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APPENDICES

APPENDIX A

SPECTRA OF SYNTHESIZED COMPOUNDS

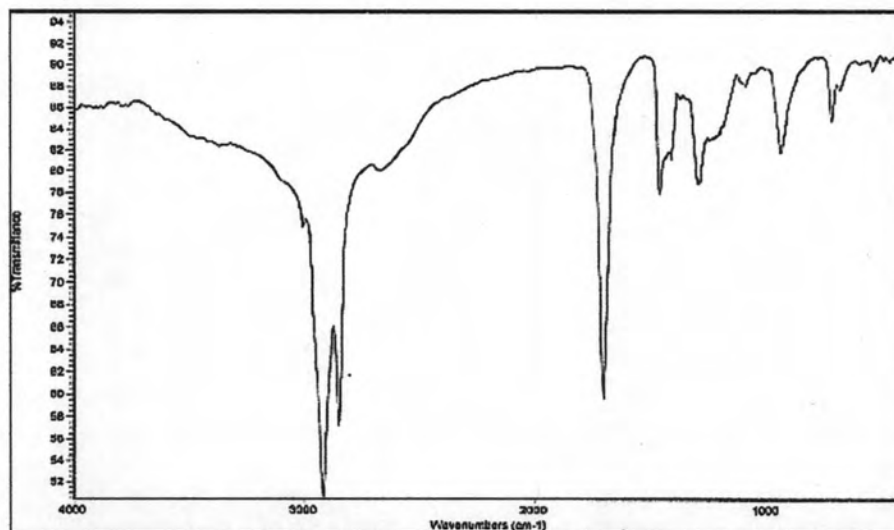


Figure A1 FTIR spectrum of palm oil soapstock (NaCl)

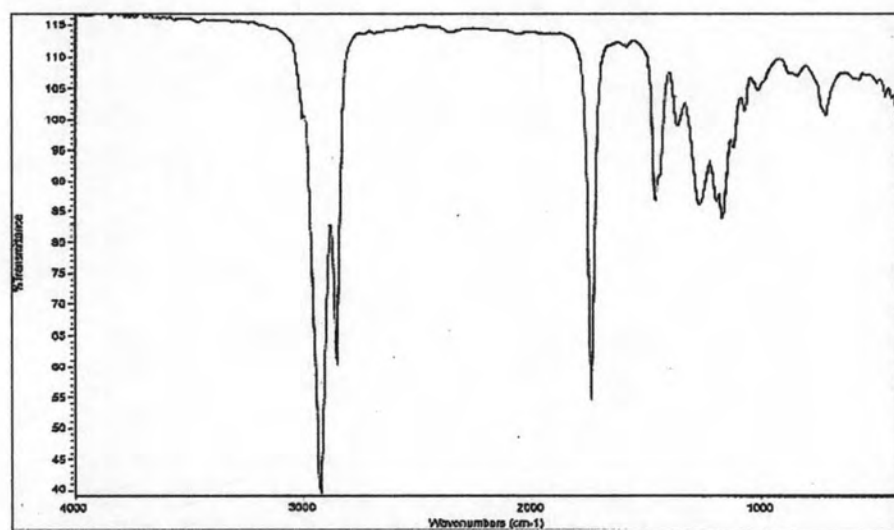


Figure A2 FTIR spectrum of palm oil methyl ester (NaCl)

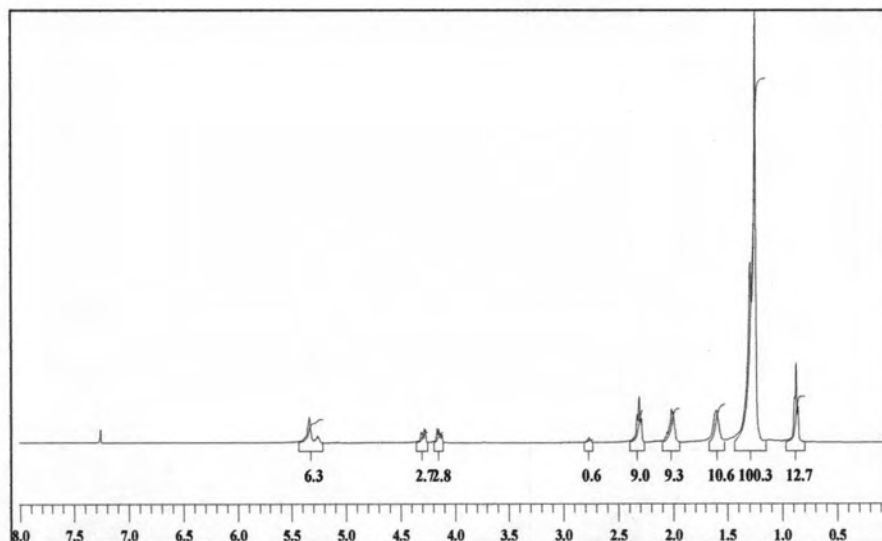


Figure A3 $^1\text{H-NMR}$ spectrum of palm oil soapstock (CDCl_3)

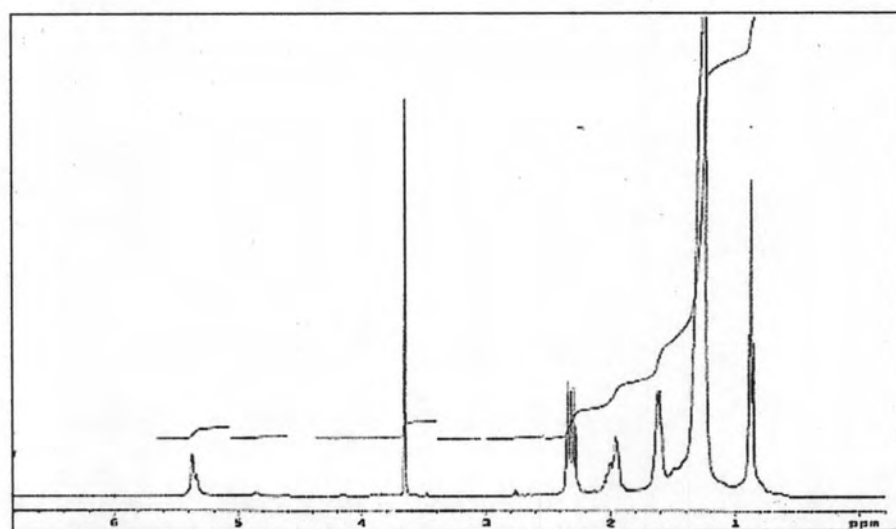


Figure A4 $^1\text{H-NMR}$ spectrum of palm oil methyl ester (CDCl_3)

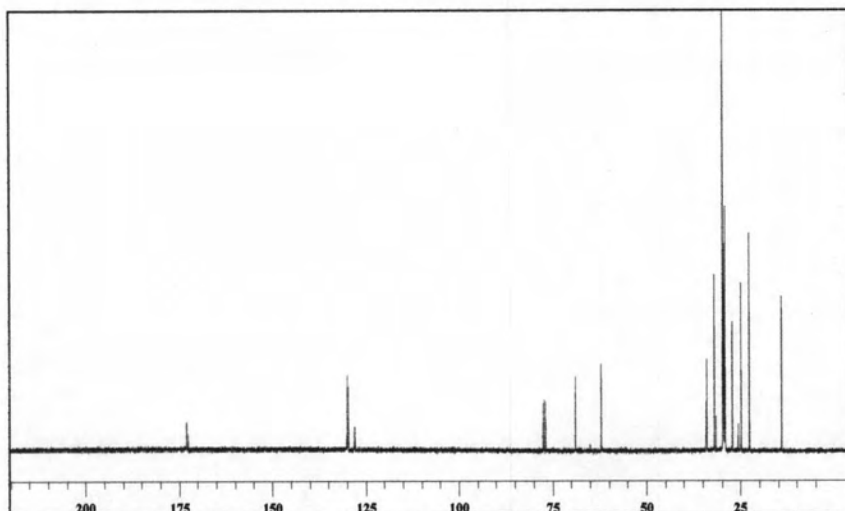


Figure A5 ^{13}C -NMR spectrum of palm oil soapstock (CDCl_3)

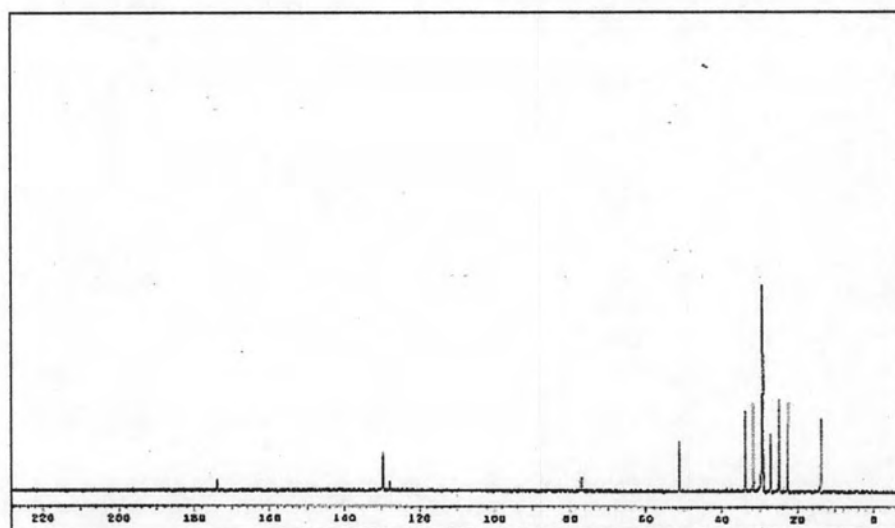


Figure A6 ^{13}C -NMR spectrum of palm oil methyl ester (CDCl_3)

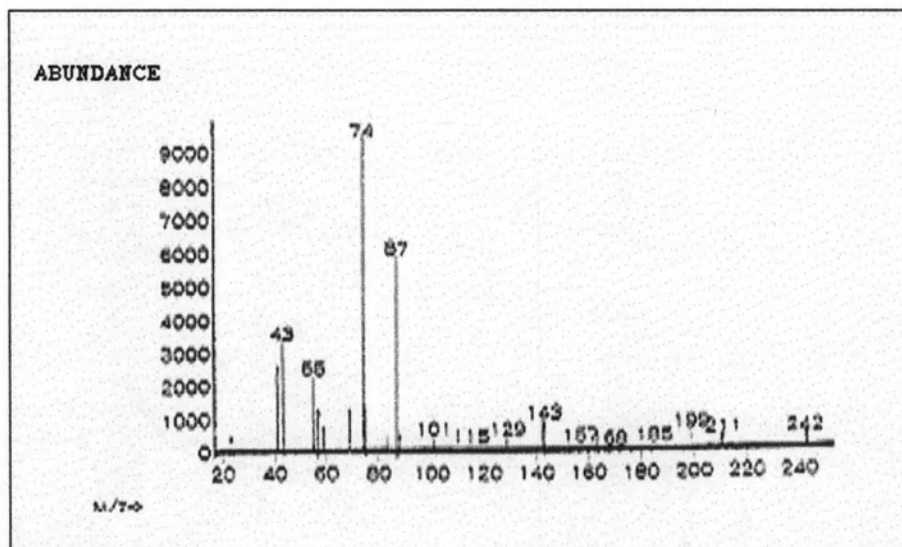


Figure A7 Mass spectrum of myristic acid methyl ester of palm oil at retention time of 10.29 min.

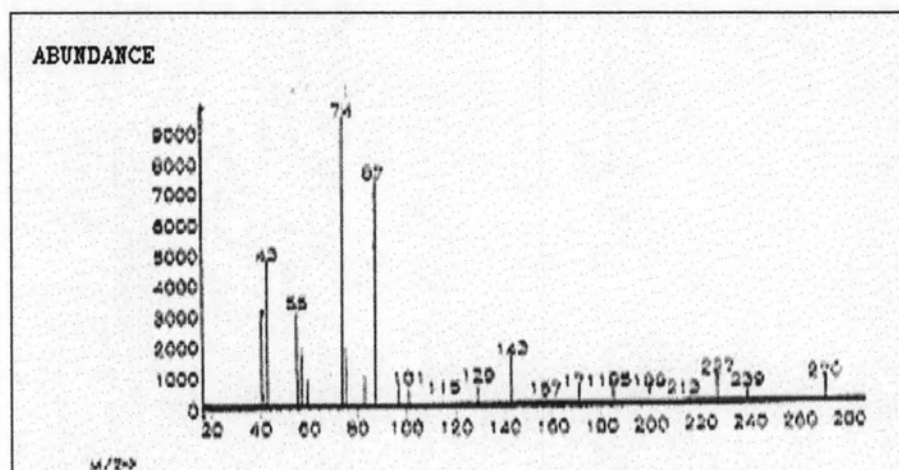


Figure A8 Mass spectrum of palmitic acid methyl ester of palm oil at retention time of 14.50 min.

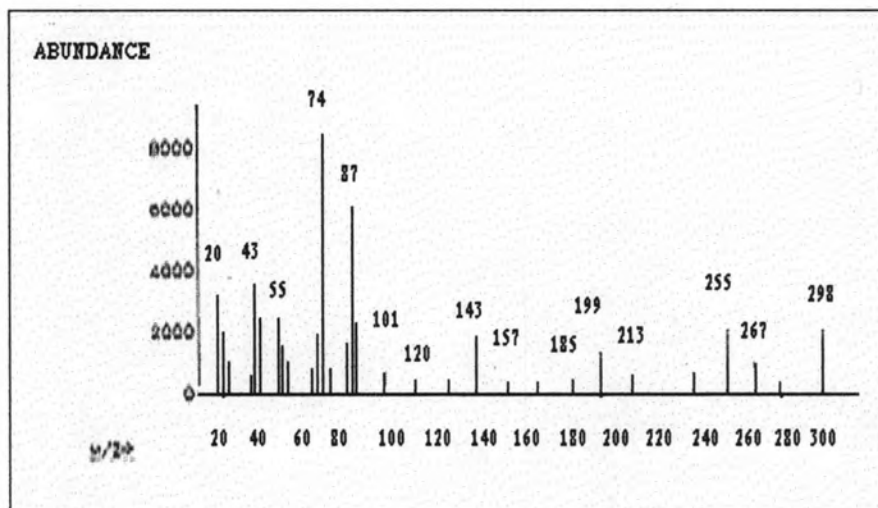


Figure A9 Mass spectrum of stearic acid methyl ester of palm oil at retention time of 10.29 min.

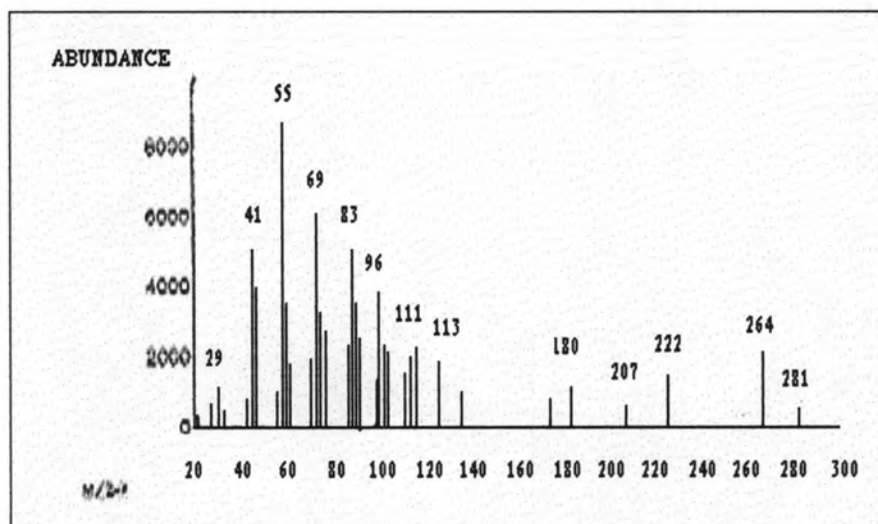


Figure A10 Mass spectrum of oleic acid methyl ester of palm oil at retention time of 10.29 min.

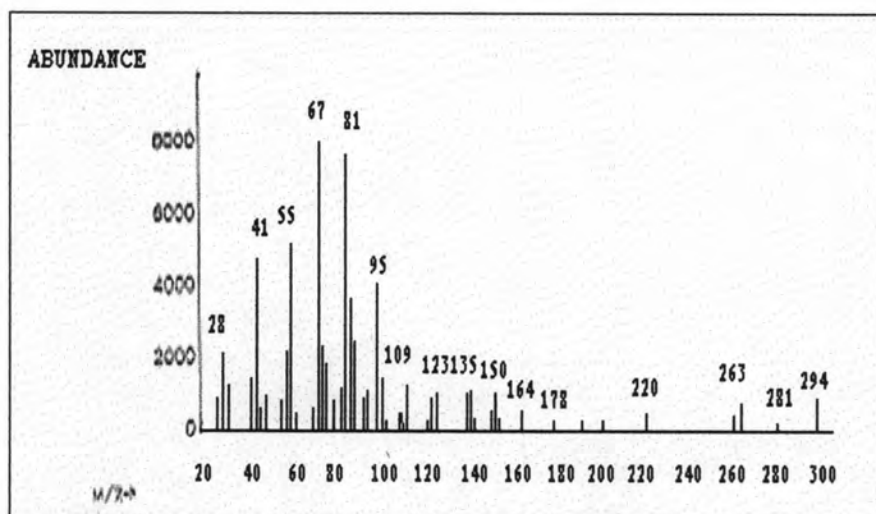


Figure A11 Mass spectrum of linoleic acid methyl ester of palm oil at retention time of 10.29 min.

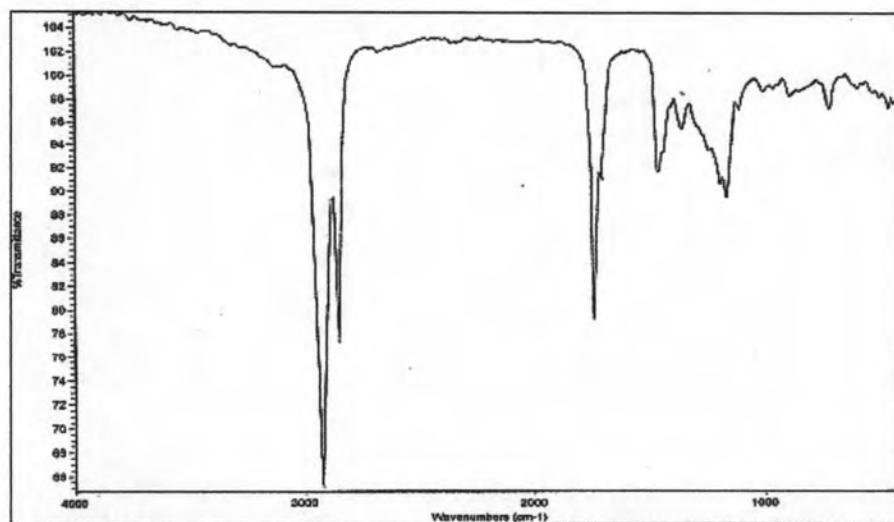


Figure A12 FTIR spectrum of palm oil sulfonated methyl ester (NaCl)



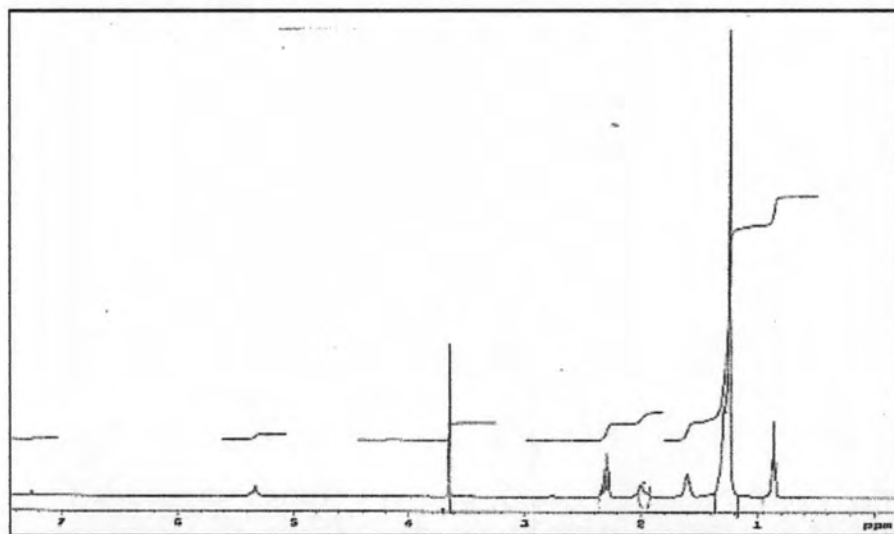


Figure A13 $^1\text{H-NMR}$ spectrum of palm oil sulfonated methyl ester (CDCl_3)

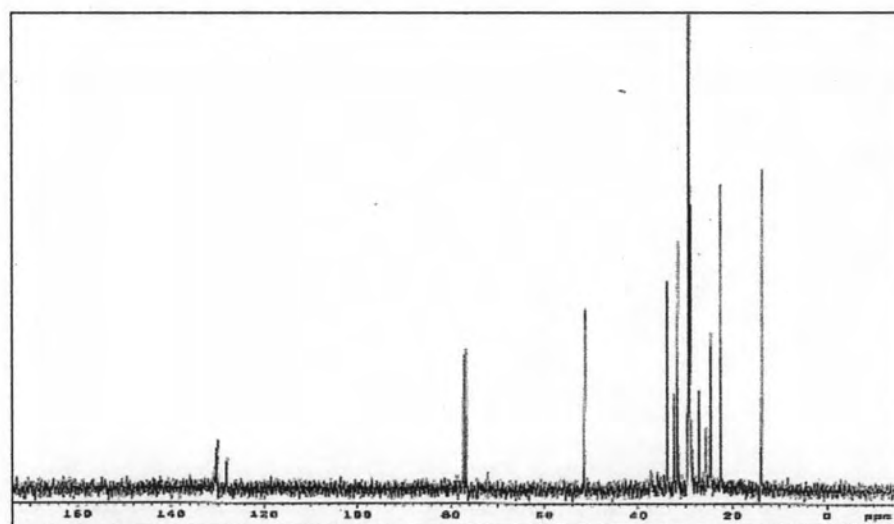


Figure A14 $^{13}\text{C-NMR}$ spectrum of palm oil sulfonated methyl ester (CDCl_3)

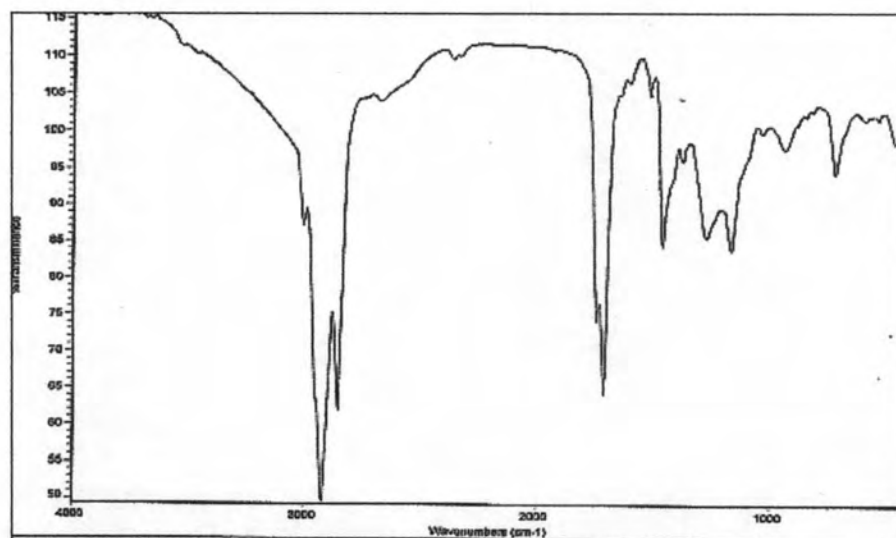


Figure A15 FTIR Spectrum of rice bran oil soapstock (NaCl)

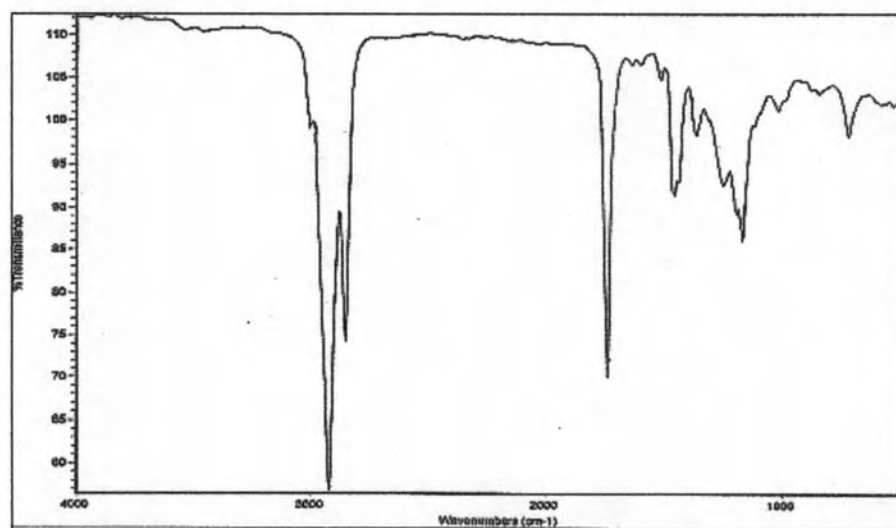


Figure A16 FTIR Spectrum of rice bran oil methyl ester (NaCl)

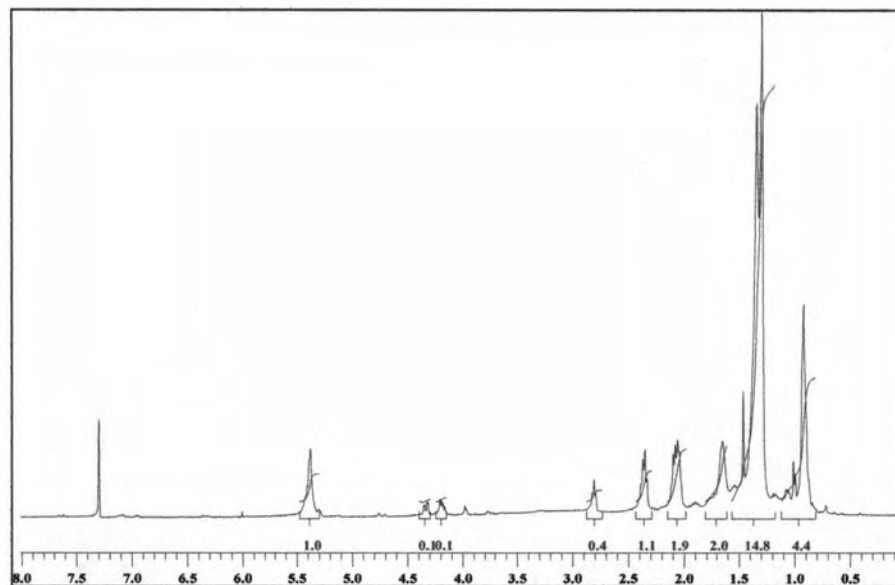


Figure A17 ¹H-NMR spectrum of rice bran oil soapstock (CDCl₃)

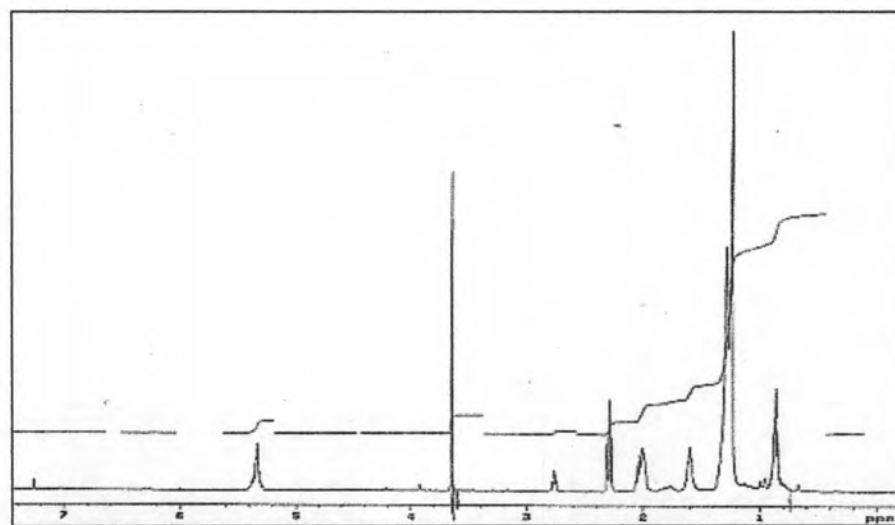


Figure A18 ¹H-NMR spectrum of rice bran oil methyl ester (CDCl₃)

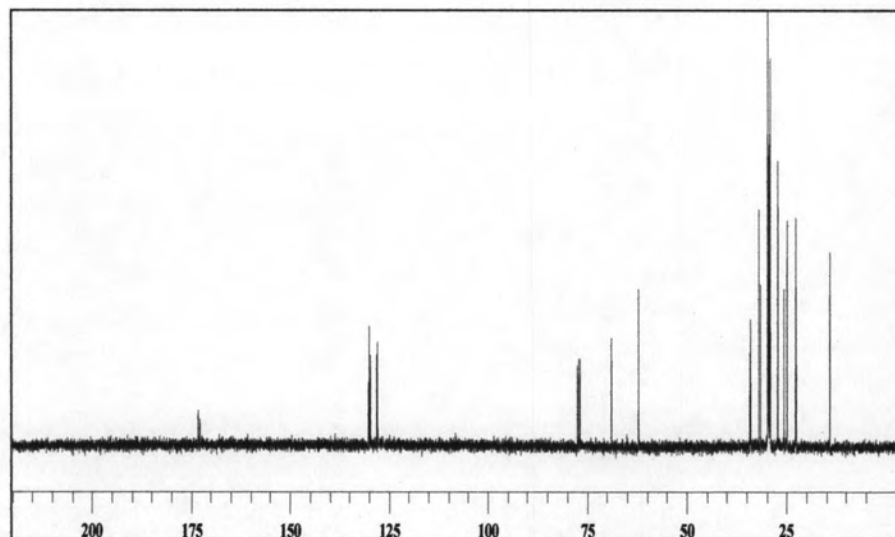


Figure A19 ^{13}C -NMR spectrum of rice bran oil soapstock (CDCl_3)

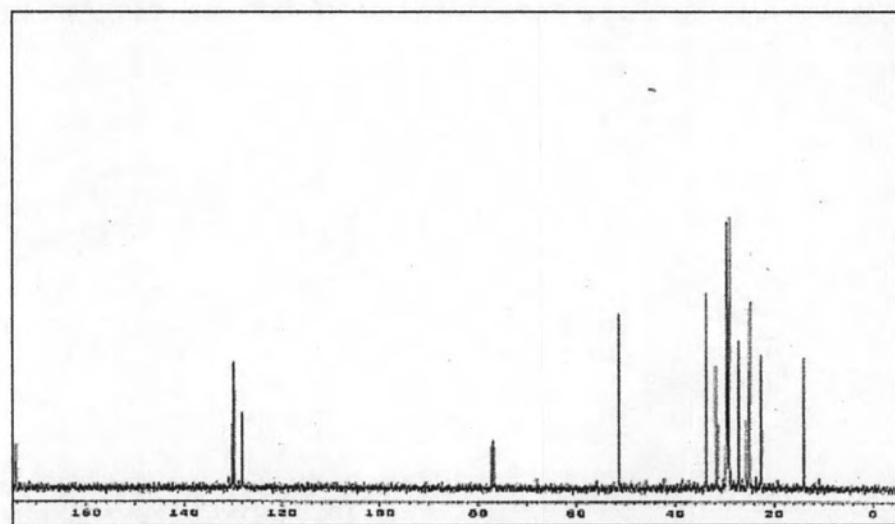


Figure A20 ^{13}C -NMR spectrum of rice bran oil methyl ester (CDCl_3)

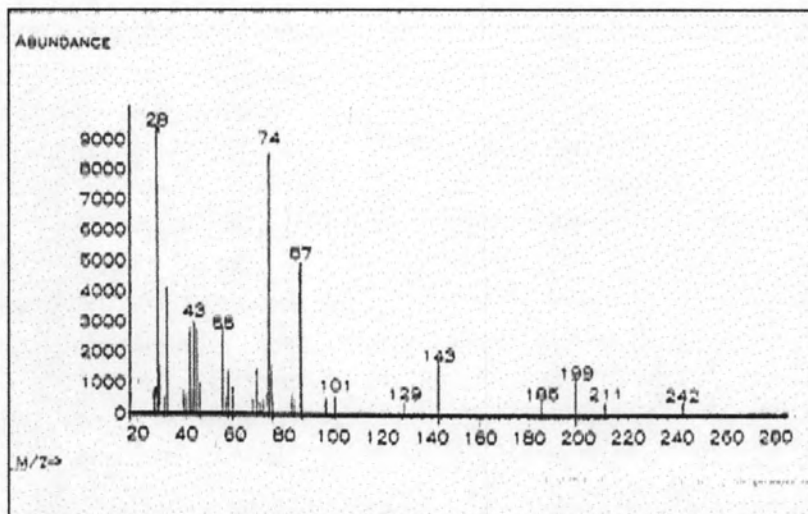


Figure A21 Mass spectrum of myristic acid methyl ester of rice bran oil at retention time of 10.29 min.

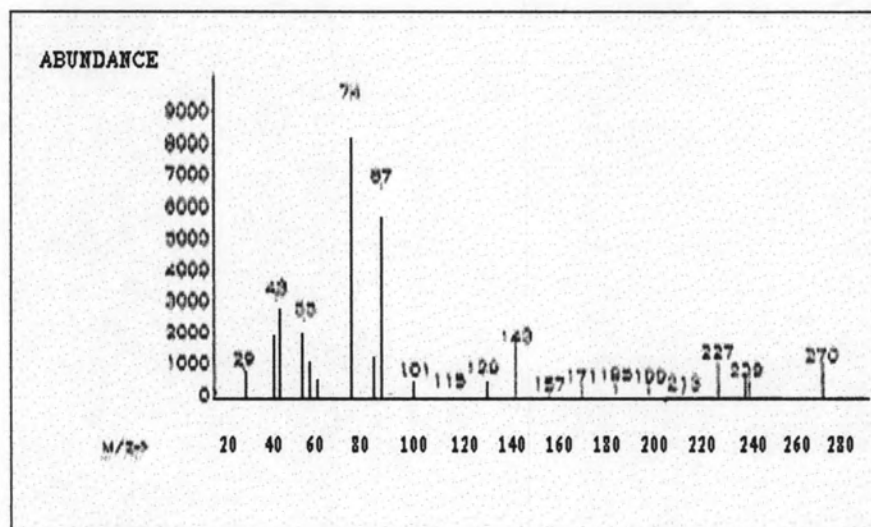


Figure A22 Mass spectrum of palmitic acid methyl ester of rice bran oil at retention time of 14.49 min.

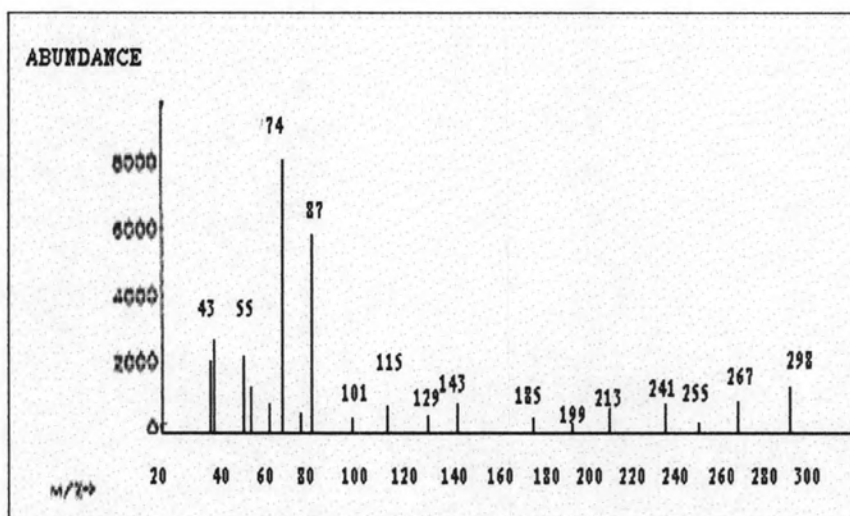


Figure A23 Mass spectrum of stearic acid methyl ester of rice bran oil at retention time of 18.71 min.

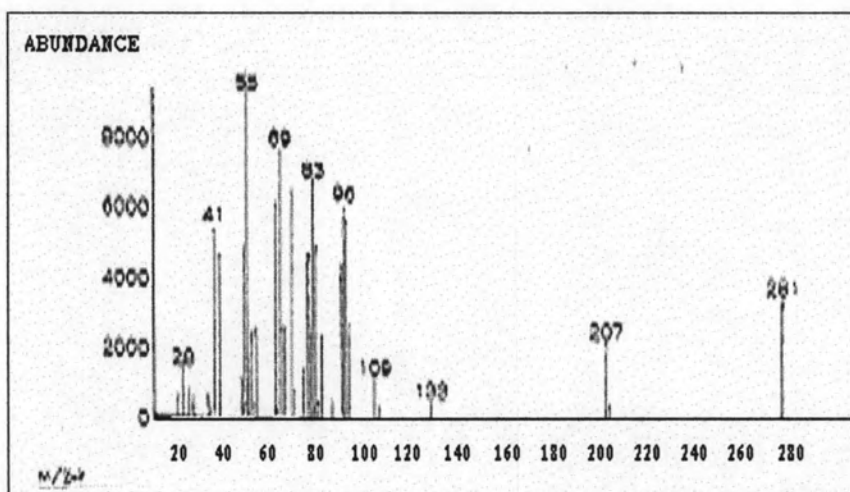


Figure A24 Mass spectrum of oleic acid methyl ester of rice bran oil at retention time of 19.10 min.

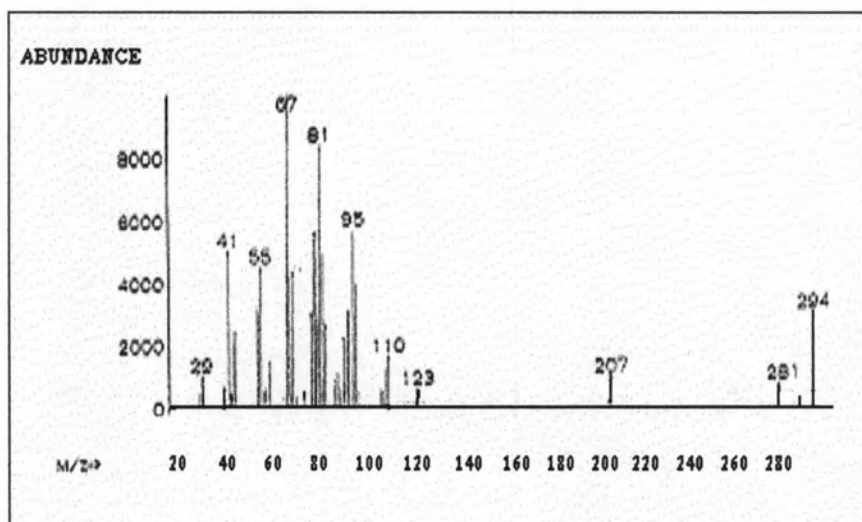


Figure A25 Mass spectrum of linoleic acid methyl ester of rice bran oil at retention time of 20.05 min.

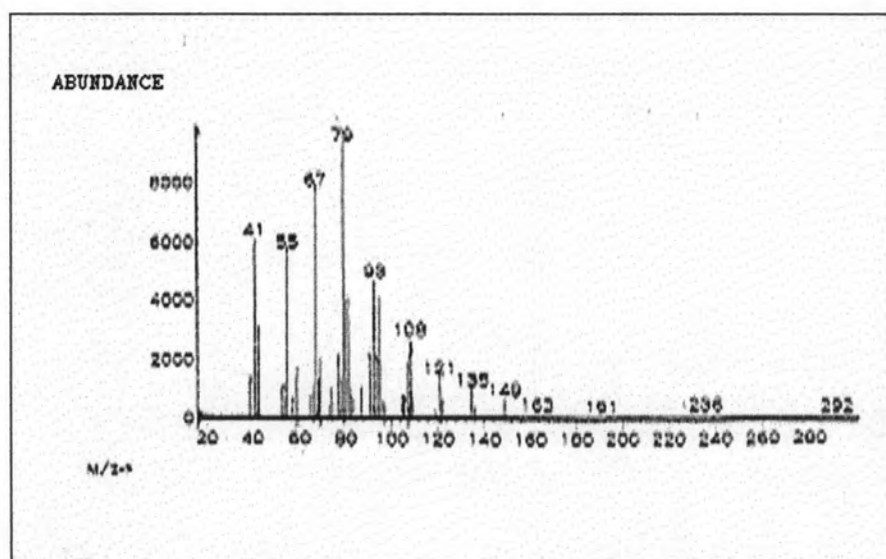


Figure A26 Mass spectrum of linolenic acid methyl ester of rice bran oil at retention time of 21.37 min.

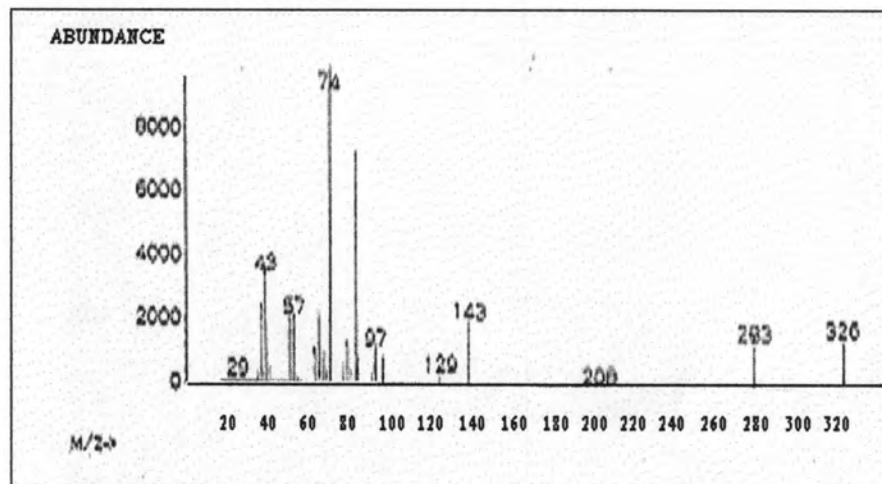


Figure A27 Mass spectrum of arachidic acid methyl ester of rice bran oil at retention time of 22.76 min.

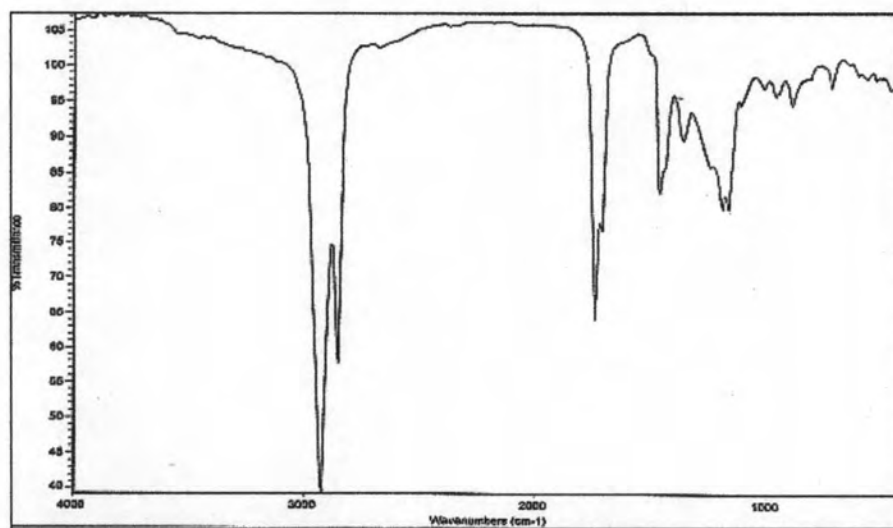


Figure A28 FT-IR spectrum of rice bran oil sulfonated methyl ester (NaCl)

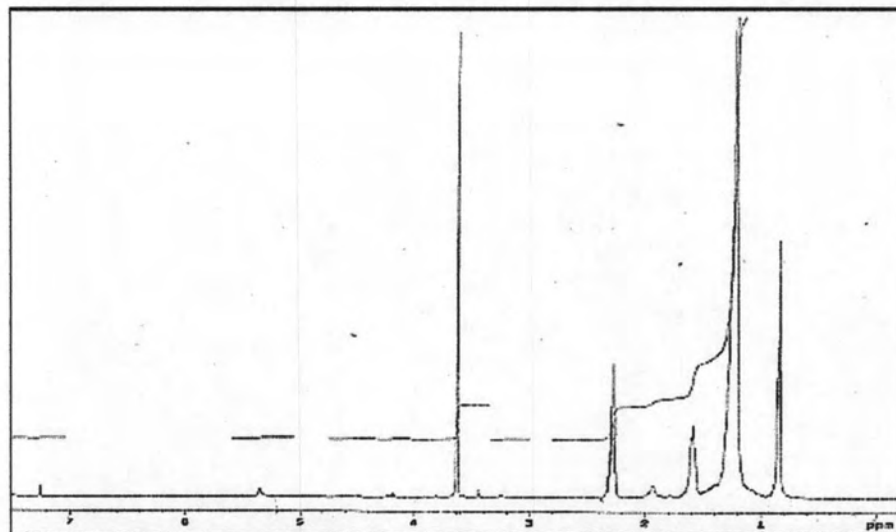


Figure A29 $^1\text{H-NMR}$ spectrum of rice bran oil sulfonated methyl ester (CDCl_3)

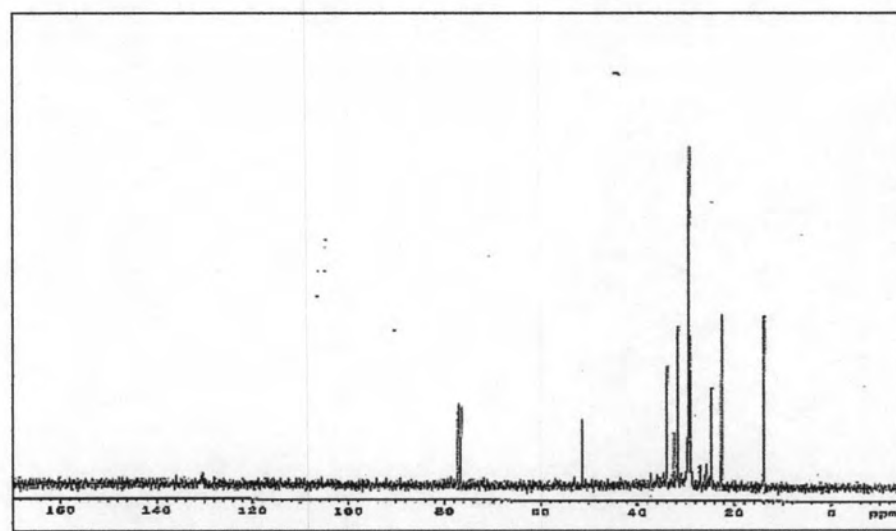


Figure A30 $^{13}\text{C-NMR}$ spectrum of rice bran oil sulfonated methyl ester (CDCl_3)

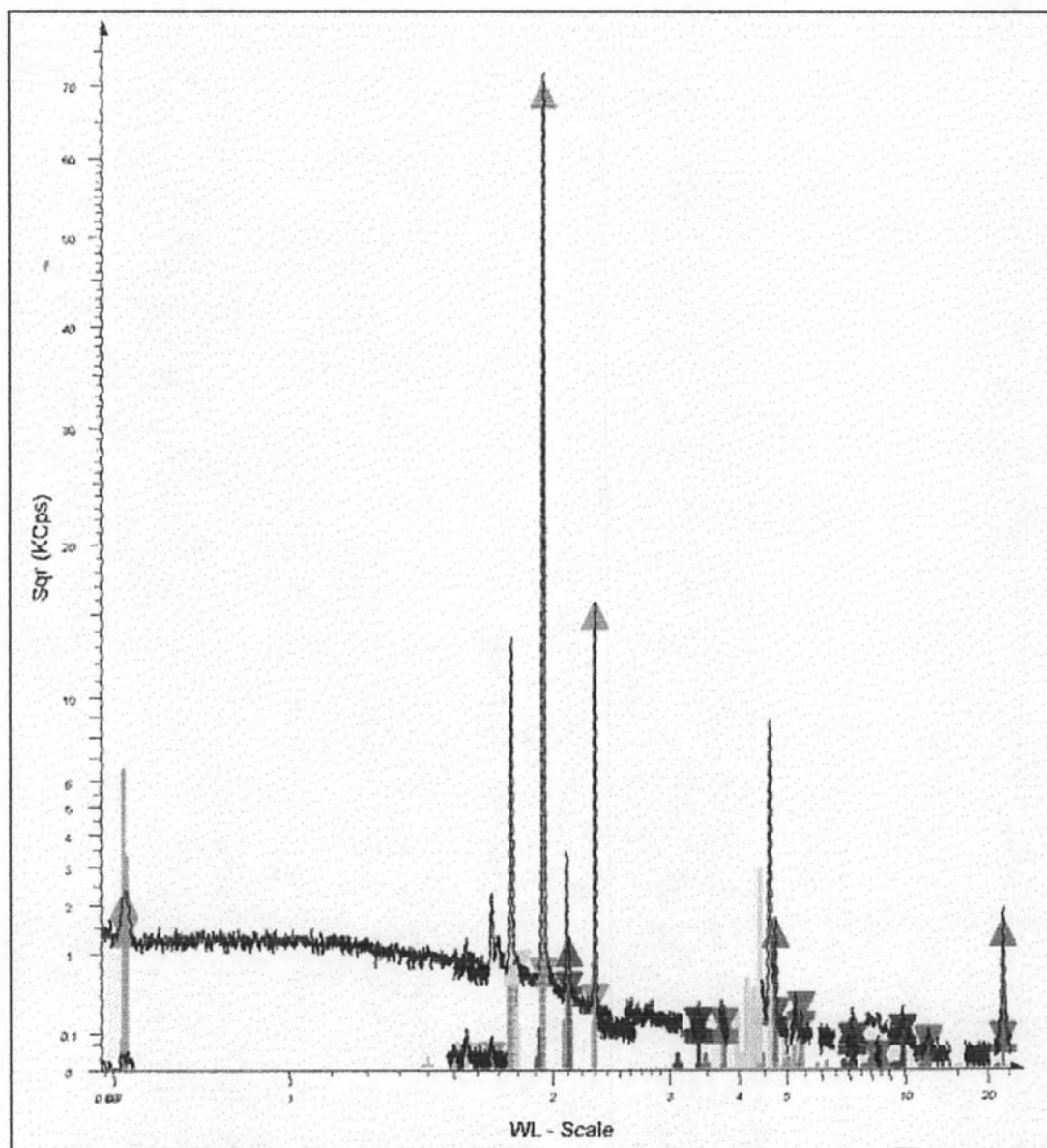


Figure A31 XRF spectrum of methyl ester product (Mylar).

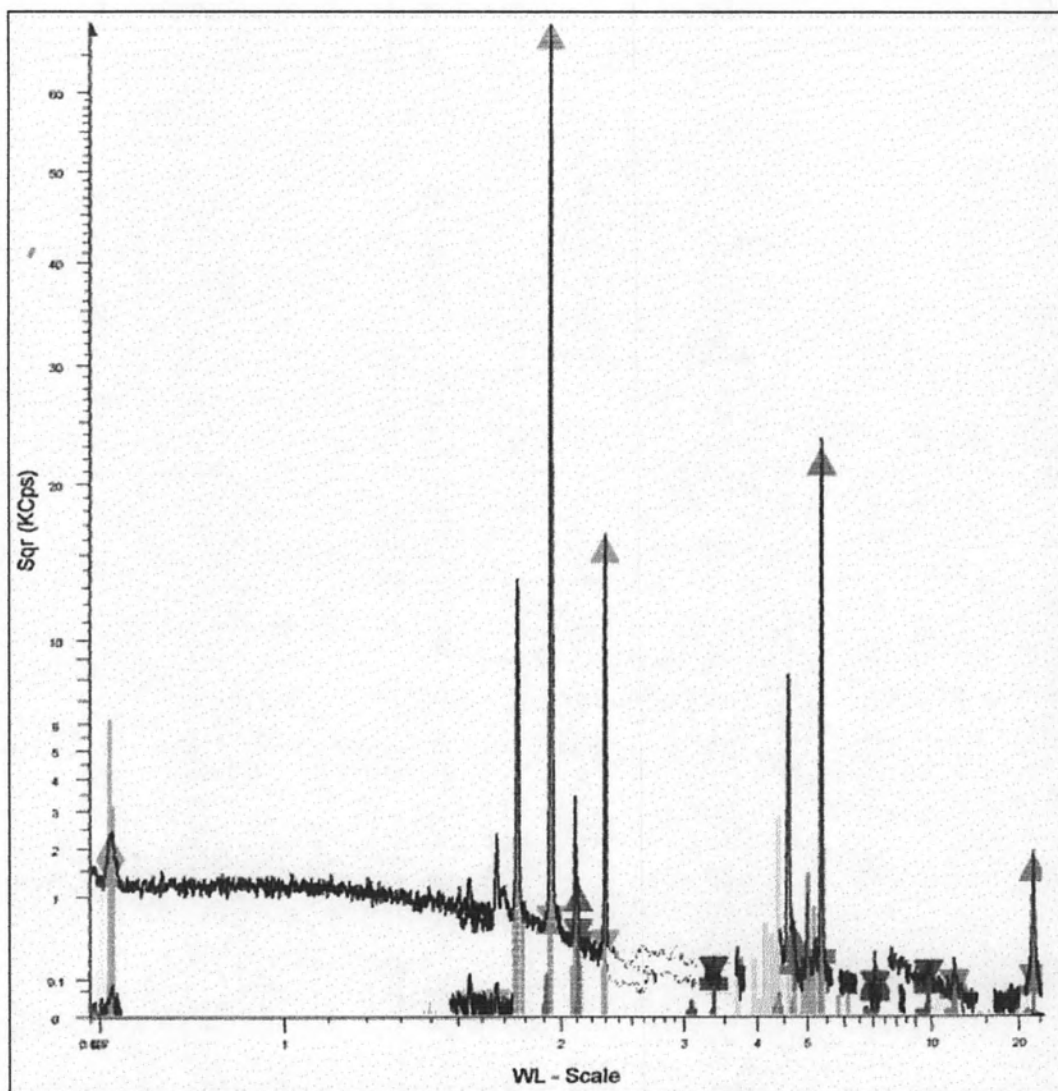


Figure A32 XRF spectrum of sulfonated methyl ester product (Mylar).

APPENDIX B

DETERMINATION OF TOTAL ACID NUMBER BY USING TITRATION TECHNIQUES

Sample	Weight of sample (g)	Volume of titrant (ml)	Volume of blank (ml)	Concentration of alcoholic NaOH (M.)	Total acid number (mgKOH/g)
Base diesel	20.04	0.16	0.02	0.1016	0.0324
	20.03	0.16	0.02		0.0325
	20.03	0.16	0.02		0.0325
5 % SMP	19.92	0.17	0.02	0.1016	0.0347
	20.05	0.17	0.02		0.0345
	20.01	0.17	0.02		0.0345
5 % SMR	20.69	0.18	0.02	0.1016	0.0354
	20.65	0.18	0.02		0.0354
	20.71	0.18	0.02		0.0353
10% SMP	20.24	0.18	0.02	0.1016	0.0361
	20.19	0.18	0.02		0.0362
	20.2	0.18	0.02		0.0362
10% SMR	21.12	0.19	0.02	0.1016	0.0366
	21.01	0.19	0.02		0.0368
	21.05	0.19	0.02		0.0367

APPENDIX C

SPECIFICATION AND TEST METHOD FOR

DIESEL FUEL IN THAILAND

Characteristic	Specification		
	High-Speed Engine	Low-Speed Engine	Methods
Density at 15.6 °C	0.81-0.87	0.92	ASTM D1286
Cetane Number or Calculated Cetane Index	min 47 min 47	min 45 min 45	ASTM D613 ASTM D976
Viscosity at 40 °C, cSt or at 50 °C, cSt	1.8-4.1	max 8.0 max 6.0	ASTM D445
Pour Point, °C	max 10	max 16	ASTM D97
Sulfur Content, %wt.	max 0.25	max 1.5	ASTM D129
Copper Strip Corrosion, number	max 1	-	ASTM D130
Carbon Residue, %wt.	max 0.05	-	ASTM D189
Water and Sediment, %vol.	max 0.05	max 0.3	ASTM D2709
Ash Content, %wt.	max 0.01	max 0.02	ASTM D482
Flash Point, °C	min 52	min 52	ASTM D93
Distillation (temperature of 90% distillation)	max 357	-	ASTM D86
Color	max 4.0	-	ASTM D1500
Detergent Additive	Test by the Standard Cummins Tandem L-10	-	CEC F-23-01



VITA

Harinate Mungpayaban was born on December 31, 1975, in Bangkok, Thailand. She received her Bachelor's Degree of Science in Chemistry, Srinakarinwirot University in 1998. She has been working at Rare Earth Research and Development Center (Office of Atom for Peace). She continued her Master Program of Multidisciplinary of Petrochemistry and Polymer Science, Faculty of Science, Chulalongkorn University and completed the program in 2006.