

Studi preparasi N Doped TiO₂ Nanotube yang didekorasi Logam Transisi (Ag) untuk mendapatkan aktifitas fotokatalitik pada daerah sinar tampak = Study on the preparation of N Doped TiO₂ Nanotube decorated with Transition Metal (Ag) to enhance the photocatalytic activity in visible light

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Abstrak

TiO₂ merupakan bahan yang telah banyak diteliti sebagai kandidat fotokatalis untuk degradasi bahan pencemar organik. Sesuai nilai band gap yang dipunyainya, TiO₂ hanya efektif jika disinari dengan sinar UV, tetapi kurang responsif terhadap sinar tampak. Doping nitrogen pada matrik TiO₂ dipercaya dapat menurunkan nilai band gap TiO₂ sehingga dapat diaktifkan dengan sinar tampak. Dalam penelitian ini dilakukan preparasi TiO₂ nanotube secara anodisasi, dan doping nitrogen serta dekorasi logam transisi Ag pada matrik katalis, dengan maksud agar lebih responsif terhadap sinar tampak. Untuk keperluan tersebut, N-TiO₂ nanotube dipreparasi dengan cara perendaman TiO₂ nanotube amorfus dalam larutan amonia (NH₄OH) sebagai sumber nitrogen dengan berbagai variasi konsentrasi (0.5M, 1M, dan 2M), dilanjutkan dengan perlakuan panas (500°C) untuk mendapatkan fasa kristal anatase. Selanjutnya N-TiO₂ nanotube yang telah berhasil di doping dengan nitrogen di dekorasi dengan Ag menggunakan metode elektrodeposisi. Ag/N-TiO₂ nanotube yang terbentuk di karakterisasi dengan menggunakan DRS UV VIS, FTIR, XRD, SEM dan LSV.

Hasilnya menunjukkan bahwa doping nitrogen kedalam matrik TiO₂ telah berhasil dilakukan, ditandai dengan penurunan nilai band gap, munculnya puncak serapan spesifik pada daerah bilangan gelombang 1360 dan 1500cm⁻¹ (indikasi adanya -N-O-). Nilai band gap terkecil (2,54 eV) dijumpai pada TiO₂ nanotube yang dipreparasi dengan cara anodisasi (menggunakan konsentrasi elektrolit 0.07M), konsentrasi prekursor nitrogen (NH₄OH) sebesar 2M, dan didekorasi dengan perak secara elektrodeposisi {Ag/N-TiO₂[D]}. Fotokatalis yang dipreparasi tersebut memiliki fasa kristal anatase (XRD) dan memiliki morfologi nanotube (SEM), keberhasilan dekorasi logam perak ditandai kemunculan noktah Ag pada permukaan N-TiO₂ nanotube (SEM). Ag/N-TiO₂ nanotube yang dipreparasi tersebut menunjukkan aktifitas yang sangat baik dibawah iluminasi sinar tampak, yakni memberikan nilai arus cahaya paling baik dan mampu mendegradasi conge red paling banyak (50.17%).

.....TiO₂ material has been studied as a photocatalyst for degradation of organic pollutants. Due to its band gap value, TiO₂ is only effective under UV light, but less responsive to visible light. On the other hand, nitrogen doped TiO₂ was reported to have a band gap value less than of its corresponding undoped TiO₂ and therefore showed its activity under visible light. I confirm the occurrence of Ag/N-TiO₂. This Ag/N-TiO₂ showed excellent activity this research, TiO₂ nanotubes was prepared by anodization of Ti metal, and followed by doping with nitrogen and transition metal decoration on the catalyst matrix, to obtain photocatalyst that more responsive to visible light. Subsequently, nitrogen doped TiO₂ was prepared by immersing amorphous as prepared TiO₂ nanotubes in various concentration of ammonia solutions (as nitrogen source), followed by heat treatment (500°C) to obtain anatase crystalline phase. The prepared photocatalysts were characterized by mean spectrochemical methods (e.g, DRS-UV-Vis; DRS-FTIR; XRD;

and SEM) and electrochemical method.

The results indicated that the nitrogen doped TiO₂ nanotubes was successfully prepared (N-TiO₂). The N-TiO₂ then was decorated by silver nanoparticle by an electrodeposition method (Ag/N-TiO₂). The DRS UV-Vis characterization revealed that the N-TiO₂ has a band gap shift to visible region. The smallest band gap value (2.54 eV) was observed in Ag/N-TiO₂ which was prepared by anodizing of Ti by using electrolyte concentration of 0.07M, and the concentration of nitrogen precursors (NH₄OH) was 2M. FTIR characterization showed specific absorption peaks in the wave numbers area of 1360 and 1500cm⁻¹ which indicated the occurrence of -NO- vibration, a sign of nitrogen incorporation into TiO₂ matrix. XRD characterization showed specific diffraction angle indicated the occurrence of anatase crystalline phase. The nanotube morphology was clearly showed by SEM image obtained. In addition SEM imaging also revealed a bright spots that can be attributed to the occurrence of nanoparticle of silver metallic, thus under visible light illumination, which produced highest photocurrent and capable to degrade more congo red (50.17%) comparing to other photocatalyst tested.