

# **APLIKASI BIOKOMPOSIT DARI CANGKANG KEPITING DAN CANGKANG TELUR TERHADAP ADSORPSI LOGAM Pb**

## **INTISARI**

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Telah dilakukan penelitian tentang aplikasi biokomposit dari cangkang kepiting dan cangkang telur terhadap adsorpsi logam Pb (timbal). Penelitian ini dilakukan dengan metode adsorpsi. Kelebihan dari metode adsorpsi yaitu prosesnya lebih sederhana, ramah lingkungan, tidak adanya efek racun dan biaya operasionalnya yang relatif murah. Metode sintesis biokomposit cangkang kepiting dan cangkang telur ayam (CK/CTA) dilakukan dengan mencampurkan natrium sulfida hidrat ( $\text{Na}_2\text{SO}_4$ ) dan Natrium Hidroksida (NaOH) yang kemudian diaduk dengan menggunakan stirrer dan kemudian dikeringkan dalam oven pada suhu  $65^\circ\text{C}$  selama 30-60 menit. Biokomposit dikarakterisasi dengan menggunakan FTIR (*Fourier Transform Infrared*) terdapat gugus OH, CH, C=O,  $\text{CO}_3^{2-}$ ,  $\text{CH}_2$ ,  $\text{CH}_3$  dan  $\text{CaCO}_3$ . Lalu hasil karakterisasi menggunakan XRD (*X-Ray Diffraction*) diperoleh material kristal dengan puncak difraksi pada sudut  $2\theta$  yaitu  $23,0611^\circ$ ,  $29,3740^\circ$ ,  $35,9944^\circ$ ,  $39,3823^\circ$ ,  $43,1550^\circ$ ,  $47,5019^\circ$  dan  $48,4894^\circ$  dengan sistem rhombohedral. Kemudian pada GSA (*Gas Sorption Analyzer*) biokomposit CK/CTA menunjukkan tipe IV yaitu mesopori. Adsorpsi dilakukan dengan menggunakan variasi pH, waktu kontak, massa, konsentrasi dan temperatur. Hasil penelitian menunjukkan pada variasi pH Pb optimum yaitu pada pH 10 dengan % adsorpsi sebesar 97,35%. Variasi massa optimum pada Pb yaitu 0,2 gram. Variasi waktu kontak optimum pada Pb yaitu pada menit ke 60 yaitu 87,5%. Variasi konsentrasi optimum pada 15 ppm yaitu 97,07%. Penentuan kinetika reaksi mengikuti orde dua semu tipe 1 dengan penentuan isoterm adsorpsi cenderung mengikuti kurva Freundlich. Penentuan termodinamika menunjukkan adsorpsi reaksi terjadi secara spontan dan bersifat endotermik.

**Kata kunci :** Adsorpsi, Biokomposit, Timbal (Pb), cangkang kepiting, NaOH.

# APPLICATION OF BIOCOMPOSITE FROM CRAB SHELL AND EGG SHELL TO ADSORPTION OF LEAD (Pb) METAL

## ABSTRACT

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Research has been conducted on the application of biocomposites made from crab shells and eggshells for the adsorption of lead (Pb) metal. This study was carried out using the adsorption method. The advantages of the adsorption method include its simpler process, environmental friendliness, absence of toxic effects, and relatively low operational costs. The synthesis method of the crab shell and chicken eggshell biocomposite (CK/CTA) is created by mixing sodium sulfide hydrate ( $\text{Na}_2\text{SO}_4$ ) and Sodium Hydroxide (NaOH), which are then stirred using a stirrer and subsequently dried in an oven at a temperature of  $65^\circ\text{C}$  for 30-60 minutes. The biocomposite is characterized using FTIR (Fourier Transform Infrared), revealing the presence of functional groups such as OH, CH, C=O,  $\text{CO}_3^{2-}$ ,  $\text{CH}_2$ ,  $\text{CH}_3$ , and  $\text{CaCO}_3$ . Further characterization using XRD (X-Ray Diffraction) results in a crystalline material with diffraction peaks at  $2\theta$  angles of  $23,0611^\circ$ ,  $29,3740^\circ$ ,  $35,9944^\circ$ ,  $39,3823^\circ$ ,  $43,1550^\circ$ ,  $47,5019^\circ$ , and  $48,4894^\circ$ , indicating a rhombohedral system. The Gas Sorption Analyzer (GSA) shows that the biocomposite (CK/CTA) exhibits type IV behavior, characteristic of mesopores. Adsorption experiments are conducted by varying pH, contact time, mass, concentration, and temperature. Research findings demonstrate that the optimal pH for Pb adsorption is at pH 10, achieving an adsorption percentage of 97,35%. The optimal mass variation for Pb is 0,2 grams. The best contact time variation for Pb is at 60 minutes, yielding an adsorption percentage of 87,5%. At a concentration variation of 15 ppm, the adsorption percentage reaches 97,07%. The reaction kinetics follow pseudo-second-order kinetics of type 1, while the adsorption isotherm tends to adhere to the Freundlich curve. Thermodynamic analysis indicates that the adsorption reaction occurs spontaneously and is endothermic in nature.

**Keyword:** Adsorption, Biocomposite, Lead, Crab shell, NaOH.