ADSORPSI SURFAKTAN ANIONIK DODESIL BENZENA SULFONAT MENGGUNAKAN ADSORBEN SELULOSA TERMODIFIKASI DODESENIL SUKSINAT

Ibnu Saleh
19/442520/PA/19269

INTISARI

Dodesil benzena sulfonat (DBS) adalah surfaktan anionik yang berasal dari garam sodium dodesil benzena sulfonat (SDBS) yang merupakan penyusun utama detergen. Dodesil benzena sulfonat akan menjadi limbah dan bersifat toksik bagi lingkungan dan biota perairan setelah digunakan dalam industri *laundry*. Penelitian ini bertujuan untuk membuat adsorben selulosa termodifikasi dodesenil suksinat (SDS) dan mempelajari kemampuannya dalam mengadsorpsi DBS dalam air. Penentuan kondisi optimum, model kinetika, dan isotermal adsorpsi DBS menggunakan adsorben SDS juga dipelajari. Adsorben SDS disintesis dengan mereaksikan serbuk selulosa (SS) dan anhidrida-2-dodesenil suksinat (ADS) dalam pelarut *N*,*N*-dimetilformamida dan piridin. Adsorben SDS kemudian dikarakterisasi menggunakan FTIR, XRD, dan SEM. Kajian adsorpsi dilakukan dengan variasi pH larutan DBS, konsentrasi awal DBS, waktu kontak, rasio adsorben SDS terhadap DBS, dan dilakukan juga uji kemampuan SDS dalam mengadsorpsi surfaktan anionik dalam limbah buatan. Konsentrasi DBS setelah adsorpsi ditentukan menggunakan metode *methylene blue active substance* (MBAS) dengan pengukuran spektrofotometri UV-Vis pada panjang gelombang 652 nm.

Hasil modifikasi selulosa berupa serbuk putih kecoklatan tanpa bau. Berdasarkan karakterisasi FTIR menunjukkan keberhasilan sintesis SDS yang ditunjukkan dengan munculnya puncak pada 1721 cm^{-1} hasil vibrasi ulur C=O ester. Kondisi optimum proses adsorpsi DBS pada SDS adalah pada pH larutan di pH 3, waktu kontak 90 menit, konsentrasi awal DBS 6,14 mmol L^{-1}, dan rasio SDS terhadap DBS 11,40 g $mmol^{-1}$. Proses adsorpsi mengikuti model kinetika orde kedua semu dengan konstanta laju adsorpsi $3{,}12\times10^{-1}$ g $mmol^{-1}$ $menit^{-1}$ dan cenderung mengikuti model isotermal Langmuir dengan kapasitas adsorpsi maksimum 140,85 mmol g^{-1}. Selain itu, model isotermal Freundlich juga memiliki koefisien korelasi yang baik sehingga mengindikasikan bahwa proses adsorpsi didominasi oleh adsorpsi monolayer, tetapi adsorpsi multilayer juga terjadi. Hasil uji kemampuan SDS pada limbah buatan menunjukkan penurunan kadar surfaktan anionik empat kali lebih besar dibandingkan menggunakan SS sebagai adsorben.

Kata kunci: adsorpsi DBS, anhidrida suksinat, metode MBAS, modifikasi selulosa

ADSORPTION OF DODECYL BENZENE SULFONATE ANIONIC SURFACTANT USING ADSORBENT OF DODECENYL SUCCINIC MODIFIED CELLULOSE

Ibnu Saleh
19/442520/PA/19269

ABSTRACT

Dodecyl benzene sulfonate (DBS) is an anionic surfactant derived from the sodium salt dodecyl benzene sulfonate (SDBS), which is the main ingredient in detergents. Dodecyl benzene sulfonate will become waste and is toxic to the environment and aquatic biota after being used in the laundry industry. This study aims to synthesize dodecenyl succinic-modified cellulose (SDS) adsorbent and study its ability to adsorb DBS in water. Determination of optimum conditions, kinetic models, and isothermal adsorption of DBS using SDS adsorbent was also studied. SDS adsorbent was synthesized by reacting cellulose powder (SS) and 2-dodecenyl succinic anhydride (ADS) in *N*,*N*-dimethylformamide and pyridine solvents. SDS adsorbent was then characterized using FTIR, XRD, and SEM. Adsorption studies were conducted with variations in the pH of the DBS solution, initial concentration of DBS, contact time, a ratio of SDS adsorbent to DBS, and SDS ability test to adsorb anionic surfactants in artificial waste. DBS concentration after adsorption was determined using the methylene blue active substance (MBAS) method with UV-Vis spectrophotometric measurements at a wavelength of 652 nm.

The synthesis of SDS adsorbent showed a brownish-white powder without odor. The appearance of peaks at 1721 cm^{-1} due to C=O stretching demonstrates the success of SDS synthesis based on FTIR characterization. The optimal conditions for DBS adsorption on the SDS surface were the pH solution at pH 3, a contact time of 90 minutes, an initial concentration of 6,14 mmol L^{-1}, and a mass of SDS to DBS ratio of 11,40 g $mmol^{-1}$. The adsorption process follows a pseudo-second-order kinetic model with a adsorption rate constant of $3{,}12\times10^{-1}$ g $mmol^{-1}$ min^{-1} and tends to follow Langmuir's isothermal model with a maximum adsorption capacity of 140,85 mmol g^{-1}. In addition, the Freundlich isothermal model also has a good correlation, thus indicating that the adsorption process is dominated by monolayer adsorption, but multilayer adsorption also occurs. The SDS ability test on artificial waste showed a decrease in anionic surfactant levels four times greater than using SS as an adsorbent.

Keywords: adsorption of DBS, cellulose modifications, MBAS method, succinic anhydride