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Appendices

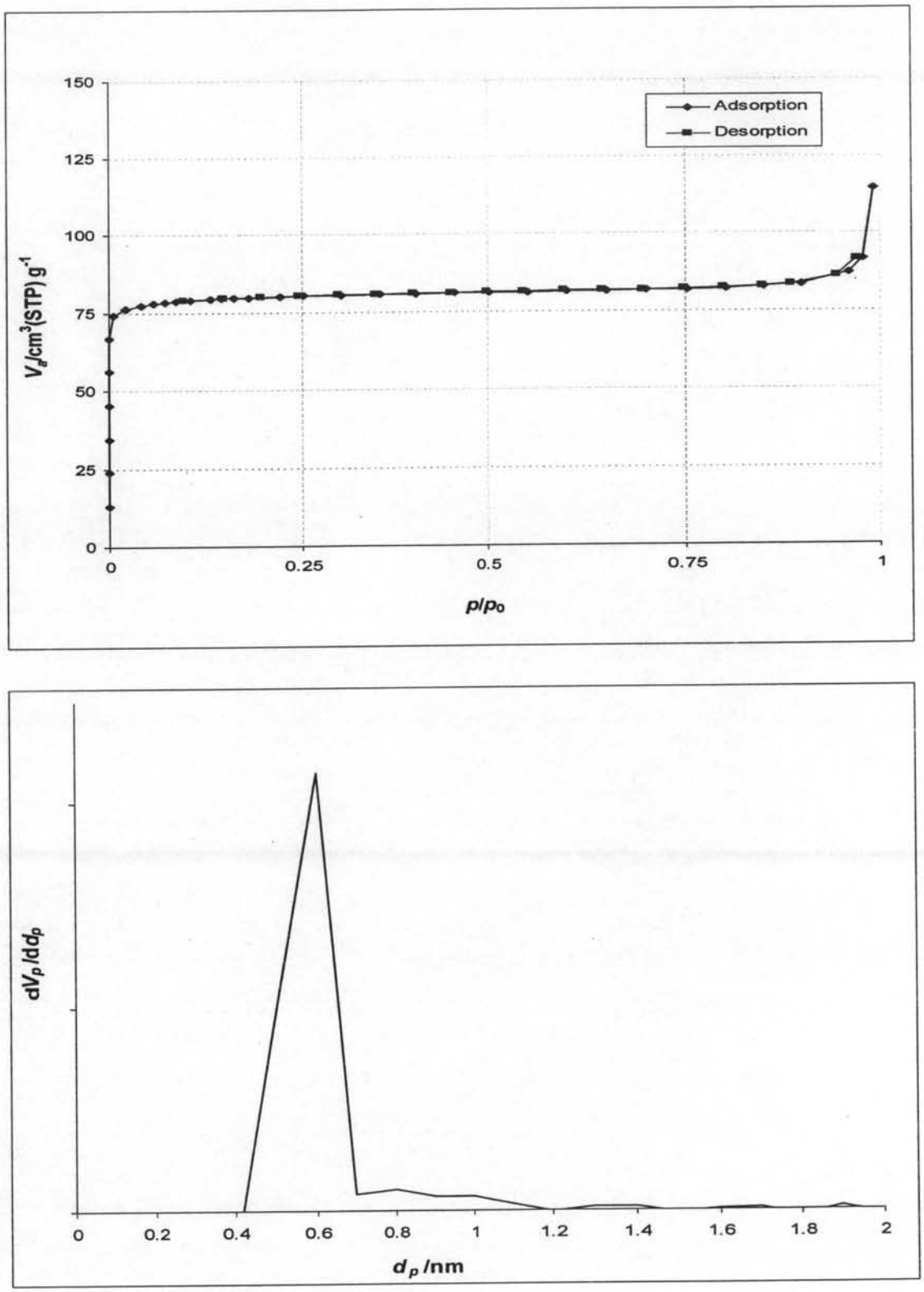

Figure A-1 N_2 adsorption-desorption isotherm and pore size distribution of ETS-10 catalyst.

1. Calculation of Correction Factor (CF)

$$CF = \frac{Mol_{ME}\ (theory)}{Mol_{ME}\ (practical)} \quad \text{.....(A-1)}$$

Where Mol_{ME} (theory) = Mol of methyl ester in prepared standard solution

$$= \frac{W_{ME}}{\text{MW of methyl ester}}$$

Mol_{ME} (practical) = Mol of methyl ester calculated from GC

$$= \frac{PA_{ME} \times Mol_{int.std}}{PA_{int.\ std.}}$$

Where PA_{ME} = Peak area of methyl ester

$PA_{int.\ std.}$ = Peak area of internal standard (eicosane)

2. Calculation of methyl ester yield

$$\%\ \text{Yield of ME product} = \frac{W_{ME}}{W_{oil}} \times 100 \quad \text{.....(A-2)}$$

Where W_{ME} = Weight of methyl ester calculated from GC (g)

$= Mol_{ME} \times$ MW of ME

$$Mol_{ME} = \frac{PA_{ME} \times Mol_{int.std}}{PA_{int.\ std.}} \times CF$$

W_{oil} = Weight of oil (g)

Where PA_{ME} = Peak area of methyl ester

$PA_{int.\ std.}$ = Peak area of internal standard (eicosane)

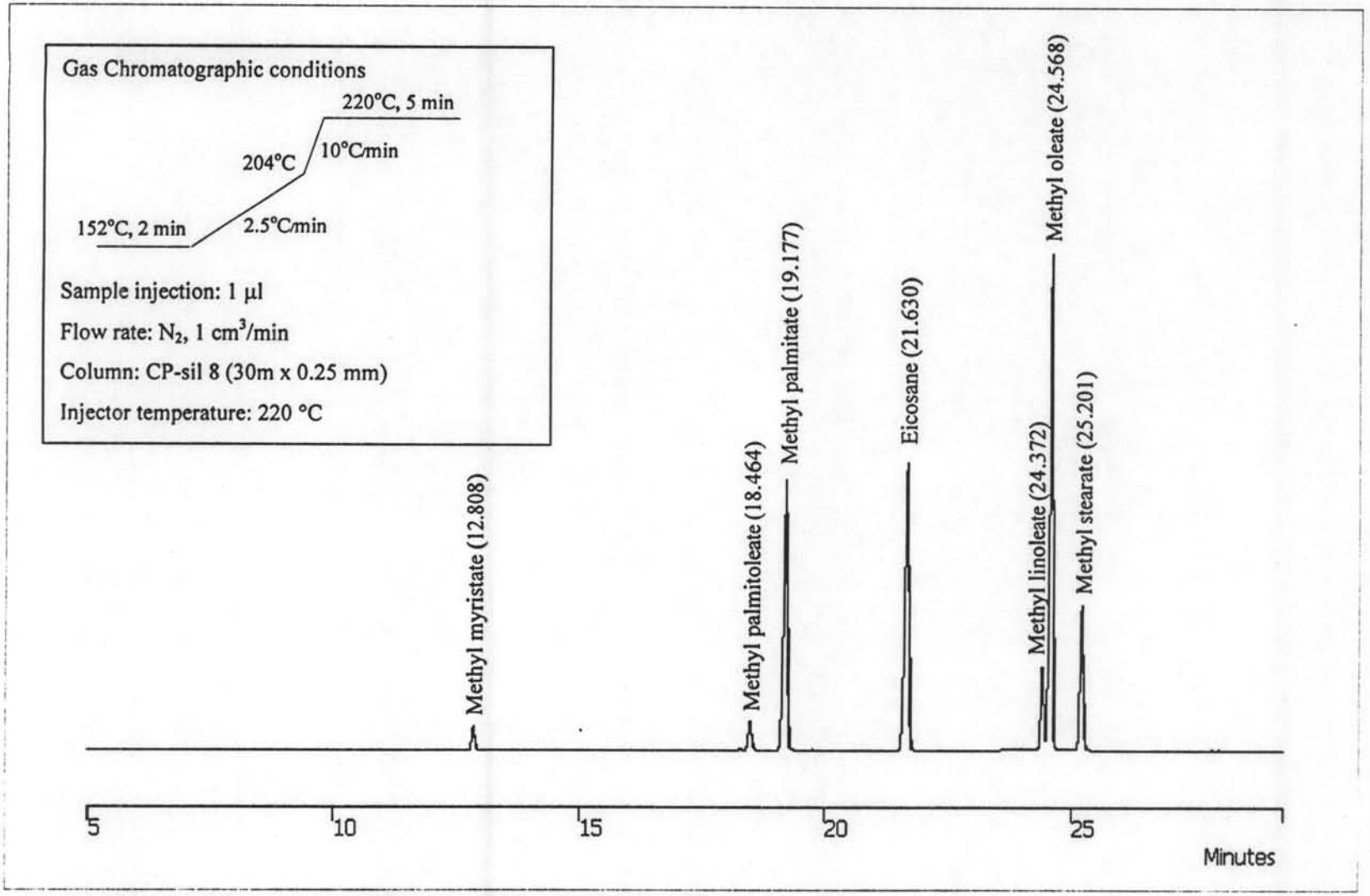

Figure A-2 GC chromatogram of standard methyl ester compounds.

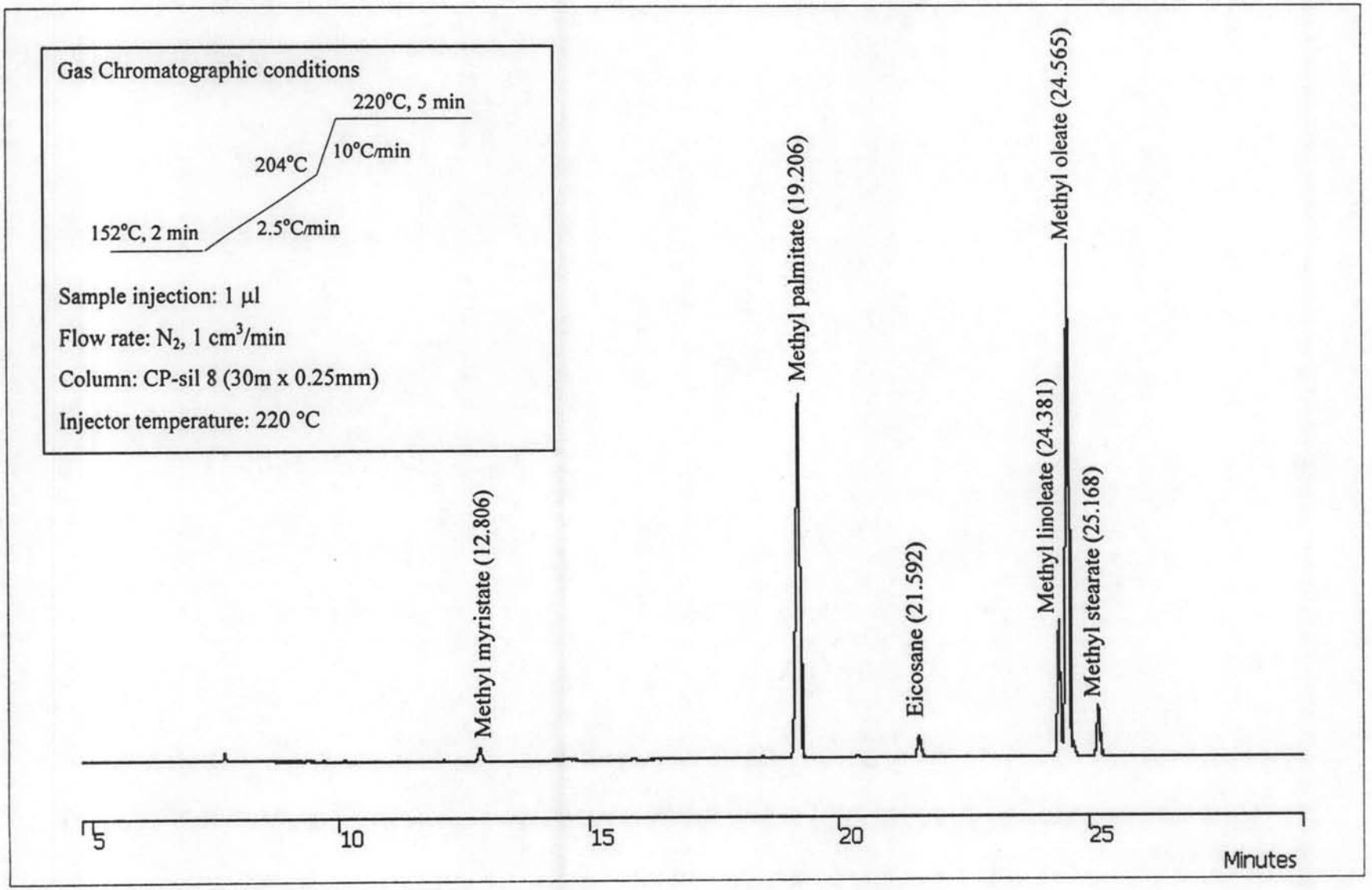

Figure A-3 GC chromatogram of methyl ester products from transesterification reaction.

Table A-1 EU Specification for automotive diesel [64]

Specification	Units	Year 2000 Limits	Possible Future Limits
Cetane number		51 (min)	55 (min)
Cetane index		No spec	52 (min)
Density@15°C	g/cm^3	0.845 (max)	0.84
Distillation			
90% boiling point	°F	No spec	608 (max)
95% boiling point	°F	680 (max)	644 (max)
Final boiling point	°F	No spec	662 (max)
90% boiling point	°C	No spec	320 (max)
95% boiling point	°C	360 (max)	340 (max)
Final boiling point	°C	No spec	350 (max)
Polyaromatic hydrocarbons (PAH)	wt%	11 (max)	2 (max)
Total aromatic	wt%	No spec	15 (max)
Sulfur	wppm	350 (max)*	10 (max)

* As discussed elsewhere, diesel sulfur will be limited to 50 wppm in 2005

Table A-2 Properties of biodiesel from different oils [58]

Vegetable oil methyl esters (biodiesel)	Cetane No.	Kinematic Viscosity at 38°C (mm^2/s)	Lower heating value (MJ/kg)	Clound point (°C)	Pour point (°C)	Flash point (°C)	Density (kg/l)
Peanut	4.9	54	33.6	5	-	176	0.883
Soya bean	4.5	45	33.5	1	-7	178	0.885
Babassu	3.6	63	31.8	4	-	127	0.875
Palm	5.7	62	33.5	13	-	164	0.880
Sunflower	4.6	49	33.5	1	-	183	0.860
Tallow	-	-	-	12	9	96	-
Diesel	3.06	50	43.8	-	-19	76	0.855
20% biodiesel blend	3.2	51	43.2	-	-16	128	0.859

VITAE

Miss Satima Saranark was born on July 20, 1982 in Bangkok, Thailand. She graduated with Bachelor's Degree in Chemistry from Faculty of Science, Mahidol University in 2004. She continued her study in Petrochemistry and Polymer Science Program, Faculty of Science, Chulalongkorn University in 2004. During her graduate study, she also received a research assistantship from Rachadapisek Sompoch Endowment Chulalongkorn University, a research grant from the Graduate School, Chulalongkorn University and Energy Policy and Planning Office, Ministry of Energy, Thailand with award number 021/2549. She has completed her study leading to a Master of Science Degree in Petrochemistry and Polymer Science Program in 2006.