NANOKOMPOSIT Fe-ZnO/NANOZEOLIT SEBAGAI AKSELERATOR FOTOSINTESIS PADA TANAMAN BAYAM BRAZIL (*Alternanthera sissoo*)

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INTISARI

Nanokomposit dapat digunakan untuk meningkatkan produksi tanaman melalui peningkatan laju fotosintesis tanaman yang diinduksi dengan memberi perlakuan penyemprotan pada daun. Pada penelitian ini telah dilakukan sintesis nanokomposit Fe-ZnO/nanozeolit yang digunakan sebagai akselerator fotosintesis tanaman bayam brazil (*Alternanthera sissoo*). Secara khusus, tujuan penelitian ini untuk mengamati pengaruh variasi konsentrasi Fe pada nanokomposit Fe-ZnO/nanozeolit terhadap laju fotosintesis tanaman bayam brazil.

Sintesis Fe-ZnO dilakukan menggunakan metode presipitasi dengan $Zn(NO_3)\cdot 6H_2O$ dan $Fe(NO_3)_3\cdot 9H_2O$ sebagai prekursor dan variasi konsentrasi doping Fe sebesar 0,01; 0,05; 0,1; dan 0,25% b/v. Nanozeolit disintesis menggunakan metode kopresipitasi dengan prekursor aluminium sulfat dan natrium silikat. Nanokomposit dibentuk melalui metode impregnasi Fe-ZnO ke dalam nanozeolit. Karakterisasi material dilakukan menggunakan spektrofotometer FT-IR, SR-UV, X-ray fluoresensi (XRF), difraksi sinar-X (XRD), *Surface Area Analyzer* (SAA), dan mikroskop transmisi elektron (TEM). Nanokomposit disemprotkan pada tanaman bayam selama 4 minggu. Pengaruh nanokomposit pada proses fotosintesis tanaman bayam diamati menggunakan Li-Cor, *chlorophyll meter*, spektrofotometer FT-IR, XRF, XRD, dan mikroskop elektron SEM-EDX.

Hasil penelitian menunjukkan bahwa material Fe-ZnO/nanozeolit berpengaruh terhadap peningkatan laju fotosintesis tanaman bayam. Namun, komposisi doping Fe pada material yang berlebihan dapat mengurangi efektivitasnya. Fe-ZnO/nanozeolit 0,1% adalah material dengan pengaruh terbaik pada laju fotosintesis dengan laju fotosintesis mencapai 23,03 μmol CO_2 m^{-2} s^{-1} dan rerata total klorofil 42,608 unit serta energi celah pita sebesar 2,90 eV, yang menunjukkan peningkatan dibandingkan sampel kontrol dengan laju fotosintesis 19,51 μmol CO_2 m^{-2} s^{-1}; rerata klorofil 27,017 unit.

Kata kunci: Bayam brazil, doping Fe, fotosintesis, nanozeolit, ZnO.

Fe-ZnO/NANOZEOLITE NANOCOMPOSITE AS A PHOTOSYNTHESIS ACCELERATOR IN BRAZILIAN SPINACH (*Alternanthera sissoo*) *PLANTS*

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ABSTRACT

Nanocomposites can be used to increase plant production by increasing the rate of plant photosynthesis induced by spraying the leaves. In this research, the synthesis of Fe-ZnO/nanozeolite nanocomposites has been carried out which is used as a photosynthesis accelerator in Brazilian spinach (Alternanthera sissoo) plants. Specifically, the aim of this research is to observe the effect of varying Fe concentrations in Fe-ZnO/nanozeolite nanocomposites on the photosynthesis rate of Brazilian spinach plants.

The synthesis of Fe-ZnO was carried out using the precipitation method with $Zn(NO_3)_2 \cdot 6H_2O$ and $Fe(NO_3)_3 \cdot 9H_2O$ as precursors and a variation of the Fe doping concentration of 0.01; 0.05; 0.1; and 0.25% m/v. Nanozeolite was synthesized using the coprecipitation method with aluminum sulfate and sodium silicate precursors. Nanocomposites are formed through the Fe-ZnO impregnation method into nanozeolite. Material characterization was carried out using FT-IR spectrophotometer, SR-UV, X-ray fluorescence (XRF), X-ray diffraction (XRD), Surface Area Analyzer (SAA), and transmission electron microscope (TEM). The nanocomposite was sprayed on spinach plants for 4 weeks. The effect of nanocomposites on the photosynthesis process of spinach plants was observed using Li-Cor, chlorophyll meter, FT-IR spectrophotometer, XRF, XRD, and SEM-EDX electron microscope.

The results showed that the Fe-ZnO/nanozeolite material had an effect on increasing the photosynthesis rate of spinach plants. However, excessive composition of Fe doping in the material can reduce its effectiveness. Fe-ZnO/nanozeolite 0.1% is the material with the best influence on the rate of photosynthesis with a photosynthesis rate reaching 23.03 μmol CO_2 m^{-2} s^{-1} and an average total chlorophyll of 42.608 units and a band gap energy of 2.90 eV, which shows an increase compared to the control sample with photosynthesis rate 19.51 μmol CO_2 m^{-2} s^{-1}; mean chlorophyll 27.017 units.

Keywords: Brazilian spinach, Fe doping, nanozeolite, photosynthesis, ZnO