RINGKASAN

Peningkatan penggunaan plastik konvensional sebagai pengemas makanan yang dapat menyebabkan meningkatnya sampah plastik sehingga berpotensi menimbulkan masalah pencemaran lingkungan karena bahan plastik konvensional sulit terdegradasi secara biologis. Salah satu upaya untuk mengurangi masalah tersebut adalah penggunaan plastik dengan bahan dasar yang ramah lingkungan sebagai alternatif pengemas pangan yaitu bioplastik. Bahan ramah lingkungan yang dapat digunakan dan dikombinasikan pada pembuatan bioplastik yaitu PVA,tapioka dan bahan pengisi serat nanoselulosa dan titanium dioksida. Penelitian ini bertujuan untuk: (1) Mengetahui karakteristik dan pengaruh terhadap sifat fisik dan mekanik bioplastik dari kombinasi perlakuan proporsi komposit polivinil alkohol dan pati dengan konsentrasi dan jenis *plasticizer*; (2) Menentukan bioplastik terbaik dari kombinasi perlakuan proporsi komposit polivinil alkohol dan pati dengan konsentrasi dan jenis *plasticizer*; (3) Mengetahui karakteristik dan pengaruh terhadap sifat fisik dan mekanik bioplastik komposit terpilih dengan penambahan bahan pengisi berupa serat nanoselulosa dan titanium dioksida (TiO_2)

Tahap pertama penelitian menggunakan Rancangan Acak Lengkap (RAL) faktorial dengan dua faktor: Proporsi PVA : tapioka (1 : 1, 1 : 2 dan 2 : 1) dengan konsentrasi dan jenis *plasticizer* (PEG 1%, PEG 2%, Gliserol 1% dan Gliserol 2%). Tahap kedua menggunakan Rancangan Acak Lengkap (RAL) satu faktor: Proporsi Serat Nanoselulosa : TiO_2 sebagai *filler*. Data dianalisis menggunakan ANOVA dan dilanjutkan dengan uji DMRT pada taraf signifikansi 95% jika terdapat perbedaan yang nyata. Parameter yang diujikan meliputi ketebalan, kekerasan, laju transmisi uap air, biodegradasi, kuat tarik, elongasi, transparansi pada sinar ultraviolet, aktivitas antimikroba dan analisis morfologi.

Hasil penelitian tahap pertama diketahui bahwa rata-rata nilai ketebalan 0,20-0,27 mm; kekerasan 17,98-22,83; laju transmisi uap air 6,055-24,784 (g/m^2.jam), biodegradasi 15,40-32,84%, kuat tarik 0,375-0,892 Mpa dan elongasi 10,32-45,09%. Perlakuan P3S3 menjadi formulasi yang digunakan pada penelitian tahap kedua. Hasil penelitian tahap kedua diketahui bahwa rata-rata nilai ketebalan 0,25-0,27 mm, kekerasan 22,94-26,37, laju transmisi uap air 4,107-5,796 (g/m^2.jam), biodegradasi 29,30-31,29%, kuat tarik 0,676-0,794 Mpa dan elongasi 26,863-28,209%, transparansi pada sinar ultraviolet 1,615-3,683 mm^{-1} dan membentuk zona hambat terhadap *E.Coli* 1,37-3,172 mm dan zona hambat terhadap *S.Aureus* 2,14-3,315 mm.. Berdasarkan hasil tersebut penambahan bahan pengisi berupa serat nanoselulosa dan titanium dioksida memberikan pengaruh nyata terhadap semua parameter kecuali biodegradasi.

SUMMARY

The increase in the use of conventional plastic as food packaging can lead to a rise in plastic waste, which has the potential to cause environmental pollution problems because conventional plastic is difficult to biologically degrade. One effort to reduce this issue is the use of environmentally friendly based plastics as an alternative food packaging, namely bioplastics. Eco-friendly materials that can be used and combined in the production of bioplastics include PVA, tapioca, and filler materials like nanocellulose and titanium dioxide. This research aims to: (1) Investigate the characteristics and effects on the physical and mechanical properties of bioplastics from the combination of treatment proportions of polyvinyl alcohol and starch composites with different concentrations and types of plasticizers; (2) Determine the best bioplastic from the combination of treatment proportions of polyvinyl alcohol and starch composites with different concentrations and types of plasticizers; (3) Investigate the characteristics and effects on the physical and mechanical properties of selected composite bioplastics with the addition of filler materials in the form of nanocellulose fibers and titanium dioxide (TiO2).

The first stage of the research used a Completely Randomized Design (CRD) factorial with two factors: the ratio of PVA:Tapioca (1:1, 1:2, and 2:1) with the concentration and type of plasticizer (PEG 1%, PEG 2%, Glycerol 1%, and Glycerol 2%). The second stage used a Completely Randomized Design (CRD) with one factor: the ratio of Nanocellulose Fiber:Titanium Dioxide as filler. The data were analyzed using ANOVA followed by a DMRT test at a significance level of 95% if there were significant differences. The parameters tested included thickness, hardness, water vapor transmission rate, biodegradation, tensile strength, elongation, transparency under ultraviolet light, antimicrobial activity, and morphological analysis.

The results of the first phase of research showed that the average thickness value was 0.20-0.27 mm; hardness 17.98-22.83; water vapor transmission rate 6.055-24.784 (g/m2.h), biodegradation 15.40-32.84%, tensile strength 0.375-0.892 Mpa, and elongation 10.32-45.09%. The P3S3 treatment became the formulation used in the second phase of research. The results of the second phase of research indicated that the average thickness value was 0.25-0.27 mm, hardness 22.94-26.37, water vapor transmission rate 4.107-5.796 (g/m2.h), biodegradation 29.30-31.29%, tensile strength 0.676-0.794 Mpa, and elongation 26.863-28.209%, transparency at ultraviolet light 1.615-3.683 mm^{-1}, and forming an inhibition zone against E. Coli 1.37-3.172 mm and an inhibition zone against S. Aureus 2.14-3.315 mm. Based on these results, the addition of filling materials in the form of nanocellulose fibers and titanium dioxide has a significant effect on all parameters except for biodegradation..