

## **PEMBUATAN PLASTIK BIODEGRADABEL BERBASIS ALGINAT SEBAGAI SUMBER MIKRONUTRISI BESI BAGI TANAMAN**

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### **INTISARI**

Penelitian pembuatan plastik biodegradabel sebagai sumber mikronutrisi besi bagi tanaman telah dilakukan. Tujuan penelitian ini adalah menghasilkan plastik biodegradabel yang berpotensi dikembangkan menjadi polibag sekaligus bertindak sebagai pupuk lepas lambat hara besi bagi tanaman. Plastik tersebut disintesis dengan metode *solvent casting* menggunakan alginat, bahan aditif dan kation besi. Plastik pada penelitian ini dibentuk menjadi lapisan tipis atau film untuk dipelajari. Pengaruh variasi jumlah besi, jenis bahan aditif meliputi PEG, bentonit dan PVA terhadap peningkatan kualitas pembentukan film alginat/Fe telah diamati. Film yang terbentuk dengan kualitas terbaik diukur sifat mekaniknya, dikarakterisasi dengan FTIR dan SEM serta dipelajari kinetika pelepasan besi dari film dalam media air dan asam sitrat.

Hasil pengamatan menunjukkan bahwa semakin bertambahnya jumlah besi dalam film alginat/Fe meningkatkan fragmentasi film. Pengaruh jenis bahan aditif memperlihatkan bahwa penambahan PVA dapat menghilangkan fragmentasi tersebut. Spektra FTIR menunjukkan bahwa hadirnya PVA dalam film mencegah interaksi antara alginat dan besi. Bertambahnya jumlah PVA dalam film alginat/PVA/Fe meningkatkan kuat tarik dan kemuluran film. Gambar SEM memperlihatkan bahwa bertambahnya kandungan PVA menyebabkan morfologi permukaan film semakin halus. Studi kinetika pelepasan besi pada film alginat/PVA/Fe dengan kandungan PVA sebanyak 0,25; 0,75 dan 1,25 %w/v menunjukkan bahwa bertambahnya PVA meningkatkan jumlah besi yang terlepas dan proses pelepasan besi mengikuti kinetika pelepasan orde dua semu. Tetapan laju pelepasan besi dari film dalam media air dengan kandungan PVA 0,25; 0,75 dan 1,25 %w/v berturut-turut adalah 1,00; 0,834 dan 0,732  $\text{mg}^{-1}\text{menit}^{-1}$  sedangkan dalam media asam sitrat adalah 0,068; 0,050 dan 0,035  $\text{mg}^{-1}\text{menit}^{-1}$ .

**Kata Kunci:** Plastik biodegradabel, alginat, mikronutrisi besi, tanaman

## **SYNTHESIS OF BIODEGRADABLE PLASTIC BASED ON ALGINATE AS IRON MICRONUTRIENT FOR PLANT**

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### **ABSTRACT**

Synthesis of biodegradable plastics as a source of iron micronutrients for plant has been studied. The aim of the research was to produce biodegradable plastic that can be developed into polybag which acts as slow release fertilizer of iron nutrient for plants. The plastics were synthesized by solvent casting method using alginates, additives and iron cations. The composites were prepared as a film. The influence of iron concentration, type of additive materials such as polyethylene glycol (PEG), bentonite and polyvinyl alcohol (PVA) on the quality of the films of alginate/Fe was studied. The film which has the best quality in term of the mechanical properties was observed and characterized by FTIR and SEM. The kinetics of iron released from film into citric acid and water were also observed.

Results showed that the increasing amount of iron in alginate/Fe film increased the fragmentation of the film. The use of PVA as additive materials has shown to prevent the fragmentation. FTIR spectra indicated that PVA prevented interaction between alginate and iron. Increasing of the PVA amount into alginate/Fe film increased tensile strength and elongation. SEM image showed that the increasing of PVA content resulted in smooth morphology of the film surface. Study of the kinetics of iron release from films with 0.25; 0.75 and 1.25 %w/v of PVA content indicated that the increasing of PVA amount would increase the amount of iron released. The release process is in accordance with pseudo second order kinetics. The rate constant of iron released from the film in water with 0.25; 0.75 and 1.25 %w/v of PVA content were 1.001; 0.834, and 0.732  $\text{mg}^{-1} \text{minute}^{-1}$ , respectively; whereas in citric acid medium is 0.068; 0.050 and 0.035  $\text{mg}^{-1} \text{minute}^{-1}$ .

Key Word: Biodegradable plastic, Alginate, Iron micronutrient, Plant