

Sintesis nanokomposit natrium alginat ganggang coklat tercangkok poli (akrilat-co-akrilamida) termodifikasi montmorillonite sebagai superabsorben pupuk lepas lambat = Synthesis of nanocomposite sodium alginate from brown algae grafting by poly (acrylic acid-co-acrylamide) modified by montmorillonite as superabsorbent slow release fertilizer

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Abstrak

Superabsorben nanokomposit berbasis natrium alginat tercangkok poli akrilat-co-akrilamida yang dikompositkan dengan montmorillonite MMT, dan dengan penambahan pupuk NPK ke dalam superabsorben nanokomposit dengan metode polimerisasi in situ telah berhasil disintesis pada penelitian ini. Pada awal penelitian dilakukan isolasi natrium alginat dari ganggang coklat dengan persen rendemen rata-rata yang diperoleh sebesar 44,26. Selanjutnya, natrium alginat hasil isolasi dikopolimerisasi dengan menggunakan asam akrilat dan akrilamida sebagai monomer, kalium persulfat sebagai inisiator, N,N'-metilen-bis-akrilamida MBA sebagai agen pengikat silang dan ditambahkan MMT untuk memperkuat sifat fisik dari superabsorben nanokomposit. Superabsorben nanokomposit dikarakterisasi dengan instrumen FTIR untuk analisis gugus fungsi, XRD untuk analisis indeks kristanilitas, dan SEM untuk melihat morfologi permukaan. Kapasitas swelling air, urea, KH₂PO₄, dan NH₄ H₂PO₄ superabsorben nanokomposit natrium alginat menunjukkan nilai kapasitas terbaik, yaitu berturut-turut sebesar 475.8 g/g, 491.1 g/g, 122.9 g/g, dan 134.9 g/g. Kapasitas release air, urea, KH₂PO₄, dan NH₄ H₂PO₄ superabsorben nanokomposit natrium alginat menunjukkan nilai kapasitas terbaik, yaitu berturut-turut sebesar 70.9, 69.8, 52.6, dan 48.6. Kapasitas swelling optimum superabsorben nanokomposit pupuk lepas lambat dengan in situ urea, KH₂PO₄, NH₄ H₂PO₄, yaitu berturut-turut sebesar 423.3 g/g, 89.8 g/g, dan 138.1 g/g. Kapasitas release optimum superabsorben nanokomposit pupuk lepas lambat dengan in situ urea, KH₂PO₄, NH₄ H₂PO₄, yaitu berturut-turut sebesar 55.0, 35.3, 28.2. Kinetika orde swelling optimum SA9 FD terhadap larutan air, urea, KH₂PO₄, dan NH₄ H₂PO₄ mengikuti hukum laju orde pseudo-pertama. Kinetika orde release optimum SA9 FD terhadap larutan KH₂PO₄, dan NH₄ H₂PO₄ mengikuti hukum laju orde pseudo-pertama, sedangkan kinetika orde release optimum SA9 FD terhadap larutan air dan urea mengikuti hukum laju orde pseudo-kedua. Kinetika orde swelling optimum superabsorben nanokomposit pupuk lepas lambat in situ KH₂PO₄ SA17 FD terhadap air mengikuti hukum laju orde pseudo-pertama, sedangkan kinetika orde swelling optimum superabsorben nanokomposit pupuk lepas lambat in situ urea SA14 FD, dan in situ NH₄ H₂PO₄ SA20 FD mengikuti hukum laju orde pseudo-kedua. Kinetika orde release optimum SA14 FD dan SA20 FD terhadap larutan NaCl 0.9 mengikuti hukum laju orde pseudo-pertama, sedangkan kinetika orde release optimum SA17 FD mengikuti hukum laju orde pseudo-kedua. Hukum laju reaksi orde pseudo-pertama mengikuti persamaan $v=k[\text{absorbat}]^1$, sedangkan hukum laju reaksi orde pseudo-kedua mengikuti persamaan $v=k[\text{absorbat}]^2$.

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Superabsorbent nanocomposite based sodium alginate grafted poly acrylate co acrylamide composited with montmorillonite MMT, and with the addition of NPK fertilizers into superabsorbent nanocomposite by in

situ polymerization methods have been successfully synthesized in this study. At the beginning of the study, the isolation of sodium alginate from brown algae with percentage of average yield was 44,26 . Furthermore, the isolated sodium alginate was copolymerized using acrylic acid and acrylamide as monomer, potassium persulfate as initiator, N, N 39 methylene bis acrylamide MBA as a crosslinking agent and MMT was added to enhance the physical properties of the superabsorbent nanocomposite. Superabsorbent nanocomposite were characterized by FTIR instruments for functional group analysis, XRD for cristallinity index analysis, and SEM for viewing surface morphology. The swelling capacity of water, urea, KH_2PO_4 , and $\text{NH}_4 \text{H}_2\text{PO}_4$ superabsorbent nanocomposite sodium alginate show the best capacity value, ie 475,8 g g, 491,1 g g, 122,9 g g, and 134,9 g g, respectively. The release capacity of water, urea, KH_2PO_4 , and $\text{NH}_4 \text{H}_2\text{PO}_4$ superabsorbent nanocomposite sodium alginate show the best capacity, ie 70,9 , 69,8 , 52,6 and 48,6 , respectively. The optimum swelling capacity of slow release fertilizer superabsorbent nanocomposites with in situ urea, KH_2PO_4 , $\text{NH}_4 \text{H}_2\text{PO}_4$, ie 423,3 g g, 89,8 g g, and 138,1 g g, respectively. The optimum release capacity of slow release fertilizer superabsorbent nanocomposites with in situ urea, KH_2PO_4 , $\text{NH}_4 \text{H}_2\text{PO}_4$, ie 55.0 g g, 35,3 g g, 28,2 g g, respectively. The optimum swelling order kinetics of SA9 FD against water, urea, KH_2PO_4 , and $\text{NH}_4 \text{H}_2\text{PO}_4$ solution follows the pseudo first order rate law. The optimum release order kinetics of SA9 FD against KH_2PO_4 , and $\text{NH}_4 \text{H}_2\text{PO}_4$ solution follows the pseudo first order rate law, whereas the optimum release order kinetics of SA9 FD against water and urea solution follows the pseudo second order rate law. The optimum swelling order kinetics superabsorbent nanocomposite fertilizer slow release in situ KH_2PO_4 SA17 FD against the water follows the pseudo first order rate law, while the optimum swelling order kinetics superabsorbent nanocomposite fertilizer slow release in situ urea SA14 FD , and in situ $\text{NH}_4 \text{H}_2\text{PO}_4$ SA20 FD follows the pseudo second order rate law. The optimum release order kinetics SA14 FD and SA20 FD against 0.9 NaCl solution follows the pseudo first order rate law, while the optimum release order kinetics SA17 FD follows the pseudo second order rate law. The pseudo first order reaction rate law follows the equation $v = k \text{ absorbat } 1$, while the pseudo second order reaction rate law follows the equation $v = k \text{ absorbat } 2$.