

**FABRIKASI FILM FOTOKATALIS POLIAKRILONITRIL/POLIVINIL
ALKOHOL/TITANIA/CARBON NANOTUBE (PAN/PVA/TiO₂/CNT)
DENGAN METODE *SOLVENT CASTING* UNTUK
DEGRADASI *MALACHITE GREEN***

Nurul Ilmi
20/466480/PPA/06046

INTISARI

Film poliakrilonitril/polivinil alkohol (PAN/PVA) telah berhasil difabrikasi dengan penambahan TiO₂ dan *carbon nanotube* (CNT) menggunakan metode *solvent casting*. Tujuan dari penelitian ini adalah mengetahui pengaruh penambahan TiO₂ dan variasi konsentrasi CNT terhadap sifat mekanik, ukuran kristalit, karakteristik energi celah pita dan spektra fotoluminesensi, dan aktivitas fotokatalitik film fotokatalis PAN/PVA/TiO₂/CNT di bawah iradiasi sinar tampak. Konsentrasi CNT yang digunakan adalah 1, 2, 5, dan 8% (b/b). Komposit film yang telah difabrikasi dikarakterisasi dengan FTIR, XRD, SEM-EDX Mapping, UV-Vis DRS, PL, pengujian kuat tarik dan elongasi, dan uji kinerja fotokatalis dilakukan dengan cara degradasi fotokatalitik terhadap senyawa *malachite green* disertai beberapa perlakuan yakni ukuran fotokatalis, konsentrasi *malachite green*, pH reaksi, waktu penyinaran, jenis fotokatalis, dan pengaruh iradiasi sinar UV dan kondisi gelap.

Hasil spektrum FTIR film PAN/PVA/TiO₂/CNT menginformasikan adanya ikatan kovalen Ti-O-C dan N-H. Hasil difraktogram dan citra SEM memperlihatkan bahwa film fotokatalis memiliki struktur berongga membentuk struktur polikristalin. Penambahan TiO₂ dan CNT dalam fabrikasi film PAN/PVA memberikan sifat mekanik mencapai tiga kali lipat dari film PAN/PVA. Peningkatan konsentrasi CNT memberikan karakteristik energi celah pita yang semakin sempit dan intensitas spektra fotoluminesensi yang semakin rendah. Variasi konsentrasi CNT terbaik diperoleh pada komposit film PAN/PVA/TiO₂/CNT 8% yang memiliki energi celah pita 1,91 eV. Uji aktivitas fotokatalitik material fotokatalis PAN/PVA/TiO₂/CNT 8% menunjukkan bahwa kondisi optimum dengan ukuran fotokatalis (3,0 x 3,0) cm² pada pH 6 untuk fotodegradasi 250 mL *malachite green* 10 ppm dengan hasil 75,18%, 84,32%, 54,51% dalam waktu empat jam berturut-turut pada paparan UV, sinar tampak, dan kondisi gelap.

Kata kunci: Film fotokatalis, PAN, CNT, TiO₂, *solvent casting*

***THE FABRICATION OF POLYACRYLONITRILE/POLYVINYL
ALCOHOL/TITANIA/CARBON NANOTUBE (PAN/PVA/TiO₂/CNT)
PHOTOCATALYTIC FILM BY SOLVENT CASTING METHOD FOR
MALACHITE GREEN DEGRADATION***

Nurul Ilmi
20/466480/PPA/06046

ABSTRACT

Film of polyacrylonitrile/polyvinyl alcohol (PAN/PVA) has been fabricated by adding TiO₂ and carbon nanotube (CNT) using solvent casting method. The purposes of this research were to determine the effect of TiO₂ addition and varying CNT concentrations on the mechanical properties, crystallite size, bandgap energy and photoluminescence spectra characteristics, and photocatalytic activity of PAN/PVA/TiO₂/CNT photocatalyst films under visible light irradiation. The CNT concentrations used were 1, 2, 5, and 8% (w/w). The fabricated composite films were characterized by FTIR, XRD, SEM-EDX Mapping, UV-Vis DRS, PL, tensile strength and elongation tests, and activity of photocatalyst were evaluated for photocatalytic degradation of malachite green with several variations namely photocatalyst size, malachite green concentration, reaction pH, irradiation time, kind of photocatalyst, and the effect of UV light irradiation and dark conditions.

The results showed that FTIR spectra of PAN/PVA/TiO₂/CNT film informed the presence of Ti-O-C and N-H covalent bonds. The diffractogram and SEM image results showed that the photocatalyst film has a hollow structure forming a polycrystalline structure. The addition of TiO₂ and CNT concentrations gave mechanical properties up to three times than PAN/PVA films. An increase in CNT concentration gives a characteristic narrower bandgap energy and lower photoluminescence spectral intensity. The best CNT concentration variation was obtained on PAN/PVA/TiO₂/CNT 8% film composite which had a bandgap energy of 1.91 eV. Photocatalytic activity test of PAN/PVA/TiO₂/CNT 8% photocatalyst material showed that the optimum conditions with photocatalyst size (3,0 x 3,0) cm² at pH 6 for photodegradation of 250 mL malachite green 10 ppm with yields of 75.18%, 84.32%, 54.51% for four hours with UV, visible light irradiation, and dark conditions, respectively.

Keyword: Photocatalytic Film, PAN, CNT, TiO₂, solvent casting