NANOKOMPOSIT Cu-TiO_2/NANOZEOLIT SEBAGAI AKSELERATOR FOTOSINTESIS TANAMAN BAYAM BRAZIL (*Alternanthera sissoo*)

Sabrina Gita Pramesti
21/473393/PA/20385

INTISARI

Aktivitas fotosintesis berperan penting dalam menentukan produktivitas tanaman. Penelitian ini bertujuan untuk menyintesis dan mengkarakterisasi nanokomposit Cu-TiO_2/Nanozeolit sebagai akselerator fotosintesis, serta mengkaji pengaruhnya terhadap kadar klorofil dan laju fotosintesis tanaman bayam Brazil (*Alternanthera sissoo*). Sintesis Cu-TiO_2 dilakukan dengan metode refluks, sedangkan nanozeolit disintesis melalui metode kopresipitasi. Nanokomposit Cu-TiO_2/Nanozeolit dibentuk dengan metode impregnasi, kemudian dikarakterisasi menggunakan FTIR, SR UV-Vis, XRD, SAA, XRF, TEM-SAED, serta diuji aplikasinya selama 8 minggu pada tanaman bayam Brazil. Parameter fotosintesis yang diukur meliputi kadar klorofil (klorofil meter), laju fotosintesis (LICOR-6400), analisis unsur daun (XRF, SEM-EDX), dan total karbon.

Fotokatalis Cu-TiO_2 berhasil disintesis melalui metode refluks dengan variasi konsentrasi Cu (0,01–0,25% b/b), yang menunjukkan peningkatan respons terhadap sinar tampak melalui penurunan energi celah pita dalam rentang 2,99–2,58 eV, optimal hingga doping Cu 0,10%. Sintesis nanokomposit TiO_2/Nanozeolit dan Cu-TiO_2/Nanozeolit melalui metode impregnasi meningkatkan luas permukaan hingga 62,79 m^2/g, serta menurunkan energi celah pita menjadi 2,85–2,56 eV. Aplikasi Cu-TiO_2/Nanozeolit pada tanaman bayam Brazil meningkatkan kadar klorofil total (15,20–18,20 µg/ml), laju fotosintesis (3,58–6,55 µmol $CO_2/m^2 \cdot s$), dan ukuran daun (3,35–3,95 cm), dengan hasil terbaik pada doping Cu 0,25%. Temuan ini menunjukkan potensi Cu-TiO_2/Nanozeolit sebagai akselerator fotosintesis berbasis nanomaterial.

Kata kunci: bayam Brazil, Cu doping, fotosintesis, nanozeolit, TiO_2

NANOCOMPOSITE OF Cu-TiO₂/NANOZEOLITE AS A PHOTOSYNTHESIS ACCELERATOR IN BRAZILIAN SPINACH PLANTS (Alternanthera sisso)

Sabrina Gita Pramesti
21/473393/PA/20385

ABSTRACT

Photosynthetic activity plays a crucial role in determining plant productivity. This study aims to synthesize and characterize Cu-TiO_2/Nanozeolite nanocomposites as photosynthesis accelerators, and to investigate their effects on chlorophyll content and photosynthetic rate in Brazilian spinach (*Alternanthera sissoo*). Cu-TiO_2 was synthesized using the reflux method, while nanozeolite was prepared via a co-precipitation method. The nanocomposite was formed through impregnation of Cu-TiO_2 into the nanozeolite matrix and characterized using FTIR, SR UV-Vis, XRD, SAA, XRF, and TEM-SAED. Application tests were conducted over 8 weeks on Brazilian spinach plants. Photosynthetic parameters were evaluated through chlorophyll content (chlorophyll meter), photosynthetic rate (LICOR-6400), elemental analysis of leaves (XRF, SEM-EDX), and total carbon measurement.

Cu-doped TiO_2 photocatalysts were successfully synthesized via reflux method with Cu concentrations of 0.01–0.25% w/w, showing enhanced visible light responsiveness by reducing the band gap energy within the range of 2.99–2.58 eV, with the optimum effect observed at 0.10% Cu doping. The TiO_2/Nanozeolite and Cu-TiO_2/Nanozeolite nanocomposites were synthesized via impregnation method, resulting in increased surface area up to 62.79 m^2/g and a band gap energy range of 2.85–2.56 eV. Application of Cu-TiO_2/Nanozeolite on Brazilian spinach (Alternanthera sissoo) improved total chlorophyll content (15.20–18.20 µg/ml), photosynthetic rate (3.58–6.55 µmol $CO_2/m^2 \cdot s$), and leaf size (3.35–3.95 cm), with the best plant growth performance achieved at 0.25% Cu doping. These findings demonstrate the potential of Cu-TiO_2/Nanozeolite nanocomposites as a nanomaterial-based photosynthesis accelerator for agricultural applications.

Keywords: Brazilian spinach, Cu doping, nanozeolite, photosynthesis, TiO_2