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APPENDICES

Appendix A The Quantitative Calculations of Gas Product

Volume of gas product passed through a vent test to measure hourly that each hour has the different a little bit in a measured gas product quantity (volume). As the gas phase, 1 mol% of methane equals to 1 vol% of methane that was a standard for giving a reference area of methane compared to an area of product i with the different a number of mol in product i (a number of methane mol = 1 mol atom and ethane = 2 mol atom for example). The chosen measured gas product in an hour should also result in a constant conversion as observed in a chromatogram. The volume of product i (ml) then was calculated to weight of product i at STP for simply further converting to conversion, selectivity. and yield of products.

$$\text{Volume of product i (ml)} = \frac{(\text{areas of product i})\times(\text{total volume of gas product})\times(1\ \text{mol \% of methane})}{(\text{number of mol in product i})\times(\text{reference area of methane})} \quad \text{A1}$$

$$\text{Weight of product i (g)} = \frac{(\text{volume of product i})\times(\text{molecular weight i})}{(22.4)\times(1000)} \quad \text{A2}$$

The calculations of conversion, products selectivity, and yield of product are defined as shown in Equations 3, 4, and 5 respectively.

$$\text{Conversion (\%)} = \frac{(\text{weight of total products(g)})\times(100)}{\text{weight of (total products(g) + remaining feed(g))}} \quad \text{A3}$$

$$\text{Selectivity of product i (\%)} = \frac{(\text{weight of products i(g)})\times(100)}{\text{weight of total products(g)}} \quad \text{A4}$$

$$\text{Yield of product i (\%)} = (\text{conversion}) \times (\text{selectivity of product i}) \quad \text{A5}$$

Appendix B Overall Mass Balance of Hydrocracking over Different Extruded Catalyst (Reaction Condition: 310 °C, 500 psig, and H_2/Feed Molar Ratio of 30

Table B1 Overall mass balance of hydrocracking over different extruded catalyst (Reaction condition: 310 °C, 500 psig, and H_2/feed molar ratio of 30)

Catalyst	Extrudates (HY:Pseudo Boehmite) wt%				
	100:0	80:20	60:40	40:60	20:80
Gas Product (g/h)	0.05	0.50	0.50	1.75	0.29
Light Product (<C5) (g/h)	0.02	0.19	0.27	0.84	0.15
Liquid Product (g/h)	3.06	2.10	4.34	4.37	2.87
Gasoline Product (C5-C8) (g/h)	0.87	2.15	2.23	2.86	1.07
Jet Product (C9-C14) (g/h)	0.98	0.26	1.10	1.52	0.82
Diesel Product (C15-C18) (g/h)	1.26	0.00	1.24	0.90	0.46
Remaining Feed (RF) (g/hr)	1.26	0.00	0.80	0.02	1.35
Liquid Product + RF (g/h) (Vial)	3.07	2.10	5.14	4.39	3.57
Gas + Liquid Product (g/h)	1.87	2.60	3.60	5.22	2.51
Total Product + RF (g/h)	3.12	2.60	5.64	6.14	3.86
Remaining H2 (g/h)	0.27	0.49	0.45	0.61	0.35
Used H2 (g/h)	0.05	0.02	0.00	0.03	0.01

Appendix C Physical Properties of Pseudo Boehmite Extrudates with Varing of vol% Glacial Acetic Acid

Catalysts	Batch Reference	Height (mm)	Diameter (mm)	Area (mm^2)	Maximum Load (N)	Maximum Load (N)/cm	Average Maximum Load (N)/cm	SD
Pseudo Boehmite	1% Glacial acetic	7.5	1.9	2.84	78.02	104.03	107.03	11.20
		6.9	1.9	2.84	82.40	119.42		
		7.3	1.9	2.84	71.27	97.63		
	2% Glacial acetic	7.0	1.9	2.84	78.80	112.69	122.27	8.43
		6.2	1.9	2.84	79.73	128.62		
		7.0	1.9	2.84	87.85	125.50		
	3% Glacial acetic	5.1	1.9	2.84	70.88	138.98	144.97	8.45
		5.2	1.9	2.84	74.81	143.48		
		4.7	1.9	2.84	70.94	150.94		
	4% Glacial acetic	7.0	1.5	1.77	68.92	98.46	83.91	12.63
		7.0	1.5	1.77	52.91	75.59		
		7.0	1.5	1.77	54.39	77.70		
	5% Glacial acetic	6.4	1.5	1.77	39.60	61.88	60.44	5.72
		6.4	1.5	1.77	34.65	54.14		
		6.4	1.5	1.77	41.80	65.32		

Appendix D Physical Properties of HY:Pseudo Boehmite Extrudates with 3 vol% of Glacial Acetic Acid

Catalysts	Batch Reference	Height (mm)	Diameter (mm)	Area (mm^2)	Maximum Load (N)	Maximum Load (N)/cm	Average Maximum Load (N)/cm	SD
HY: Pseudo Boehmite	80:20	6.2	1.9	2.84	34.49	55.63	50.41	7.98
		5.0	1.9	2.84	27.18	54.37		
		6.9	1.9	2.84	28.44	41.22		
	60:40	5.8	1.7	2.26	48.15	83.02	81.68	1.21
		5.5	1.7	2.26	44.35	80.64		
		6	1.7	2.26	48.83	81.38		
	40:60	4.8	1.7	2.26	45.59	94.97	92.30	7.22
		7.8	1.7	2.26	65.61	84.12		
		7.6	1.7	2.26	74.13	97.80		
	20:80	7.0	1.7	2.26	90.68	129.53	126.77	3.42
		7.8	1.7	2.26	95.89	122.93		
		7.2	1.7	2.26	115.31	127.84		

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2. Jariyasin, K.; Jongpatiwut, S.; Wasanapiarnpong T.; Butnark, S.; and Tachakritikul C. (2015, April 21) Catalytic cracking/isomerization of hydrogenated biodiesel: catalyst formulation. Poster presented at The 6th Research Symposium on Petrochemical and Materials Technology and The 21th PPC Symposium on Petroleum, Petrochemicals, and Polymers, Chulalongkorn University, Bangkok, Thailand.