

# Peningkatan Yield dan Angka Oktana Gasoline pada Proses Perengkahan Katalitik menggunakan Umpan Campuran Gasoil dengan Trigliserida Asam Lemak Sawit = Upgrading Yield and Octane Number of Gasoline in Fluid Catalytic Cracking Process Using Feed Mixture of Gasoil with Palms Fatty Acid Triglycerides

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## Abstrak

Konsumsi minyak bensin atau gasoline untuk bahan bakar mesin transportasi dalam negeri selama ini telah melebihi kapasitas unit produksi. Sebagian besar produk gasoline dihasilkan dari unit perengkahan katalitik menggunakan umpan utama fraksi gasoil. Upaya untuk meningkatkan yield dan kualitas oktana gasoline umumnya dilakukan melalui seleksi katalis dan optimalisasi kondisi proses, meskipun demikian sifat umpan juga mempengaruhi produk akhir. Penelitian ini bertujuan untuk menemukan dan mempelajari metode proses alternatif peningkatan yield dan angka oktana gasoline dengan cara modifikasi umpan menggunakan campuran vacuum gasoil dengan trigliserida dan asam lemak jenuh dan tak jenuh berbasis sawit.

Eksperimen reaksi perengkahan dilakukan pada fluid-bed reaktor dengan umpan campuran vacuum gasoil dengan minyak sawit murni, distilat asam lemak dan asam oleat dalam rentang konsentrasi 0 sampai 15% menggunakan katalis zeolite REY pada suhu 530oC dan rasio katalis-umpan 5,5 g/g. Perengkahan umpan menghasilkan produk gas dan cair serta coke yang terdeposit dalam katalis. Produk gas dianalisa menggunakan GC refinery gas analyzer untuk menentukan komposisi gas hidrokarbon C1, C2, C3 & C4 serta H2. Produk cair dianalisa menggunakan GC simulated distillation untuk menentukan yield gasoline, LCO dan bottom. Angka oktana gasoline dianalisa dengan GC DHA. Kadar air dalam produk cair dianalisa dengan metode Karl-Fischer. Analisa coke dengan metode Infrared dan keasaman katalis dengan metode NH3-TPD.

Dari hasil penelitian didapatkan bahwa perengkahan VGO dengan 5%RBDPO meningkatkan yield gasoline dari 42,9% menjadi 46,9% dan angka oktana dari 91,8 menjadi 96,2. Perengkahan VGO dengan 5%(RBDPO\_PFAD) dapat meningkatkan yield gasoline menjadi 48,3% dengan angka oktana 97,5. Perengkahan VGO dengan 5%(RBDPO\_Oleic acid) dapat meningkatkan yield gasoline menjadi 45,2% dengan angka oktana 98,2. Kandungan asam lemak jenuh dan tak jenuh dalam umpan berperan dalam reaksi-reaksi perengkahan, isomerisasi, transfer hidrogen dan aromatisasi yang mempengaruhi struktur yield produk dan komposisi hidrokarbon n-parafin, iso-parafin, olefin, naften dan aromatik. Penambahan RBDPO, PFAD dan Oleic acid pada umpan VGO menyebabkan kenaikan komposisi hidrokarbon iso-parafin dan olefin dalam gasoline.

The consumption of gasoline for transportation fuel in domestic has exceeded the production unit capacity. Most of gasoline is produced from fluid catalytic cracking unit that proceeds gasoil fraction as main feedstock. Some efforts to upgrade gasoline yield and its octane quality usually is performed by catalyst selection and process optimization, eventhough feed nature also influence to the end-product.

This research work was aimed to find out and learn the alternative method in fluid catalytic cracking process to upgrade gasoline yield and octane quality by means of feed modification using mixture of vacuum gasoil with palms triglycerides and fatty acids having single and double-bonds. The experimental catalytic reaction

was performed at fluid-bed reactor of advance cracking evaluation unit utilizing mixture of vacuum gasoil with pure palm oil, fatty acid distillate and oleic acid over zeolite REY catalysts at reaction temperature of 530oC and catalyst oil ratio 5.5 g/g.

The cracking of feedstocks under process condition resulted in gaseous and liquid products, as well as coke deposited on catalyst. The gaseous product was analyzed by online gas chromatography to identify dry gas of C1, C2 & H2, and LPG of C3, C4 hydrocarbons. Liquid product was analyzed using gas chromatography of simulated distillation to obtain yields of gasoline, light cycle oil and bottoms. Gasoline octane number was analyzed using GC DHA method. Water contained in liquid product was analyzed by Karl Fischer method. Coke was analyzed by online Infrared analyzer and catalyst acidity was analyzed using NH3 TPD method.

From the reaseach work, it was found that the cracking of VGO with 5%RBDPO could increase gasoline yield from 42.9% to 46.9% and octane number from 91.8 to 96.2. The cracking of VGO with 5%RBDPO PFAD increased gasoline yield to 48.3% and octane number to 97.5 meanwhile cracking of VGO with 5%RBDPO Oleic acid increased gasoline yield to 45.2% and octane number to 98.2. The role of single and double-bonds fatty acids in feedstock appeared to play in reactions of cracking, isomerization, hydrogen transfer and aromatization that influenced the product yields structure and hydrocarbon composition of nparaffins, isoparaffins, olefins, naphthene and aromatics. The addition of RBDPO, PFAD dan Oleic acid in VGO had caused increase of hydrocarbon composition of iso-paraffins and olefin in gasoline