Elektrooksidasi Limbah Produksi Minyak Kelapa Sawit (Palm Oil Mill Effluent) oleh Boron Doped Diamond = Electrooxidation of Palm Oil Mill Effluent (POME) by Boron Doped Diamond

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Abstrak

Asam palmitat merupakan asam lemak jenuh yang paling banyak terdapat dalam air buangan industri kelapa sawit (Palm Oil Mill Effluent, POME). POME menyebabkan tingginya kebutuhan oksigen kimia dan berdampak kepada kerusakan ekosistem di perairan. Pada penelitian ini, asam palmitat dalam sistem emulsi air-etanol dan satu fasa (air) dengan pH basa digunakan sebagai model limbah cair POME untuk di elektrooksidasi menggunakan anoda Boron-Doped Diamond (BDD) secara kontinu dan batch. Karakterisitik kinerja anoda BDD di amati melalui siklik voltametri dan kronoamperometri, sedangkan penurunan asam palmitat dimonitor dengan pengukuran Chemical Oxygen Demand (COD) dan LCMS-MS pada setiap waktu elektrooksidasi. Selain itu, untuk melihat umur pakai anoda BDD dan stabilitas struktur BDD pada elektrolisis asam palmitat telah dipelajari juga penggunaan potensial tinggi. Hasil penelitian mengindikasikan bahwa elektrooksidasi asam palmitat pada sistem campuran air-etanol maupun tanpa etanol terjadi secara tidak langsung melalui pembentukan radikal hidroksida pada daerah dekat pembebasan oksigen. Indikator penurunan asam palmitat dalam sistem emulsi air-etanol baik secara kontinu dan batch ditunjukan oleh penurunan COD yang berturut-turut mencapai 75,91% dan 75.46% selama 1 jam elektrooksidasi pada potensial +10,0V. Penurunan COD dipengaruhi oleh besarnya potensial yang diberikan dan lama waktu elektrooksidasi. Pada metoda kontinu, potensial yang diterapkan +10,0V dan lama waktu elektrookasidasi 4 jam tercapai penurunan COD sebesar 87,61%, sedangkan pada metoda batch, potensial yang diterapkan +3,0V dan lama waktu elektrooksidasi sama yaitu 4 jam tercapai penurunan COD tertinggi sebesar 85,75%. Sedangkan penurunan asam palmitat dalam sistem tanpa etanol dan potensial yang diterapkan +5,0V selama 5 menit elektrooksidasi menunjukan efisiensi yang rendah yaitu 37,16% dan bertambahnya waktu penurunan COD konstan. Studi stabilitas struktur BDD menunjukan bahwa penerapan potensial tinggi dan lama waktu elektrooksidasi 4 jam telah menyebabkan penurunan kualitas struktur BDD. <hr /> POME causes high chemical oxygen demand and impacts on the damage to the ecosystem in the waters. In this study, palmitic acid in a emulsion system of water- ethanol and one-phase system of water and alkaline pH was used as a model of POME liquid waste to be electrooxidated using Boron-Doped Diamond (BDD) anodes continuously and in batches. The performance characteristics of BDD anodes are observed through voltammetry cyclic and chronoamperometry, whereas the decrease in palmitic acid is monitored by the measurement of Chemical Oxygen Demand (COD) and LCMS-MS in every time of electro-oxidation. In addition to looking at the life span of BDD anodes and the stability of BDD structures, high potential use in palmitic acid electrolysis has also been studied. The results of the study indicated that the electro-oxidation of palmitic acid in the water-ethanol emulsion system and the without ethanol occurs indirectly through the formation of hydroxide radicals in the area near oxygen evolution. Indicators of a decrease in palmitic acid in water-ethanol mixture system both continuously and in batch are shown by a decrease in COD which respectively reached 75,91% and 75,46% for one hour of electro-oxidation at a potential of +10,0V. The decrease in COD is influenced by the magnitude of the

potential given and the time length of electro-oxidation. In the continuous method, when the potential applied was + 10,0V and the time length was four hours of electro-oxidation, it achieved a COD reduction to 87,61%, while in the batch method, the potential applied was +3,0V and the time length of electro-oxidation was the same that is ie 4 hours, it achieved the highest COD reduction into 85,75%. On the other hand, the decrease of palmitic acid in the solution system without ethanol and the potential applied +5,0V for 5 minutes of electro-oxidation showed a low efficiency of 37,16% and increased time to decrease COD constant. The study of BDD structure stability showed that the application of high potential and the time length of electro-oxidation of 4 hours has caused a decrease in the quality of BDD structure.</p>