

PENGARUH SUSUNAN KATALIS Co, Mo, DAN W TEREMBAN PADA KARBON AKTIF DALAM REAKTOR TERHADAP SELEKTIVITAS DAN YIELD BIOAVTUR UNTUK *HYDROTREATMENT REFINED PALM OIL* (RPO)

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INTISARI

Sintesis katalis berbasis logam Co, Mo, dan W yang diembankan pada karbon aktif melalui metode impregnasi kering telah dilakukan. Tujuan dari penelitian ini adalah mempelajari pengaruh susunan katalis C, Co/C, Mo/C, W/C, CoMo/C, dan CoW/C, terhadap *yield* dan selektivitas bioavtur dalam *hydrotreatment Refined Palm Oil* (RPO) dan uji *reusability* katalis. Umpan RPO diperoleh dari hasil *degumming*, *bleaching*, dan perlakuan termal terhadap CPO. Logam yang diimpregnasikan bersumber dari larutan prekursor $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$, $(\text{NH}_4)_6\text{Mo}_7\text{O}_{24} \cdot 4\text{H}_2\text{O}$, dan $(\text{NH}_4)_6\text{H}_2\text{W}_{12}\text{O}_{40} \cdot \text{H}_2\text{O}$. Katalis dikarakterisasi menggunakan instrumen FTIR, XRD, SEM-EDX, SAA, NH_3 -TPD, dan TEM. Uji aktivitas katalis dilakukan melalui *hydrotreatment* RPO I (fraksi I) dan II (fraksi II) menggunakan reaktor *semi-batch* dengan pemanas ganda dalam sistem *one-pot double-decker*. Produk cair hasil reaksi dianalisis menggunakan instrumen GC-MS. Susunan katalis dengan hasil produk cair tertinggi dilakukan uji *reusability* dalam lima kali siklus reaksi menggunakan umpan RPO I+II (campuran) dan RPOK (komersial).

Katalis Co/C, Mo/C, W/C, CoMo/C, dan CoW/C telah berhasil dipreparasi dengan metode impregnasi kering cara semprot, menunjukkan karakter luas permukaan berturut-turut sebesar 21,61; 30,10; 56,34; 34,99; dan 151,74 m^2/g ; keasaman total berturut-turut sebesar 0,90; 0,83; 0,44; 0,68; dan 0,37 mmol/g . Umpan RPO mengandung senyawa dominan berupa asam oleat (41,93%–44,67%) dan asam palmitat (38,22%–40,88%). Susunan katalis Co/C–Mo/C menghasilkan *yield* bioavtur tertinggi menggunakan umpan RPO II sebesar 49,80% dengan selektivitas sebesar 94,59%. Titik beku produk bioavtur dari susunan katalis Co/C–Mo/C dengan umpan RPO II sebesar $-35,6^\circ\text{C}$. Katalis dengan susunan Co/C–Mo/C memiliki performa yang menjanjikan setelah dilakukan uji *reusability* sebanyak lima kali menggunakan umpan RPO I+II dan RPOK dengan *yield* bioavtur diperoleh pada uji ketiga sebesar 52,66% dan 48,32%.

Kata kunci: bioavtur, *hydrotreatment*, *refined palm oil*, karbon aktif

THE EFFECT OF ARRANGEMENT OF Co, Mo, AND W CATALYSTS SUPPORTED ON ACTIVATED CARBON IN A REACTOR TOWARDS SELECTIVITY AND *YIELD* OF BIOAVTUR IN HYDROTREATMENT OF REFINED PALM OIL (RPO)

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ABSTRACT

Synthesis of Co, Mo, and W metal-based catalysts supported on activated carbon by the dry impregnation method has been carried out. The purpose of this study was to evaluate the effect of catalyst arrangement C, Co/C, Mo/C, W/C, CoMo/C, and CoW/C, towards yield and selectivity bio-jet fuel in the hydrotreatment of Refined Palm Oil (RPO) and the reusability test of the catalyst. The RPO feed was obtained from degummed, bleached, and thermally treated of CPO. Metal support of 5% by weight of activated carbon was carried out by spraying using solutions of the precursors $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$, $(\text{NH}_4)_6\text{Mo}_7\text{O}_{24} \cdot 4\text{H}_2\text{O}$, and $(\text{NH}_4)_6\text{H}_2\text{W}_{12}\text{O}_{40} \cdot \text{H}_2\text{O}$. The catalyst was characterized using FTIR, XRD, SEM-EDX, SAA, NH₃-TPD, and TEM instruments. The catalyst activity test was carried out through the hydrotreatment of RPO I (fraction I) and II (fraction II) using a semi-batch reactor with a double-heater in a one-pot double-decker system. The liquid products of the reaction were analysed using a GC-MS instrument. The catalyst composition with the highest liquid product yield was tested for reusability in five reaction cycles using feed RPO I+II (mixture) and CRPO (commercial).

Co/C, Mo/C, W/C, CoMo/C, and CoW/C catalysts have been successfully prepared using the spray dry impregnation method, showing surface area characteristics of 21.61; 30.10; 56.34; 34.99; and 151.74 m²/g, respectively, and total acidity of 0.90; 0.83; 0.44; 0.68; and 0.37 mmol/g, respectively. RPO feed contains dominant compounds in the form of oleic acid (41.93%–44.67%) and palmitic acid (38.22%–40.88%). The Co/C–Mo/C catalyst arrangement produced the highest bio-jet fuel yield using RPO II feed of 49.80% with selectivity of 94.59%. The freezing point of bio-jet fuel products from the Co/C–Mo/C catalyst arrangement with RPO II feed is –35.6 °C. The catalyst with the Co/C–Mo/C composition had promising performance after reusability tests were carried out five times using RPO I+II and CRPO feeds with bio-jet fuel yields obtained in the third test of 52.66% and 48.32%.

Keywords: bio-jet fuel, hydrotreatment, refined palm oil, activated carbon.