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Sintesis Film Nanokomposit Kitosan-PVA/Co-doped ZnO sebagai Kemasan Makanan Antibakteri = Synthesis of Chitosan-PVA/Co-doped ZnO Nanocomposite Film as Antibacterial Food Packaging

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Abstrak

Kemasan makanan berbasis plastik sintetis telah menimbulkan masalah bagi lingkungan karena limbah yang dihasilkan sulit terdegradasi. Saat ini, telah banyak dikembangkan kemasan makanan berbasis biopolimer karena sifatnya yang mudah terurai alami dan biokompatibel. Penelitian ini bertujuan untuk sintesis film nanokomposit berbasis biopolimer kitosanPVA dan dikompositkan dengan nanopartikel Codoped ZnO sebagai nanofiller untuk meningkatkan sifat fungsional dan antibakteri kemasan makanan. Nanopartikel Co(15%)doped ZnO berhasil dikompositkan dengan kitosanPVA membentuk film nanokomposit kitosanPVA /Codoped ZnO didukung dengan FTIR, XRD, UV-Vis DRS, SEM yang menunjukkan permukaan film tidak rata dan heterogen, dan SEM-EDS yang menunjukkan keberadaan nanopartikel Codoped ZnO pada matriks biopolimer. Film nanokomposit kitosanPVA /Codoped ZnO diperoleh komposisi nanopartikel Codoped ZnO terbaik yaitu 1,5% yang mana meningkatnya konsentrasi nanopartikel akan meningkatkan ketebalan, kekuatan tarik, dan perpanjangan saat putus, menurunkan kapasitas swelling, kelarutan, transparansi, transmisi cahaya, dan laju transmisi uap air dari film. Konsentrasi release ion Zn2+ dan Co2+ masih berada dibawah ambang batas maksimum menurut European food safety authority (EFSA). Kinetika release ion Zn2+ pada media simulan makanan mengikuti model Higuchi dengan mekanisme release adalah difusi. Film nanokomposit kitosanPVA/ Codoped ZnO (1,5%) memberikan aktivitas antibakteri terbaik dengan zona hambat untuk E.coli dan S.aureus masing-masing sebesar 10,4 mm dan 10 mm. Pengembangan film biopolimer kitosanPVA dengan nanopartikel Codoped ZnO mempunyai potensi untuk aplikasi kemasan makanan antibakteri ramah lingkungan di masa depan.
.....Synthetic plastic-based food packaging has caused problems for the environment because the waste produced is difficult to degrade. Currently, biopolymer-based food packaging has been developed due to its biodegradability and biocompatible properties. This study aims to synthesize nanocomposite films based on chitosanPVA biopolymer and composited them with Codoped ZnO nanoparticles as nanofillers to improve the functional and antibacterial properties of food packaging. Co(15%)doped ZnO nanoparticles were successfully composited with chitosanPVA to form chitosanPVA /Codoped ZnO nanoparticles supported by FTIR, XRD, UV-Vis DRS, SEM which showed an rough and heterogeneous film surface, and SEM- EDS showing the presence of Codoped ZnO nanoparticles in the biopolymer matrix. ChitosanPVA /Co-doped ZnO nanocomposite film obtained the best Codoped ZnO nanoparticle composition of 1.5% in which increasing nanoparticle concentration increases thickness, tensile strength, and elongation at break, decreasing swelling capacity, solubility, transparency, light transmission, and the water vapor transmission rate of the film. Release concentrations of Zn2+ and Co2+ ions are still below the maximum threshold according to the European food safety authority (EFSA). The kinetic release of Zn<sup>2+ ion in food simulants media follows the Higuchi model with the release mechanism is diffusion. ChitosanPVA/CodopedZnO (1.5%) nanocomposite films provided the best antibacterial activity with inhibition zones for E.coli and S.aureus of 10.4 mm and 10 mm, respectively. The development of

chitosanPVA biopolymer films with Codoped ZnO nanoparticles has the potential for future applications of environmentally friendly antibacterial food packaging.