# Perengkahan Katalitik Minyak Jarak Kepyar (Ricinus communis L.) menjadi Senyawa Bio-Hidrokarbon dengan Katalis Zeolite Berbasis Fly-Ash Terimpregnasi Atom Boron dan Fosfor = Catalytic Cracking of Castor Oil (Ricinus communis L.) into Bio-Hydrocarbon Compounds with Fly-Ash Based Zeolite Catalyst Impregnated with Boron and Phosphorus Atoms

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Abstrak

Bio-hidrokarbon dapat dihasilkan dari konversi asam lemak minyak nabati non-pangan melalui reaksi perengkahan katalitik. Pada penelitian ini dilakukan perengkahan minyak jarak kepyar untuk menghasilkan bio-hidrokarbon dengan bantuan katalis zeolite. Katalis zeolite didapatkan dari preparasi fly-ash dengan metode pencucian asam (HCl) dan peleburan alkali (NaOH), yang kemudian diimpregnasi dengan atom boron (B) dan fosfor (P) untuk memodifikasi keasamannya. Untuk mendapatkan konversi minyak jarak kepyar setinggi mungkin, maka dilakukan variasi suhu reaksi (450, 500, dan 550°C) serta variasi katalis. Hasil reaksi perengkahan berupa bio-oil akan dikarakterisasi dengan GC-MS dan FTIR; sedangkan hasil preparasi katalis dikarakterisasi dengan XRD dan XRF. Berdasarkan hasil penelitian, minyak jarak kepyar berhasil dikonversi menjadi senyawa bio-hidrokarbon. Konversi terbesar dihasilkan oleh variasi katalis zeolite fly-ash terimpregnasi 5%wt boron (5%B/FA) pada suhu 550°C sebesar 72.86% dan variasi rasio massa katalis terhadap minyak umpan 10%wt pada suhu 550°C sebesar 81.55%. Berdasarkan hasil GC-MS, katalis campuran boron dan fosfor dengan rasio massa 10% terhadap minyak umpan (10%wt B/P/FA) memiliki selektivitas terhadap senyawa alkana dan alkena yang terbesar, masing-masing sebesar 24.77% dan 21.07%. Sedangkan jika ditinjau berdasarkan sifat fisiknya, karakteristik dari bio-hidrokarbon hasil variasi katalis zeolite fly-ash terimpregnasi 1%wt fosfor (1%P/FA) pada suhu 550°C bersifat mendekati standar biodiesel dengan nilai densitas, viskositas kinematik, dan angka RON masing-masing sebesar 796 kg/m3, 2.72 cSt dan 87.

.....Bio-hydrocarbons can be produced through the catalytic cracking of non-edible vegetable oil fatty acids. In this study, the cracking of castor oil was conducted to produce bio-hydrocarbons using zeolite catalyst. The zeolite catalyst was obtained from fly ash through acid (HCl) leaching and alkali (NaOH) fusion methods, followed by impregnation with boron (B) and phosphorus (P) atoms to modify its acidity. To achieve the highest possible conversion of castor oil, reaction temperature variations (450, 500, and 550°C) and catalyst variations were performed. The resulting cracking products, in the form of bio-oil, were characterized using GC-MS and FTIR, while the prepared catalysts were characterized using XRD and XRF. Based on the research result, castor oil was successfully converted into bio-hydrocarbon compounds. The highest conversion was achieved with the 5%wt boron-impregnated fly ash zeolite catalyst (5%B/FA) at 550°C by 72.86%, also the variation of a catalyst-to-feedstock mass ratio of 10%wt at 550°C, resulting in 81.55% conversion. According to the GC-MS analysis, the catalyst with a 10%wt boron and phosphorus mixture (10%wt B/P/FA) exhibited the highest selectivity towards alkane and alkene compounds, at 24.77% and 21.07% respectively. When considering the physical properties, the bio-hydrocarbon produced using a 1%wt phosphorus-impregnated fly ash catalyst (1%P/FA) at 550°C exhibited characteristics close to

biodiesel standards, with density, kinematic viscosity, and research octane number values of 796 kg/m$^3$, 2.72 cSt, and 87 respectively.