

# Preparasi Oksida Logam Ce<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub>-TiO<sub>2</sub> menggunakan Ekstrak Kulit Buah Srikaya (*Annona squamosa* L.) melalui pendekatan sol-gel dan Kinerja Fotokatalitiknya dibawah Sinar Tampak = Preparation of novel Ce<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub> -TiO<sub>2</sub> using Annona Squamosa L. Peels Extract for photodegradation of methylene blue under visible-light illumination

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## Abstrak

Untuk pertama kalinya, oksida logam Ce<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub>-TiO<sub>2</sub> disintesis menggunakan ekstrak kulit *Annona squamosa* L. (ASE) yang mengandung alkaloid sebagai agen hidrolisis serta saponin, flavonoid, dan tanin untuk agen capping yang menstabilkan pembentukan oksida logam. Material ini dipelajari melalui berbagai hasil pengujian karakterisasi. Oksida logam terbarukan Ce<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub>-TiO<sub>2</sub> ini telah dikonfirmasi melalui beberapa uji karakterisasi, antara lain FT-IR, XRD, Spektrofotometer UV/Vis DRS, SEM dan TEM. Analisa XRD oksida logam TiO<sub>2</sub> hasil sintesa mempunyai struktur kristal anatase dengan sejumlah kecil fase brookite, Ce<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub> memiliki struktur pyrochlore-like compound, dan oksida logam Ce<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub>-TiO<sub>2</sub> memiliki puncak khas 2 kristal gabungan dari keduanya. Pengukuran SEM -Mapping mendapatkan morfologi flake-like yang beragam dengan persebaran atom-atom yang merata tanpa adanya elemen pengotor. Uji Kinerja material oksida logam dilakukan melalui aktivitas fotokatalitik terhadap degradasi metilen biru menggunakan sinar tampak. Hal tersebut didukung melalui hasil karakterisasi UV-Vis DRS dari oksida logam Ce<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub>-TiO<sub>2</sub>, TiO<sub>2</sub> dan Ce<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub> yang memiliki nilai celah pita masing-masing 2,60; 3,25 dan 2,48 eV. Oksida logam Ce<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub>-TiO<sub>2</sub> dapat mendegradasi metilen biru sebesar 77,00 % selama 120 menit waktu penyinaran dibawah sinar tampak. Uji Kinetika reaksi fotodegradasi membuktikan bahwa oksida logam Ce<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub>-TiO<sub>2</sub> mengikuti kinetika pseudo-orde satu dengan nilai k = 1,1 x 10<sup>-2</sup> menit<sup>-1</sup>.

.....In the last decades, the green synthesis of metal oxide is being developed. For the first time, Ce<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub>-TiO<sub>2</sub> metal oxide is synthesized using *Annona Squamosa* L. peels extract (ASE). The extract contains alkaloids as hydrolyzing agents, meanwhile, the content of saponins, flavonoids, and tannins act as capping agents the formation of Ce<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub>-TiO<sub>2</sub>. Various characterizations using FT-IR Spectroscopy, XRD, SEM-EDS, UV-Vis DRS and UV-Vis Spectrophotometer was performed to investigate the vibrational, structural, optical and photocatalytic properties of Ce<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub>-TiO<sub>2</sub>. The photocatalytic performance of Ce<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub>-TiO<sub>2</sub> was tested for the degradation of methylene blue under visible light illumination. As a result, the efficiency of methylene blue degradation using Ce<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub>-TiO<sub>2</sub> was obtained to be 77.00% for 120 min under visible light illumination. The reaction kinetics of photodegradation of methylene blue followed a pseudo-first-order rate with kapp value of = 1.1 x 10<sup>-2</sup> min<sup>-1</sup>. Modification of TiO<sub>2</sub> with Ce<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub> improves the photocatalytic efficiency due to the diminishing of bandgap energy from 3.25 to 2.60 eV. This research suggests a facile technique to construct TiO<sub>2</sub>-based composite, which can be potential as a novel material for photocatalytic dye degradation under visible-light illumination.