparasi ekstrak kulit jeruk manis (*Citrus sinensis*) kemudian dilakukan sintesis material  $\text{BiVO}_4$  dengan mencampurkan bismuth(III) nitrat pentahidrat  $\text{Bi}(\text{NO}_3)_3 \cdot 5\text{H}_2\text{O}$  dan ammonium metavanadat ( $\text{NH}_4\text{VO}_3$ ) beserta *capping agent* (ekstrak kulit jeruk) dengan variasi volume 2,5; 5; dan 7,5 mL. Material hasil sintesis dikarakterisasi dengan FT-IR, XRD, DR-UV Vis, TEM dan SEM-EDX. Pengujian aktivitas fotokatalitik dilakukan dalam reaktor tertutup pada paparan sinar UV dan tampak disertai kajian beberapa variable (pH reaksi, massa fotokatalis, dan waktu penyinaran). Hasil degradasi ditentukan dengan metode spektrometri UV-Visibel.

Hasil penelitian menunjukkan bahwa material  $\text{BiVO}_4$  yang terbentuk memiliki struktur campuran monoclinic *scheelite* (m-s) dan tetragonal *zircon* (t-z) dengan nilai energi celah pita ( $E_g$ ) meningkat seiring meningkatnya volume ekstrak kulit jeruk dengan  $E_g$  paling rendah yaitu sebesar 2,34 eV pada volume ekstrak kulit jeruk jeruk 2,5 mL. Material  $\text{BiVO}_4$  hasil sintesis memiliki bentuk morfologi bulat dan tabung dengan ukuran nano. Material  $\text{BiVO}_4$  yang dibuat dengan volume *capping agent* sebesar 2,5 mL dapat mendegradasi larutan kongo merah secara optimum dengan konsentrasi awal larutan kongo merah sebesar 10 ppm, pH larutan 3,2, menggunakan massa fotokatalis 40 mg dan waktu penyinaran 2,5 jam, dengan hasil degradasi sebesar 98,57 % pada paparan sinar tampak dan 92,75 % pada paparan sinar UV.

Kata kunci:  $\text{BiVO}_4$ , *capping agent* dari ekstrak kulit jeruk manis (*Citrus sinensis*), sinar tampak, fotokatalis, kongo merah

***SYNTHESIS OF BiVO<sub>4</sub> NANOPARTICLES AS CATALYST FOR PHOTOCATALYTIC  
DEGRADATION OF CONGO RED SOLUTION***

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**ABSTRACT**

In this study, BiVO<sub>4</sub> material was synthesized using the green synthesis method assisted by microwave radiation using sweet orange peel extract (*Citrus sinensis*) as a capping agent. The synthesized BiVO<sub>4</sub> material was then tested for its activity as a photocatalyst in the degradation of congo red dye solution. This research was started by the preparation of sweet orange peel extract (*Citrus sinensis*) and then synthesis of BiVO<sub>4</sub> material by mixing bismuth(III) nitrate pentahydrate Bi(NO<sub>3</sub>)<sub>3</sub>·5H<sub>2</sub>O and ammonium metavanadate (NH<sub>4</sub>VO<sub>3</sub>) along with capping agent (orange peel extract) with a volume variation of 2.5; 5; and 7.5 mL. The prepared materials were characterized by FT-IR, XRD, DR-UV Vis, TEM and SEM-EDX. The photocatalytic activity test was carried out in a closed reactor under UV and visible light illumination along with the study of several variables (reaction pH, photocatalyst mass, and irradiation time). The degradation results were determined by UV-Visible spectrometry method.

The results showed that the BiVO<sub>4</sub> material formed has a monoclinic *scheelite* (m-s) and tetragonal *zircon* (t-z) structure with a band gap energy ( $E_g$ ) values increasing as the volume of orange peel extract increase with the lowest  $E_g$  of 2.34 eV at a volume of 2.5 mL orange peel extract. The synthesized BiVO<sub>4</sub> material has a spheric and tubular morphology with nano size. The BiVO<sub>4</sub> material synthesized with a capping agent volume of 2.5 mL could optimally degrade congo red solution with the initial concentration of 10 ppm at the solution pH of 3.2, using photocatalyst mass of 40 mg for 2.5 h irradiation time, with the degradation results were 98.57 and 92.75 % under visible and UV light, respectively.

**Keywords:** BiVO<sub>4</sub>, capping agent from sweet orange peel extract (*Citrus sinensis*), visible light, photocatalyst, congo red.