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SUPPLEMENTARY INFORMATION

Fabrication of nutrient delivery system of docosahexaenoic acid nanoemulsions by high energy techniques

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Appendix A. Supplementary data

The following are the supplementary data related to this article:

Table 1. Main bands of the FTIR spectra of DHA algae oil.

Wavenumber(cm^{-1})	Functional group	Mode of vibration
3014.3	=C-H (*cis*)	Stretching
2926.8	-C-H (CH_2)	Asym-stretching
2854.8	-C-H (CH_2)	Sym-stretching
1751.3	-C=O (ester)	Stretching
1651.9	-C=C- (*cis*)	Stretching
1463.7	-C-H (CH2, CH3)	Bending (scissoring)
1371.3	-C-H (CH3)	Bending (sym)
1149.3	-C-O and -CH_2	Stretching and bending
719	-$(CH2)_n$-and –HC=CH- (*cis*)	Rocking, bending out

Table 2. Total fatty acid (g/100 g of fatty acid) compositions.

Fatty acid composition	Control-DHA algae oil (%)	HSH-DHA-NE (%)	HPH-DHA-NE (%)	HSH+HPH-DHA-NE (%)
Myristic acid	5.660±1.34	5.014±0.49	5.210±0.60	4.446±0.03
Palmitic acid	15.038±1.29	16.765±0.45	19.532±0.48[a]	17.470±1.60
Stearic acid	1.051±0.07	1.224±0.02	1.689±0.30	1.651±0.50
Oleic acid	19.320±1.66	17.954±2.33	16.607±0.52	17.586±2.30
Linoleic acid	1.553±0.01	1.300±0.10 [a]	1.292±0.12 [b]	1.358±0.05
Arachidonic acid	0.328±0.06	0.309±0.03	0.352±0.08	0.271±0.02
Eicosapentaenoic acid	0.613±0.18	0.582±0.23	0.498±0.03	0.568±0.18
Docosapentaenoic acid	16.581±0.39	16.357±0.68	12.39±2.34[a]	16.522±0.34
Docosahexaenoic acid	38.119± 0.07	38.177±0.25	36.787±1.20	37.502±2.19

All the fatty acid composition values are expressed as mean±SD of three measurements (*n*=3). Different letters are significantly different from control ($P<0.05$) according to the Turkey's test. The lowest value in the same line indicated with a and the highest value was indicated with b.

Table 3. ^{1}H NMR data of DHA algae oil, HSH, HPH and HSH+HPH-DHA nanoemulsion.

Chemical shift value (δ)	Multiplicity	Integration value	Position
5.32-5.45	Multiplet	12	Olefinic proton
2.82-2.89	Multiplet	10	five methylene
2.37-2.43	Multiplet	4	two methylene towards carboxylic end
2.09	Pentet	2	Methylene between 1and 3 position of C-atom
0.99	Triplet	3	Terminal methyl

Appendix B. Supplementary data

NMR Spectra of Tween-40 emulsifier

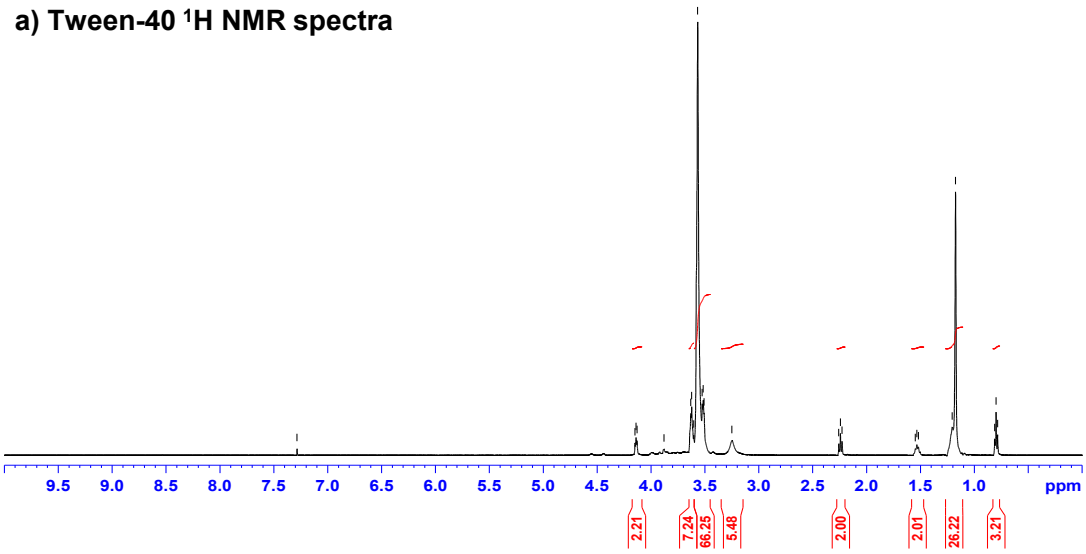


Fig. 1 Proton NMR spectra of Tween-40 emulsifier

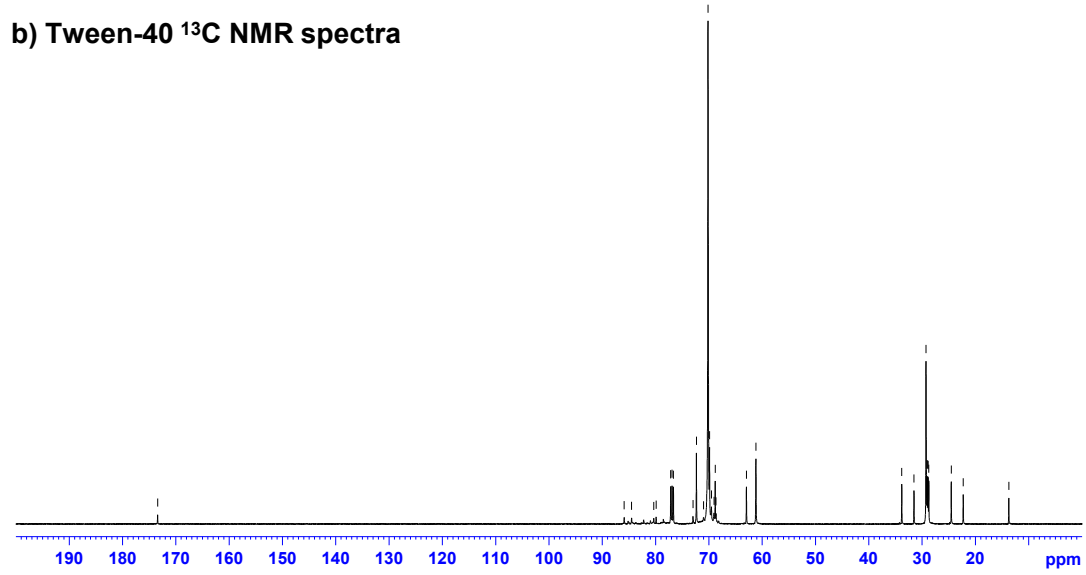
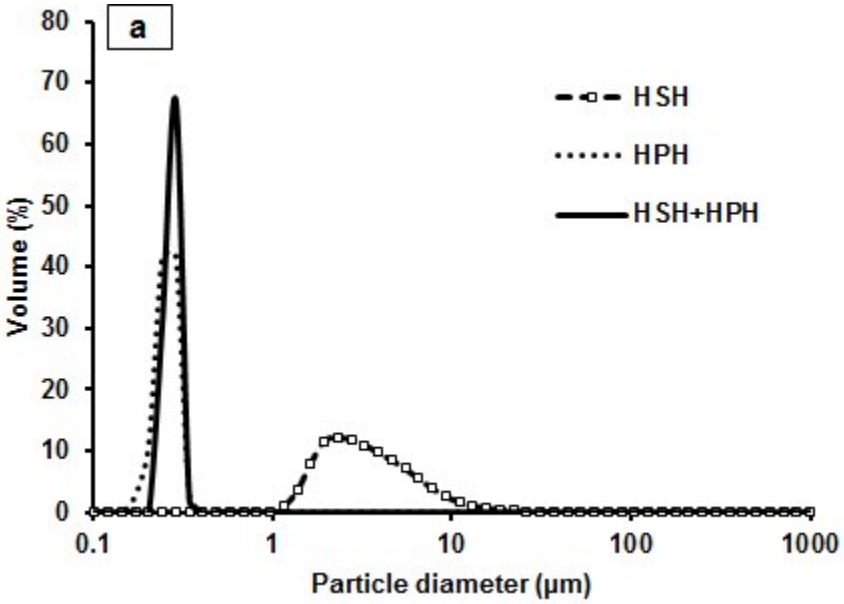
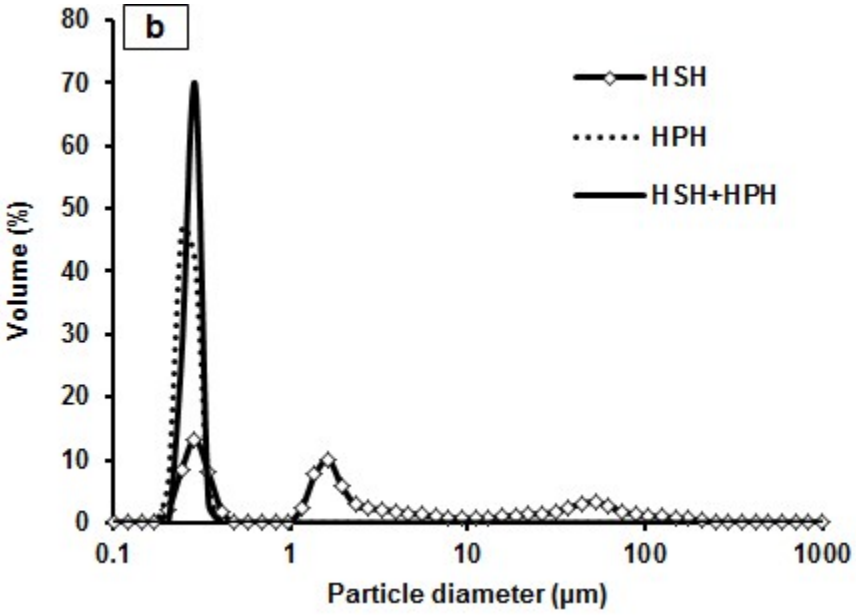


Fig. 2 Carbon NMR spectra of Tween-40 emulsifier

Appendix C. Supplementary data

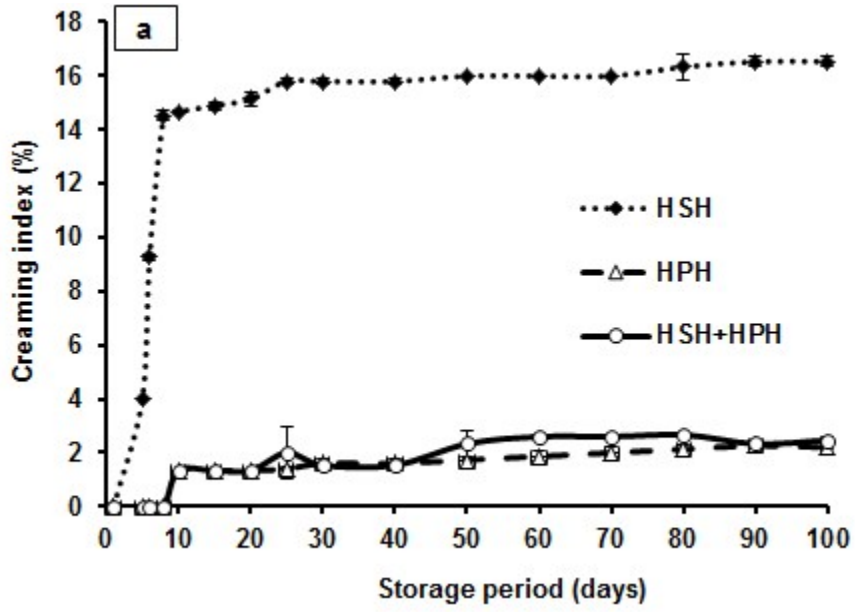
Particle size distribution of DHA nanoemulsions at 100th day: a) stored at refrigeration condition (4±1 ºC); b) stored at oven condition (40±0.2 ºC).

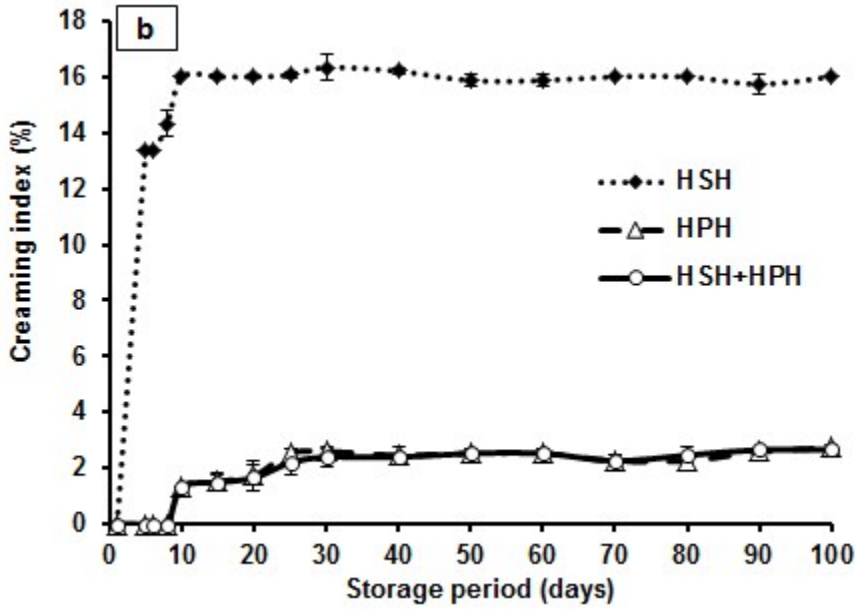




Appendix D. Supplementary data

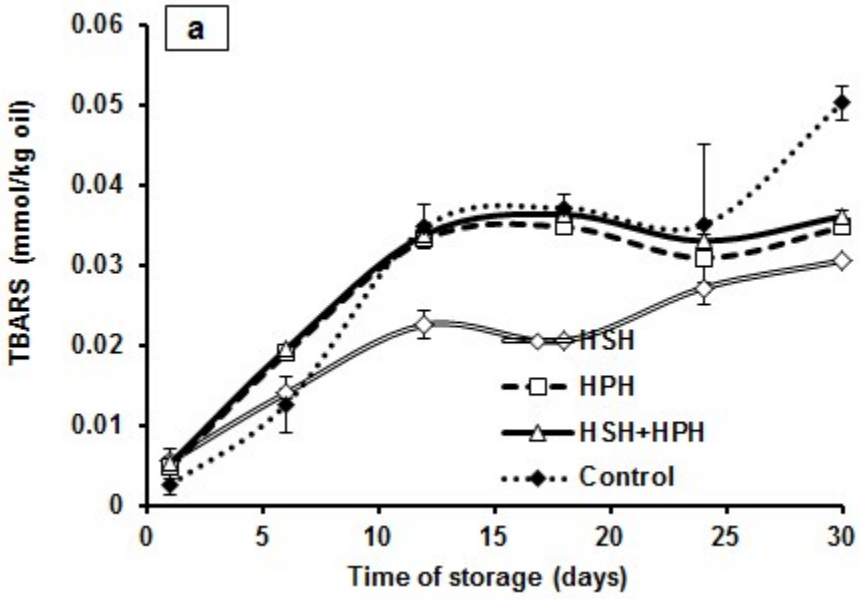
Creaming stability studies of DHA nanoemulsions: a) stored at refrigeration condition (4±1 ºC); b) stored at oven condition (40±0.2 ºC).

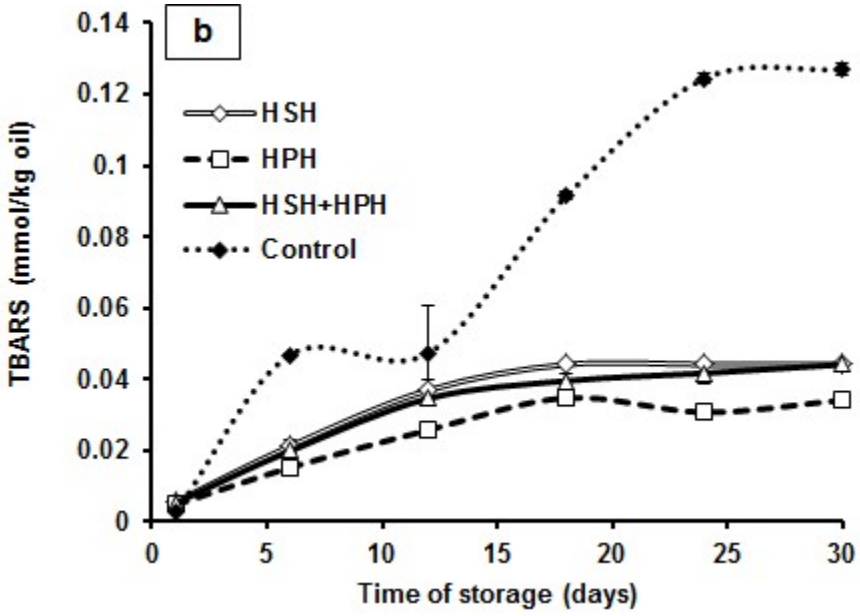




Appendix E. Supplementary data

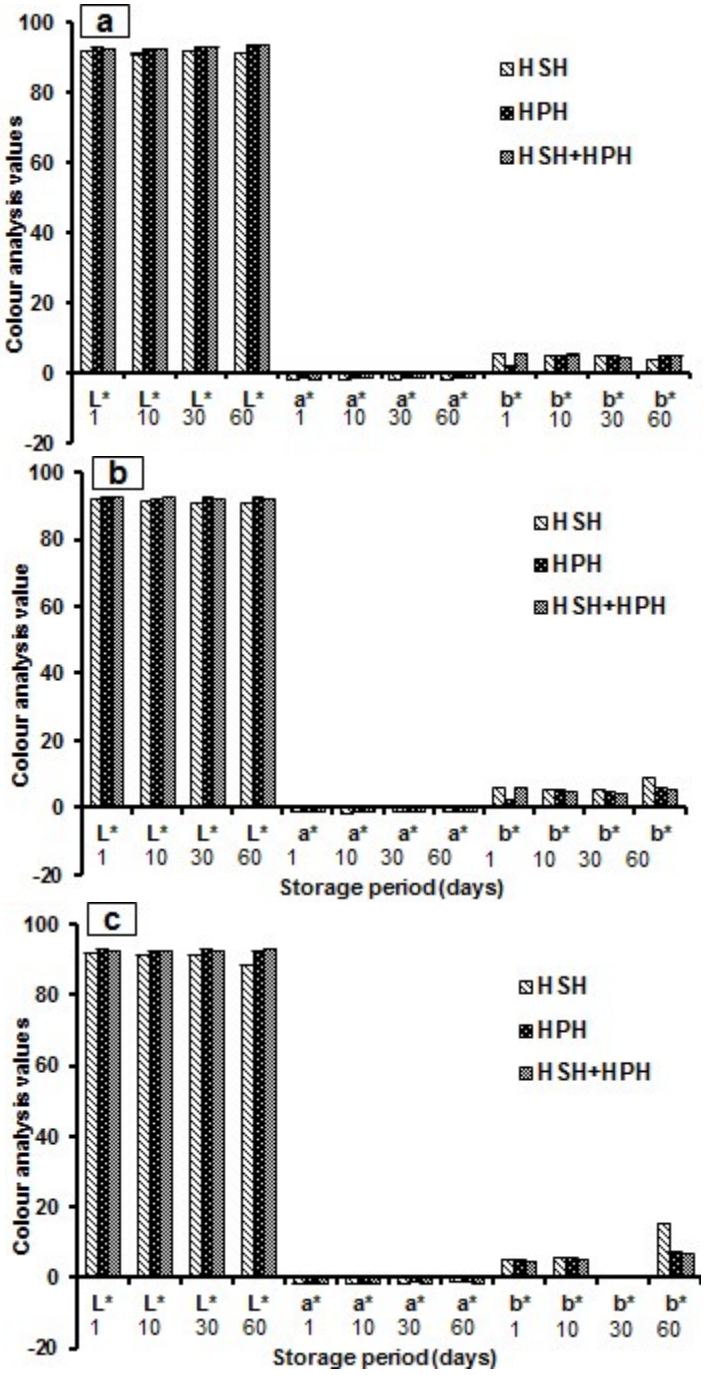
Oxidative stability studies of DHA nanoemulsions: a) stored at refrigeration condition (4±1 ºC); b) stored at oven condition (40±0.2 ºC).





Appendix F. Supplementary data

Color stability studies of DHA nanoemulsions: a) stored at refrigeration condition (4±1 ºC); b) stored at room condition (28±1 ºC); c) stored at oven condition (40±0.2 ºC).



Appendix G. Supplementary data

FTIR storage studies of DHA algae oil (control) and nanoemulsions during the storage of 30 days at different temperature (4±1ºC, 28±1ºC and 40±0.2ºC).

a) Stored at refrigeration temperature (4±1ºC) at 10th day

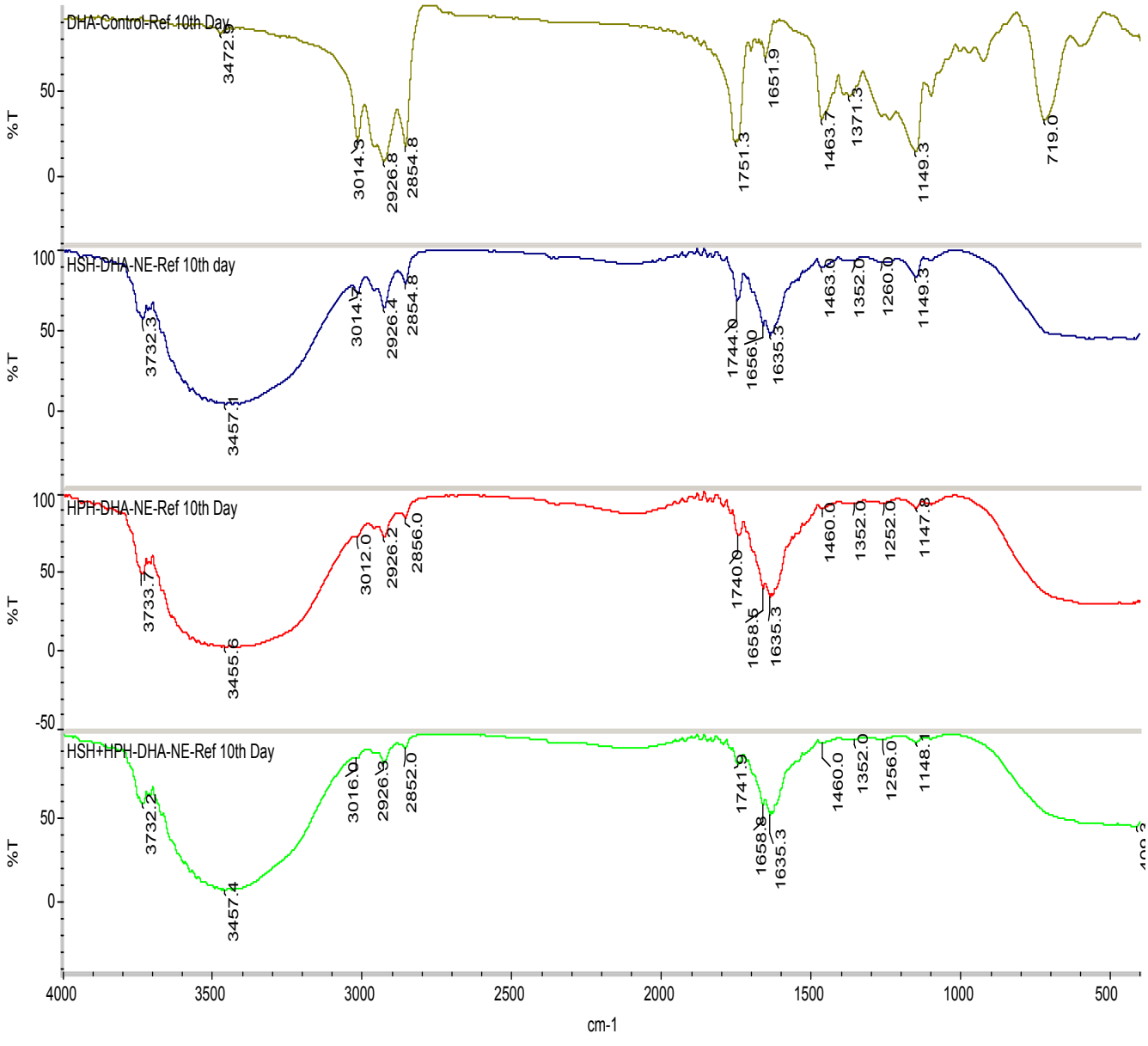


Fig. 1 FTIR spectra of DHA control, HSH-DHA-NE, HPH-DHA-NE, and HSH+HPH-NE.

b) Stored at refrigeration temperature (4±1°C) at 20th day

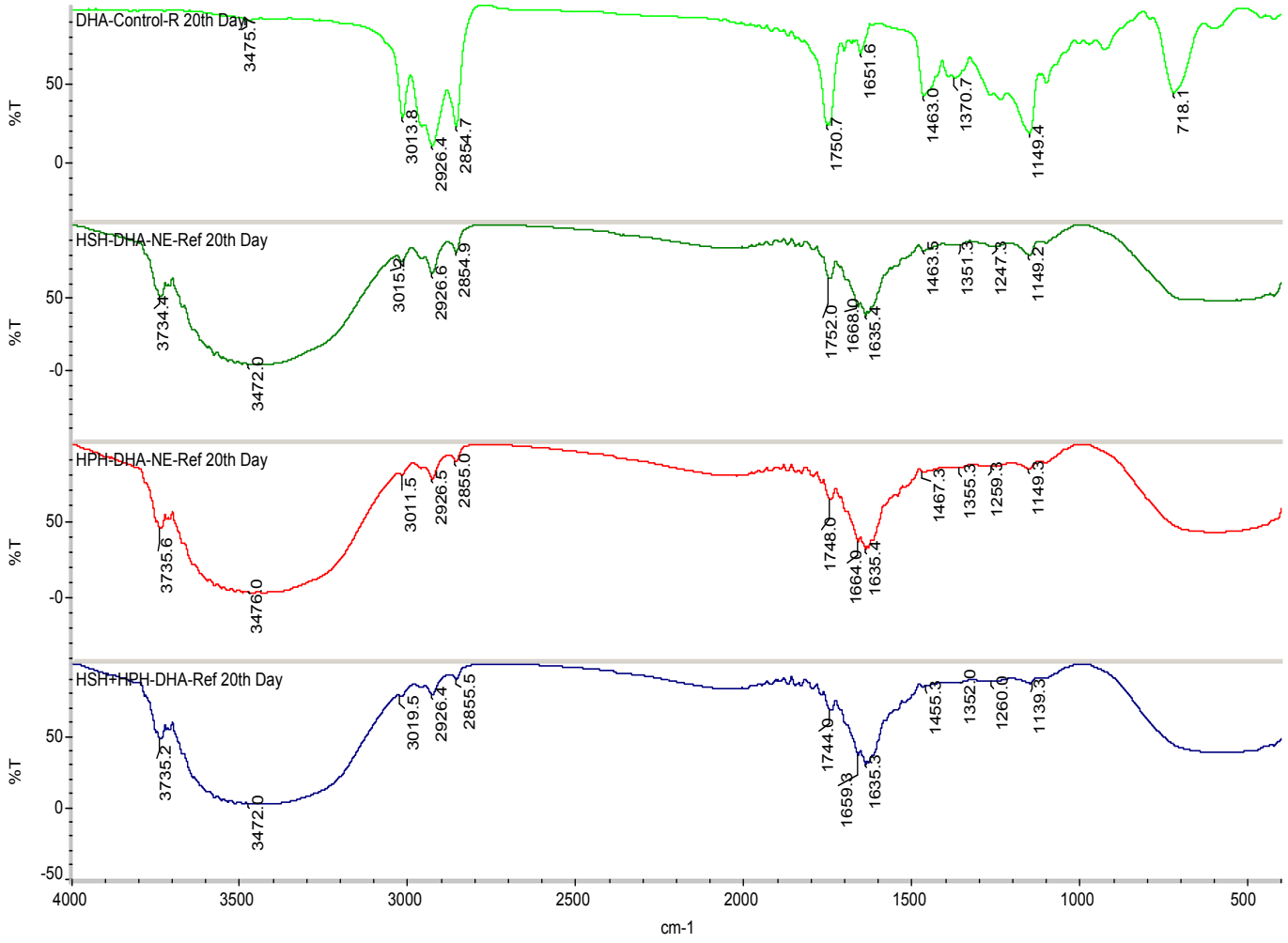


Fig. 2 FTIR spectra of DHA control, HSH-DHA-NE, HPH-DHA-NE, and HSH+HPH-NE.

c) Stored at refrigeration temperature (4±1°C) at 30th day

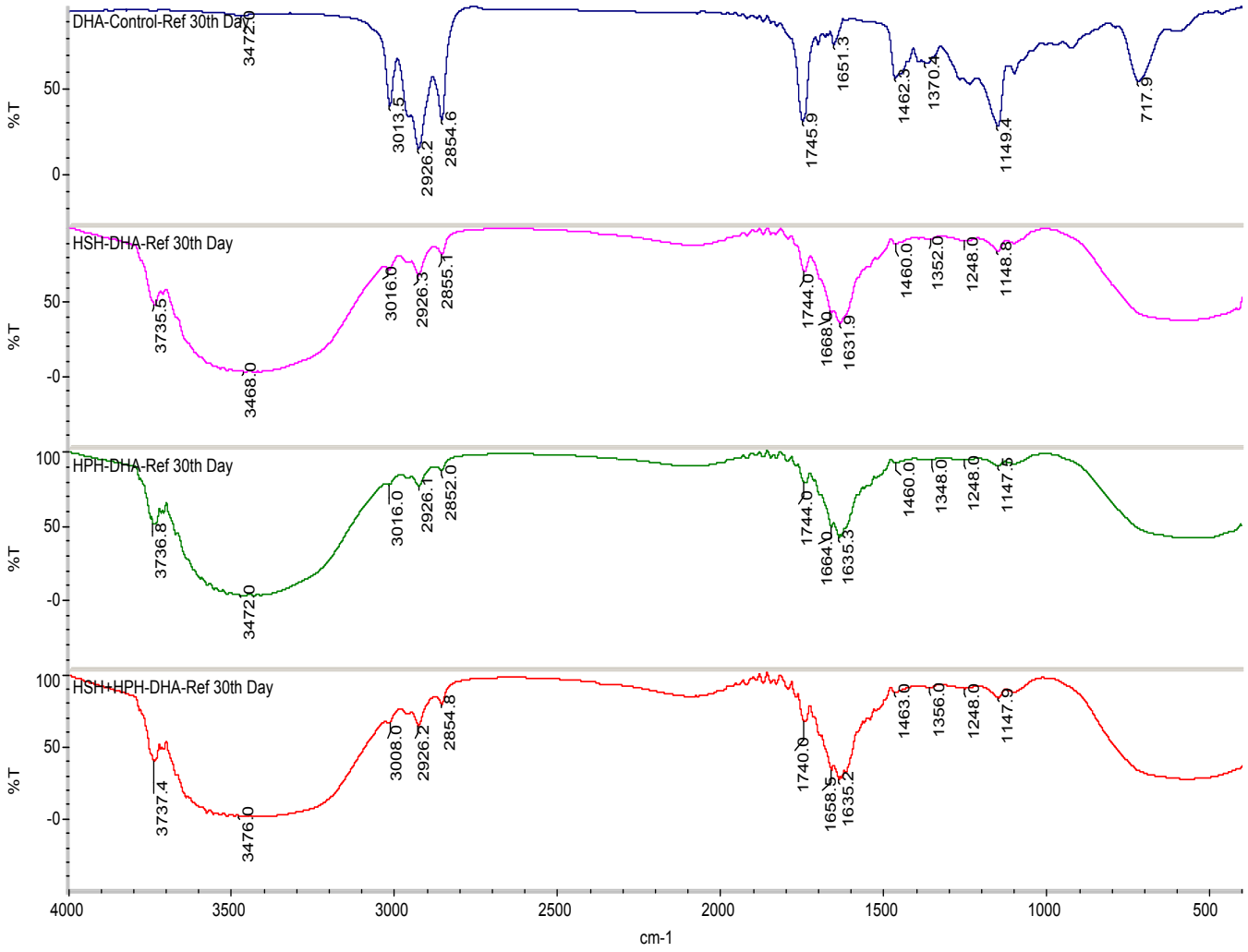


Fig. 3 FTIR spectra of DHA control, HSH-DHA-NE, HPH-DHA-NE, and HSH+HPH-NE.

d) Stored at room temperature (28±1ºC) at 10th day

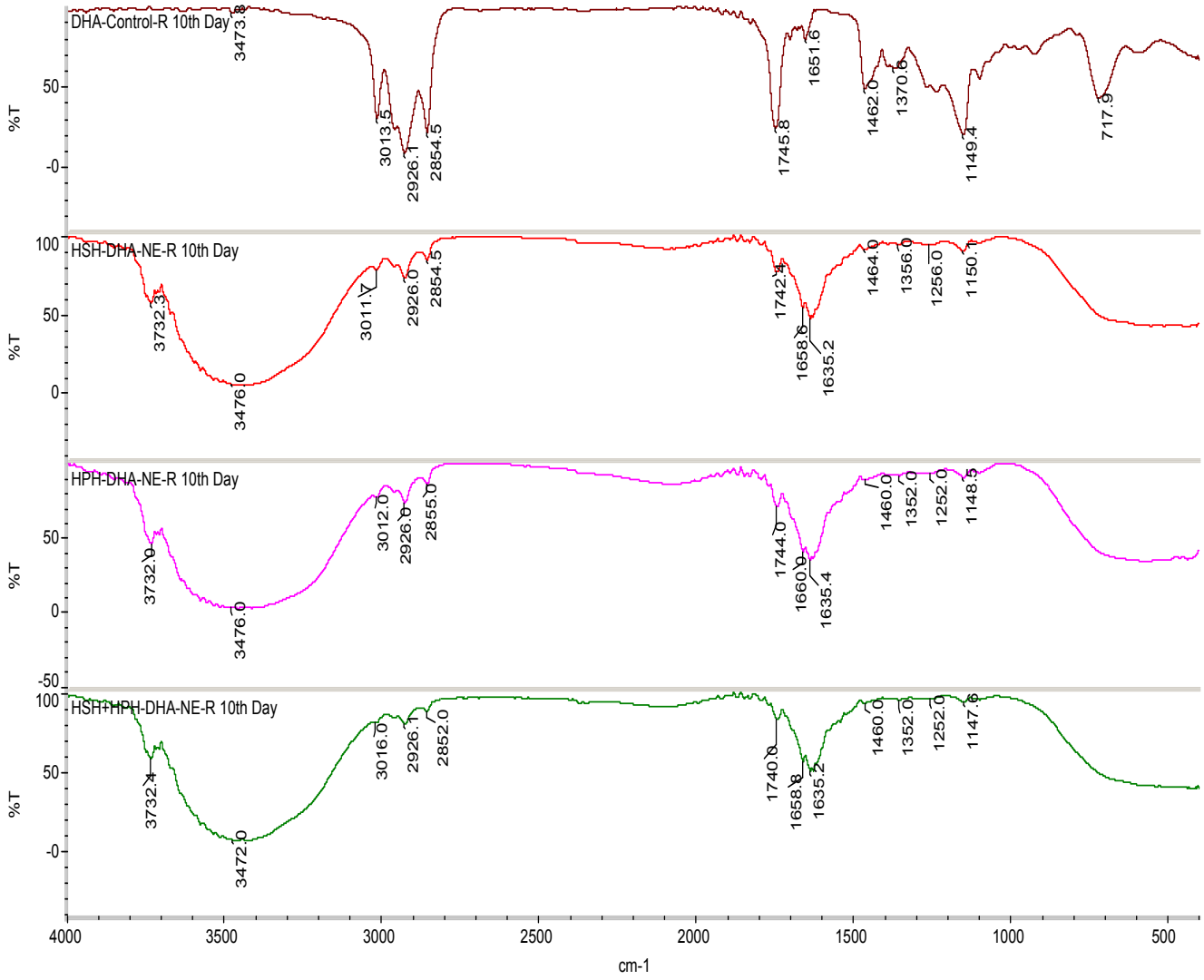


Fig. 4 FTIR spectra of DHA control, HSH-DHA-NE, HPH-DHA-NE, and HSH+HPH-NE.

e) Stored at room temperature (28±1ºC) at 20th day

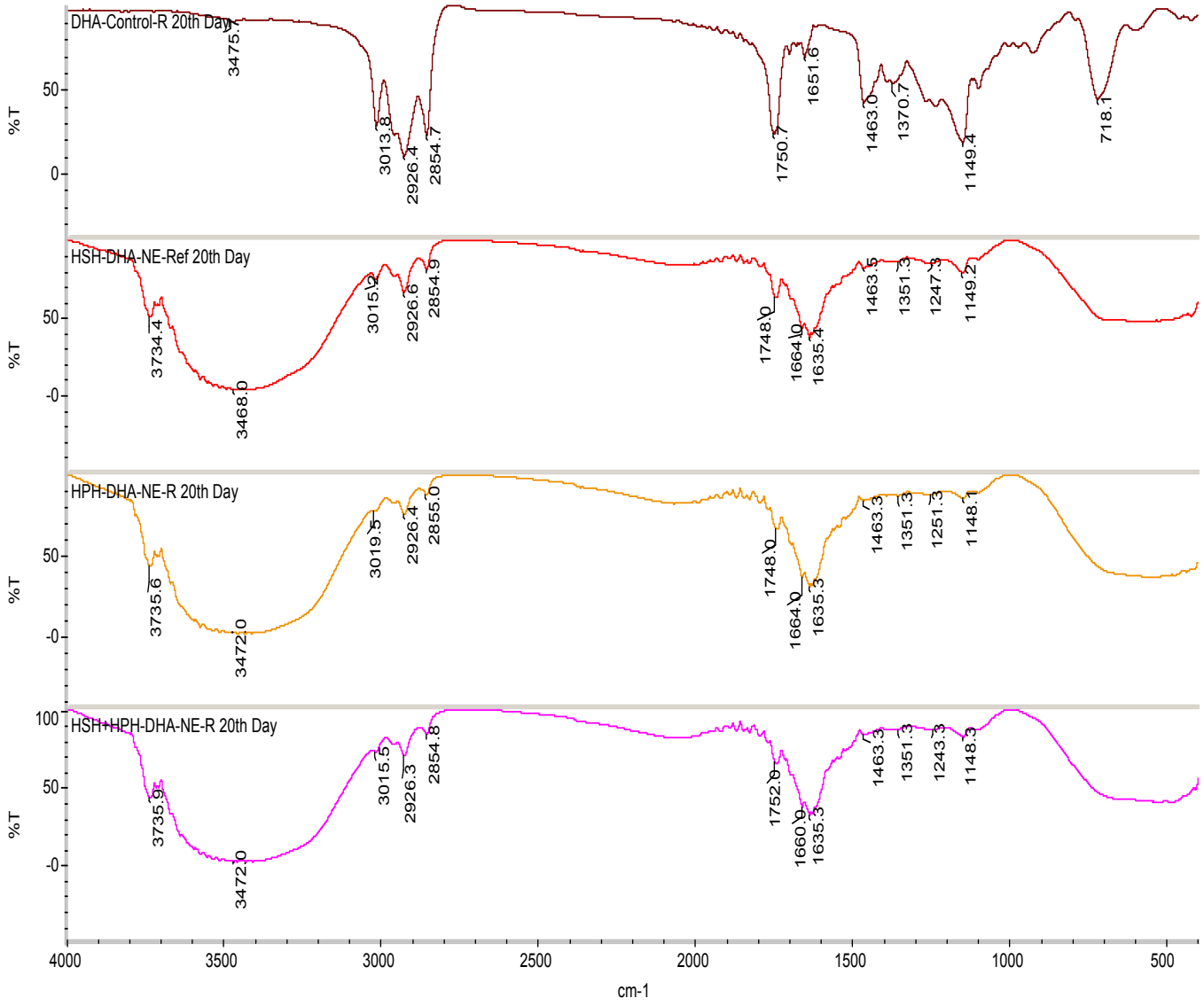


Fig. 5 FTIR spectra of DHA control, HSH-DHA-NE, HPH-DHA-NE, and HSH+HPH-NE.

f) Stored at room temperature (28±1°C) at 30th day

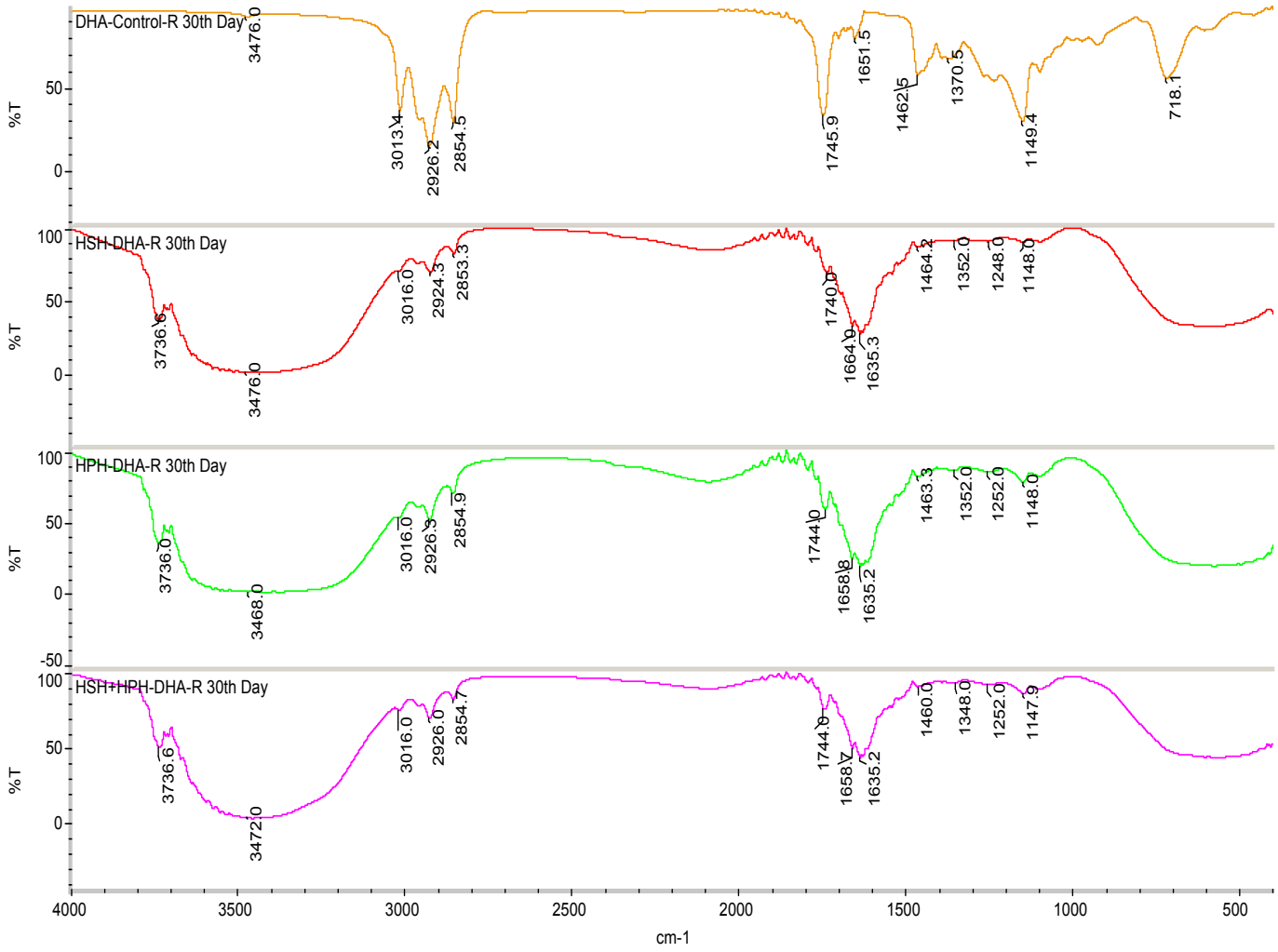


Fig. 6 FTIR spectra of DHA control, HSH-DHA-NE, HPH-DHA-NE, and HSH+HPH-NE.

g) Stored at oven temperature (40±0.2°C) at 10th day

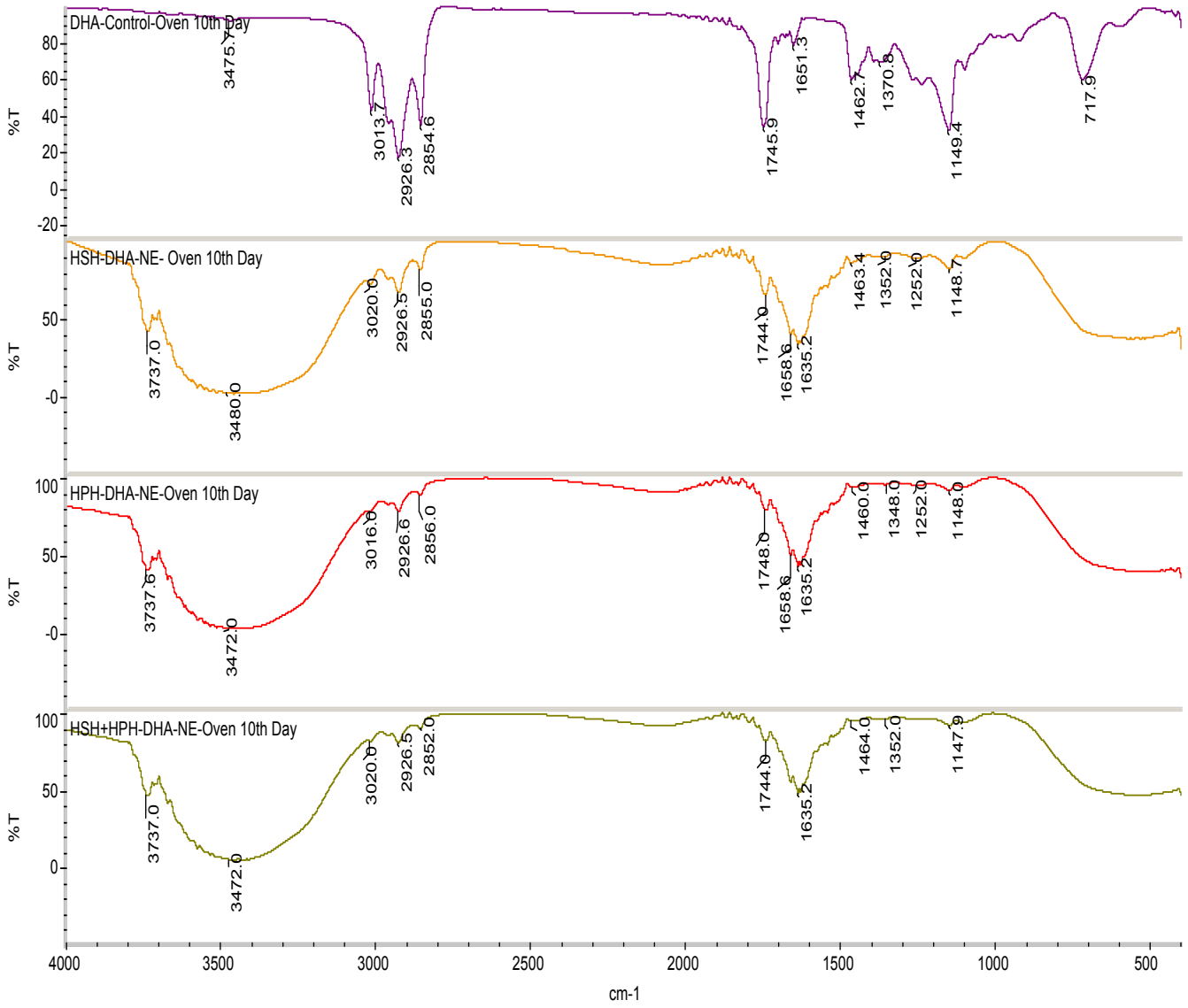


Fig. 7 FTIR spectra of DHA control, HSH-DHA-NE, HPH-DHA-NE, and HSH+HPH-NE.

h) Stored at oven temperature (40±0.2°C) at 20th day

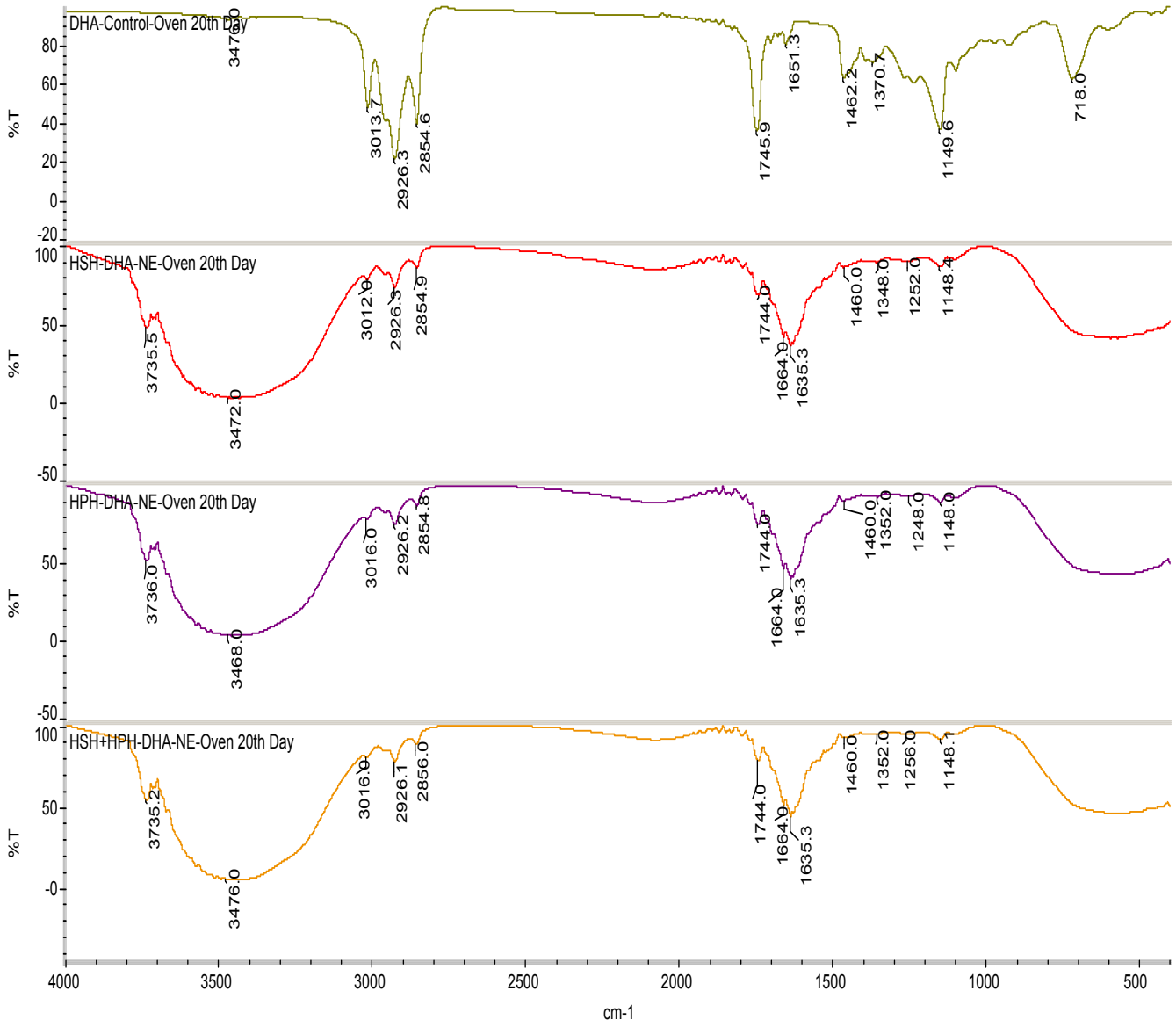


Fig. 8 FTIR spectra of DHA control, HSH-DHA-NE, HPH-DHA-NE, and HSH+HPH-NE.

i) Stored at oven temperature (40±0.2°C) at 30th day

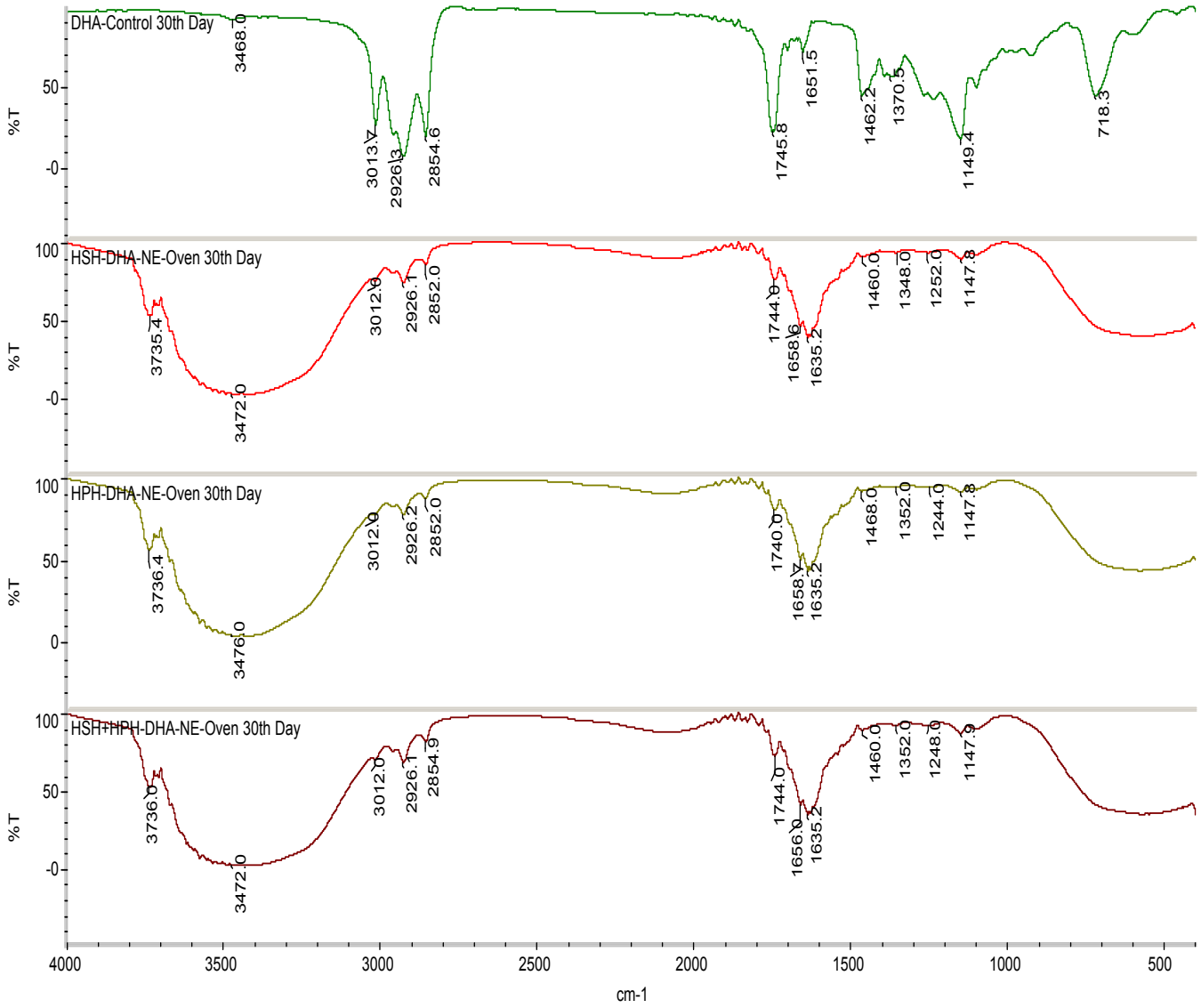


Fig. 9 FTIR spectra of DHA control, HSH-DHA-NE, HPH-DHA-NE, and HSH+HPH-NE.

Appendix H. Supplementary data

Determination of volatile compounds after formulation of DHA nanoemulsions by comparing the Hexanal with DHA algae oil and nanoemulsified DHA using GC-MS.

a) Hexanal spectra

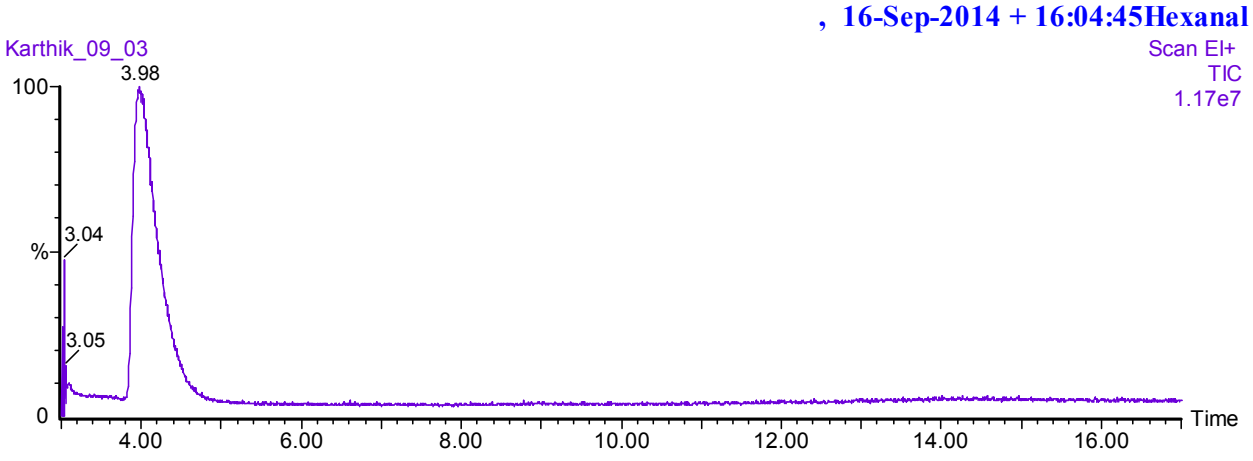


Fig. 1 GC-MS spectra for Hexanal (The peak at RT 3.98 min corresponds to Hexanal).

b) DHA algae oil spectra:

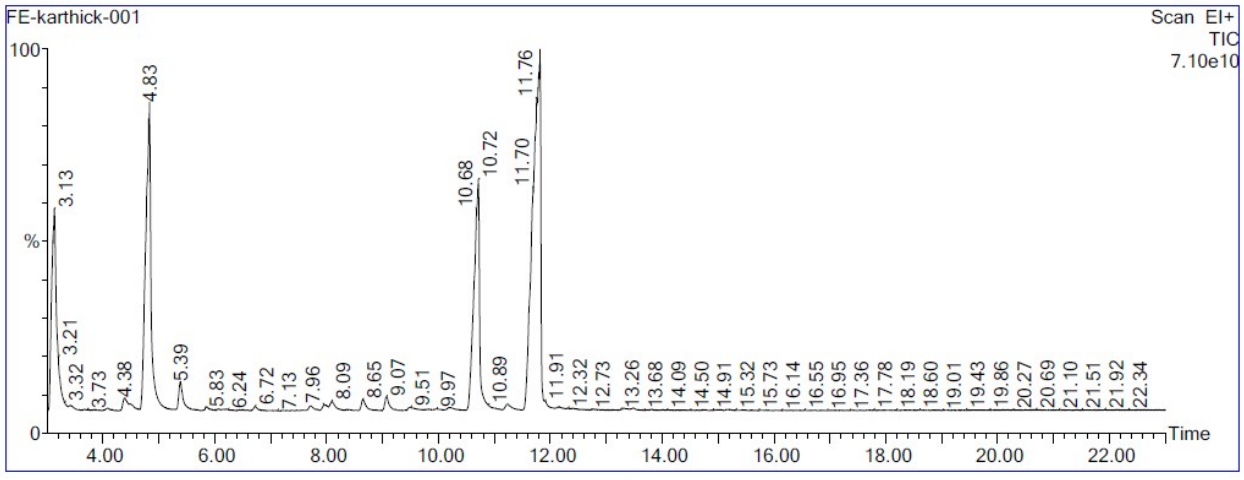


Fig. 2 GC-MS spectra for DHA algae oil (control)

c) HSH DHA Nanoemulsion spectra

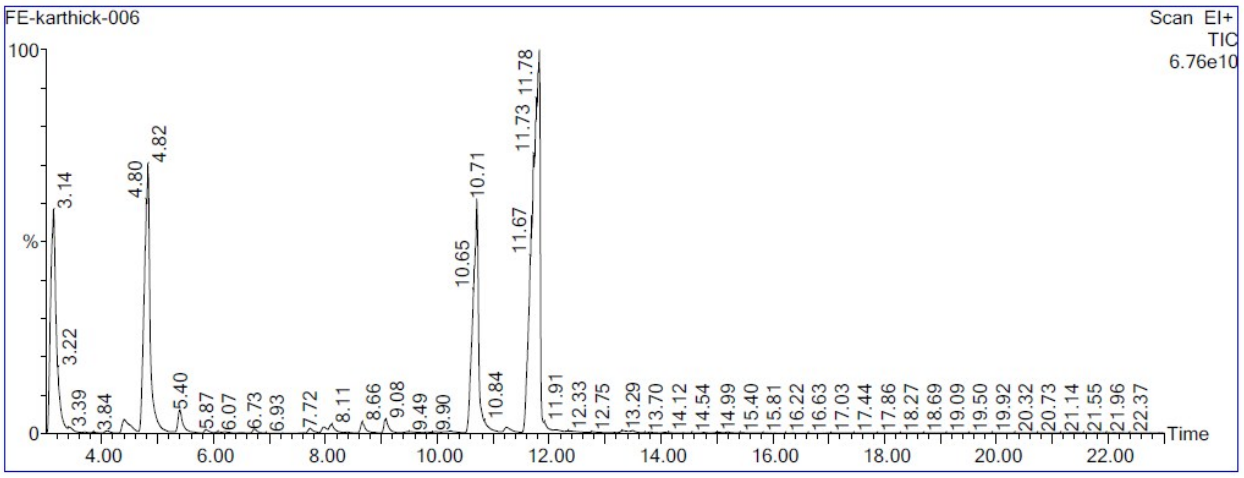


Fig. 3 GC-MS spectra for HPH technique used DHA nanoemulsion.

d) HPH DHA Nanoemulsion spectra

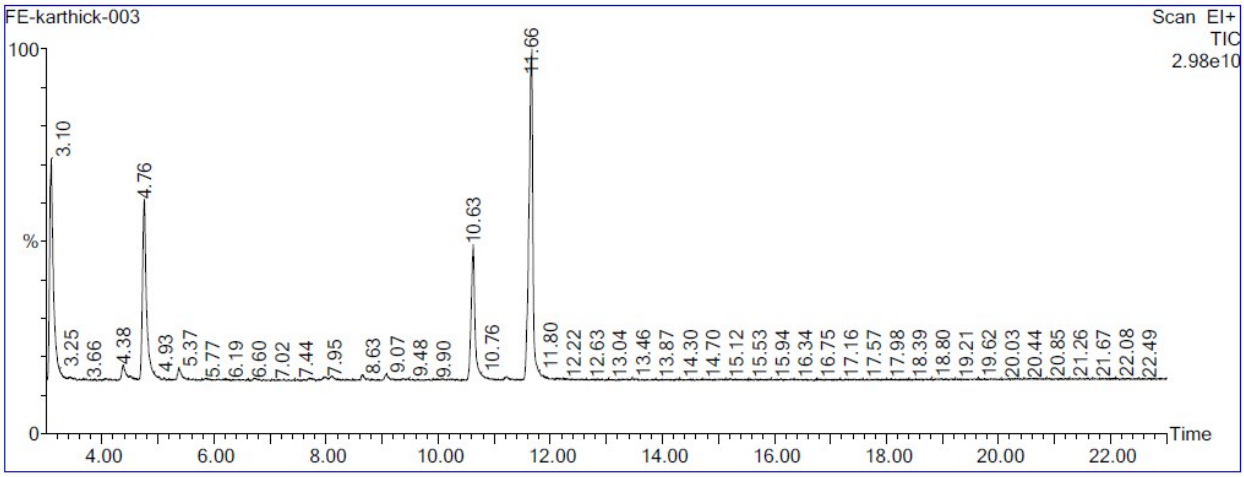


Fig. 4 GC-MS spectra for HPH technique used DHA nanoemulsion.

e) HSH+HPH DHA Nanoemulsion spectra

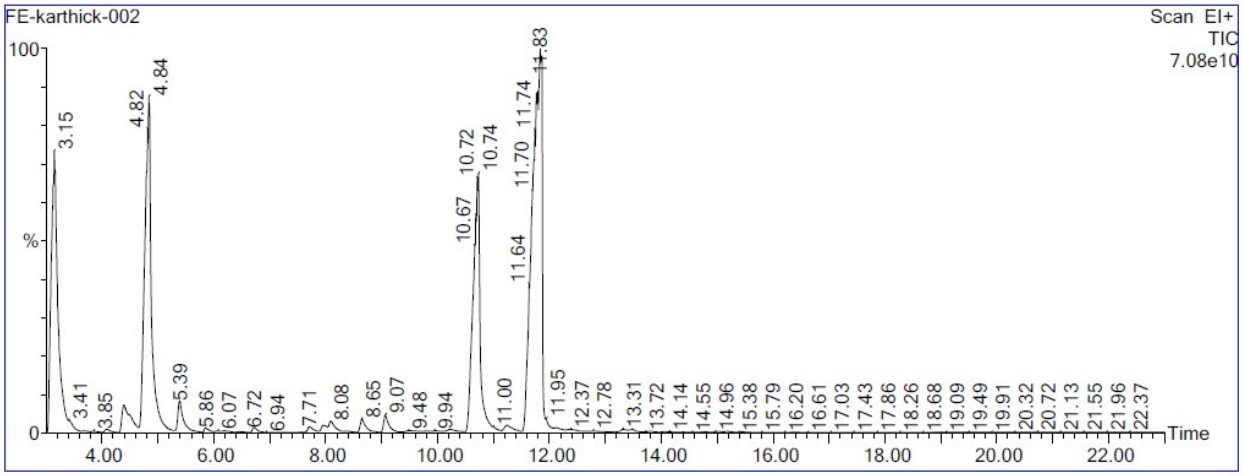


Fig. 5 GC-MS spectra for HSH+HPH technique used DHA nanoemulsion.