

## **ADSORPSI Cr(VI) PADA HIBRIDA AMONIUM KUATERNER SILIKA BERBAHAN DASAR ABU SEKAM PADI**

Syukri Rofi'ati  
10/300141/PA/13152

### **INTISARI**

Telah dipelajari adsorpsi Cr(VI) pada material hibrida amonium kuaterner silika (HAKS) dalam sistem *batch*. HAKS disintesis menggunakan natrium silikat ( $\text{Na}_2\text{SiO}_3$ ) yang dibuat dari abu sekam padi sebagai prekursor dan senyawa trimetil-[(3-trimetoksisilil)propil]amonium iodida melalui metode sol-gel. Amonium kuaterner disintesis dengan mereaksikan (3-aminopropil)trimetoksisilan dengan metil iodida berlebih dalam pelarut metanol dan basa natrium metoksida ( $\text{NaOCH}_3$ ). HAKS dikarakterisasi dengan spektrofotometer FTIR dan difraktometer sinar-X (XRD), sedangkan ion Cr(VI) yang teradsorpsi dianalisis secara kuantitatif dengan spektrofotometer UV-Vis. Adsorpsi dilakukan dengan variasi waktu kontak, pH, dan konsentrasi awal Cr(VI). Isoterm adsorpsi dikaji dengan model isoterm Langmuir dan Freundlich. Pengaruh anion lain yang terdapat dalam limbah industri pelapisan logam, seperti  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$ , dan  $\text{PO}_4^{3-}$ , terhadap adsorpsi Cr(VI) juga turut dipelajari.

Hasil karakterisasi dengan spektrofotometri FTIR menunjukkan HAKS telah berhasil disintesis, ditandai dengan munculnya serapan dari gugus-gugus fungsional, seperti metil ( $-\text{CH}_3$ ), metilen ( $-\text{CH}_2-$ ), silanol ( $\equiv\text{Si}-\text{OH}$ ), dan siloksan ( $\equiv\text{Si}-\text{O}-\text{Si}\equiv$ ). Berdasarkan data XRD, dapat disimpulkan bahwa struktur HAKS adalah amorf. Adsorpsi Cr(VI) optimum pada waktu 30 menit dan pH 3. Studi isoterm adsorpsi menunjukkan adsorpsi Cr(VI) mengikuti model isoterm Langmuir dengan kapasitas adsorpsi  $25,995 \text{ mg.g}^{-1}$  dan energi adsorpsi  $25,170 \text{ kJ.mol}^{-1}$ . Keberadaan anion  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$ , dan  $\text{PO}_4^{3-}$  mempengaruhi adsorpsi Cr(VI), dengan penurunan konsentrasi paling besar dikarenakan adanya anion  $\text{PO}_4^{3-}$ .

Kata kunci: adsorpsi, Cr(VI), amonium kuaterner, silika, abu sekam padi

## **ADSORPTION OF Cr(VI) ON QUATERNARY AMMONIUM SILICA HYBRID FROM RICE HULL ASH**

Syukri Rofi'ati  
10/300141/PA/13152

### **ABSTRACT**

Adsorption of Cr(VI) on quaternary ammonium silica hybrid (QASH) material in a batch system has been studied. QASH was synthesized using sodium silicate ( $\text{Na}_2\text{SiO}_3$ ) prepared from rice hull ash as precursor and trimethyl-[(3-trimethoxysilyl)propyl]ammonium iodide via sol-gel method. Quaternary ammonium was synthesized by reacting (3-aminopropyl)trimethoxysilane with excess of methyl iodide in methanol solvent and sodium methoxide ( $\text{NaOCH}_3$ ) base. QASH was characterized by FTIR spectrophotometer and X-ray diffractometer (XRD), while the adsorbed Cr(VI) ion was quantitatively analyzed using UV-Vis spectrophotometer. Adsorption was carried out with variation of time, pH, and initial Cr(VI) concentration. Adsorption isotherm was investigated using Langmuir and Freundlich isotherm models. The influence of coexisting anions found in metal plating industrial waste, i.e.  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$ , and  $\text{PO}_4^{3-}$ , toward Cr(VI) adsorption was also studied.

The FTIR spectrophotometry characterization showed that QASH was successfully synthesized, indicated by the presence of specific absorption of functional groups, i.e. methyl ( $-\text{CH}_3$ ), methylene ( $-\text{CH}_2-$ ), silanol ( $\equiv\text{Si}-\text{OH}$ ), and siloxane ( $\equiv\text{Si}-\text{O}-\text{Si}\equiv$ ). Based on the XRD data, it could be concluded that the structure of QASH was amorphous. The adsorption of Cr(VI) was optimum at 30 minutes and pH 3. Isotherm adsorption studies showed that the adsorption of Cr(VI) followed the Langmuir isotherm model with the adsorption capacity was  $25.995 \text{ mg.g}^{-1}$  and the adsorption energy was  $25.170 \text{ kJ.mol}^{-1}$ . The presence of anion  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$ , and  $\text{PO}_4^{3-}$  influenced the adsorption of Cr(VI), with the largest decreasing concentration was caused by  $\text{PO}_4^{3-}$  anion.

Keywords: adsorption, Cr(VI), quaternary ammonium, silica, rice hull ash