Appendix A. Supplementary material

Rapid extraction of free fatty acids from edible oil after accelerated storage based on amino-modified magnetic silica nanospheres

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Fig. 1s Scatchard plot for Fe_3O_4@SiO_2@NH_2 to different FFAs.

Fig. 2s The effect of Fe_3O_4@SiO_2@NH_2 amount on the recoveries of FFAs (n=3).

Fig. 3s The effect of blending time on the recoveries of FFAs (n=3).

Fig. 4s The effect of elution volume on the recoveries of FFAs (n=3).

Fig. 5s The effect of extraction volume on the recoveries of FFAs (n=3).

Table 1s The intra- and inter-day precisions of the assay (n = 6).

Table 2s Applied of the proposed method for the determination of FFAs in different oil samples after accelerated storage.

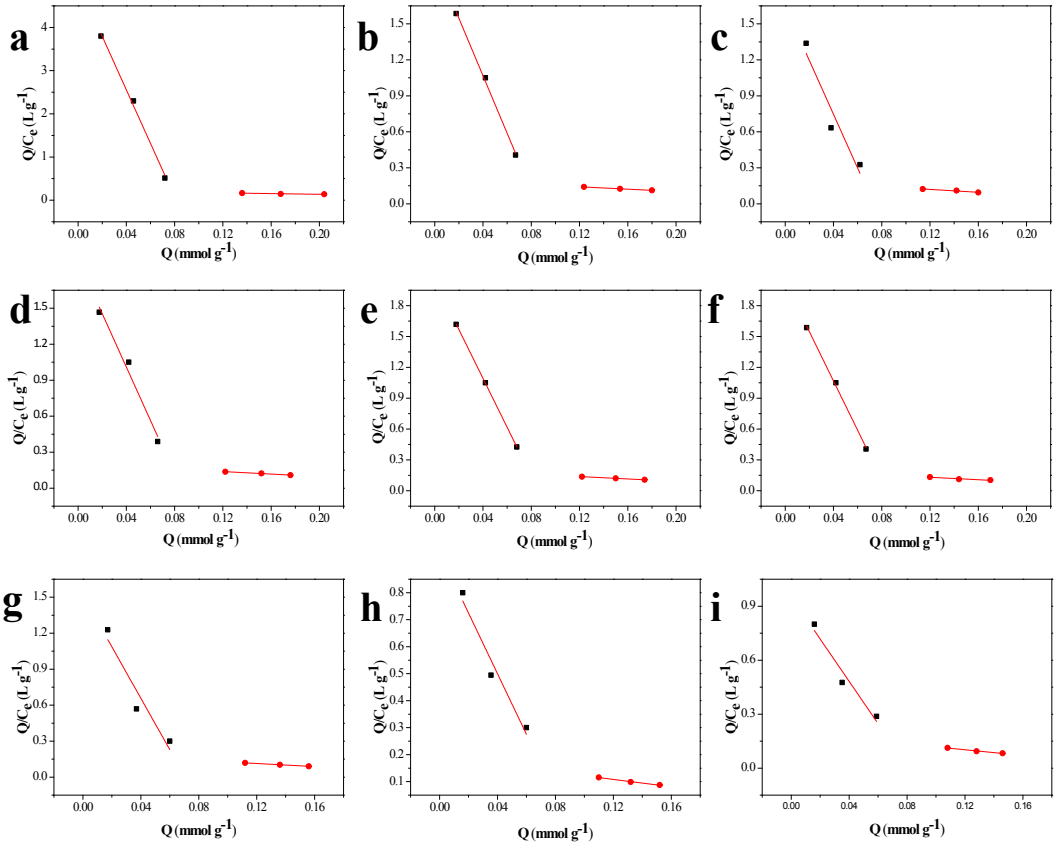

Fig. 1s Scatchard plot for Fe_3O_4@SiO_2@NH_2 to different FFAs (palmitic acid (C16:0) (a), stearic acid (C18:0) (b), eicosanoic acid (C20:0) (c), oleic acid (C18:1n9c) (d), linoleic acid (C18:2n6c) (e), linolenic acid (C18:3n3) (f), eicosapentaenoic acid (C20:5n3, EPA) (g), docosanoic acid (C22:0) (h), docosahexaenoic acid (C20:6n3, DHA) (i)).

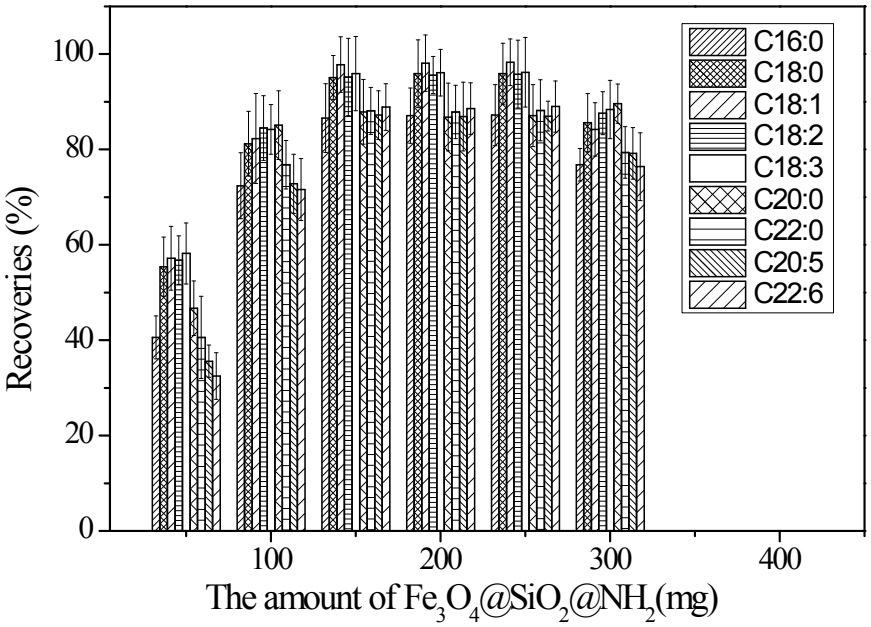

Fig. 2s The effect of Fe_3O_4@SiO_2@NH_2 amount on the recoveries of FFAs (n=3).

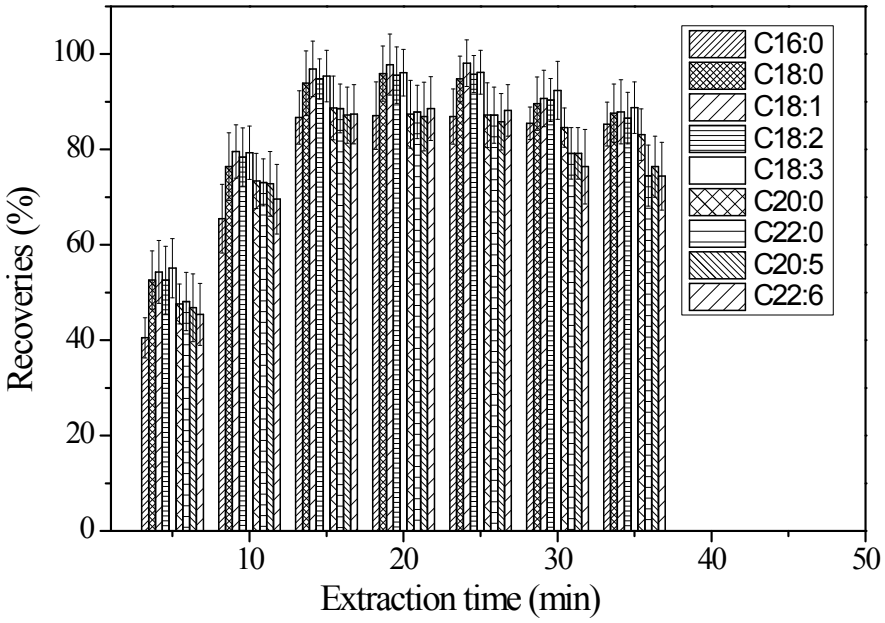

Fig. 3s The effect of blending time on the recoveries of FFAs (n=3).

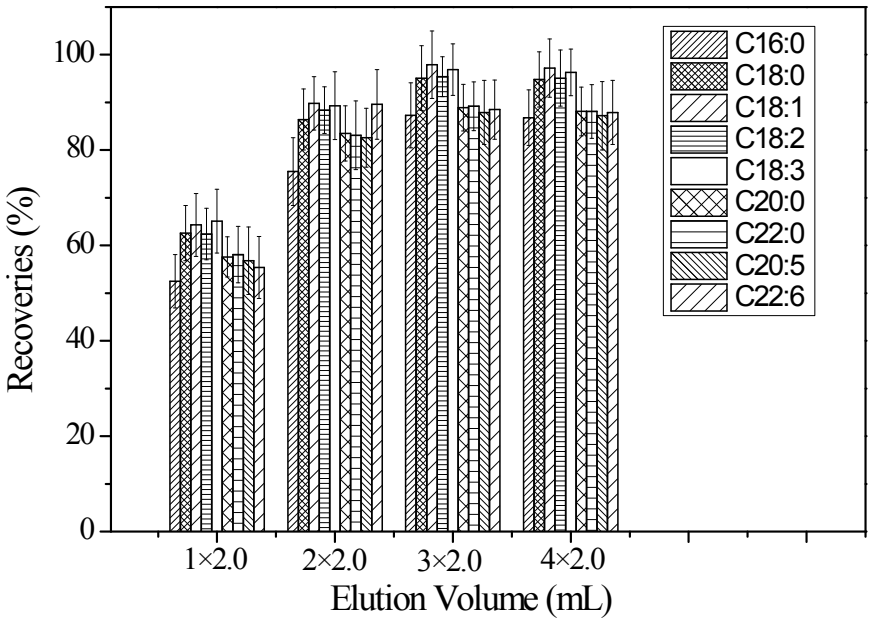

Fig. 4s The effect of elution volume on the recoveries of FFAs (n=3).

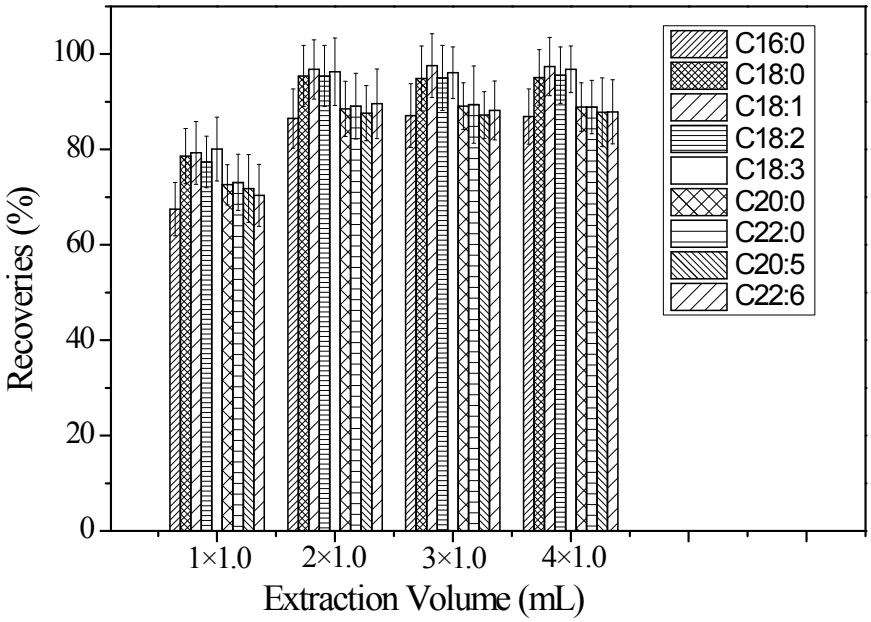

Fig. 5s The effect of hexane volume on the recoveries of FFAs (n=3).

Table 1s The intra- and inter-day precisions of the assay (n = 6).

Analytes	Intra-day precision						Inter-day precision					
	2 nmol g^{-1}		20 nmol g^{-1}		100 nmol g^{-1}		2 nmol g^{-1}		20 nmol g^{-1}		100 nmol g^{-1}	
	Recovery (%)	RSD (%)	Recovery (%)	RSD (%)	Recovery (%)	RSD (%)	Recovery (%)	RSD (%)	Recovery (%)	RSD (%)	Recovery (%)	RSD (%)
C16:0	92.4	6.9	94.8	5.9	101.3	3.4	92.1	9.2	93.6	7.6	99.8	6.8
C18:0	92.8	7.3	98.2	5.5	102.4	4.2	93.8	7.9	97.2	6.8	100.8	5.4
C18:1	93.4	6.5	95.9	4.9	101.8	4.1	94.2	7.6	96.2	6.9	99.6	5.9
C18:2	94.6	6.7	95.4	5.2	98.7	4.5	93.6	7.9	97.8	7.1	100.6	6.1
C18:3	93.6	6.8	96.1	6.1	98.5	4.4	92.8	8.2	98.2	7.6	101.4	7.2
C20:0	80.5	6.2	88.8	7.2	96.8	5.0	81.1	8.4	89.6	6.5	96.7	7.9
C22:0	81.9	7.5	87.9	7.6	97.6	4.9	80.1	8.7	88.6	6.2	95.8	8.1
C20:5	79.6	8.2	88.4	7.2	98.4	5.2	79.6	9.2	90.1	7.5	96.9	6.5
C22:6	77.4	8.0	89.2	7.6	99.5	5.3	78.4	9.4	88.5	5.8	97.2	5.9

Table 2s Applied of the proposed method for the determination of FFAs in different oil samples after accelerated storage (nmol g^{-1}, mean±S.D, n = 3).

Analytes	Olive oil									
	0		3		6		9		12	
	Proposed method	Traditional method	Proposed method	Traditional method	Proposed method	Traditional method	Proposed method	Traditional method	Proposed method	Traditional method
C16:0	34.96±2.71	34.12±2.66	35.36±3.21	34.12±0.021	35.75±2.03	34.47±0.04	36.91±2.54	34.26±2.15	38.85±2.12	37.45±2.16
C18:0	10.31±0.56	10.21±0.43	10.39±0.96	10.24±0.56	10.46±0.51	9.98±0.71	10.69±4.09	10.54±1.02	11.07±0.78	10.52±1.01
C18:1	192.49±8.17	190.36±6.54	194.61±4.24	192.14±5.89	196.74±5.14	191.12±8.27	196.74±6.32	193.47±4.32	196.74±5.86	199.98±7.79
C18:2	41.07±0.01	39.84±1.82	41.52±3.14	40.14±0.85	41.98±2.32	42.41±3.04	41.98±1.04	40.68±0.76	41.98±2.17	42.17±2.19
C18:3	3.86±0.06	3.79±0.28	3.91±0.11	3.77±0.27	3.95±0.18	3.87±0.21	3.95±0.23	3.78±0.34	3.95±0.11	3.71±0.22
C20:0	-	-	-	-	-	-	-	-	-	-
C22:0	-	-	-	-	-	-	-	-	-	-
C20:5	-	-	-	-	-	-	-	-	-	-
C22:6	-	-	-	-	-	-	-	-	-	-
Analytes	Blend oil									
	0		3		6		9		12	
	Proposed method	Traditional method	Proposed method	Traditional method	Proposed method	Traditional method	Proposed method	Traditional method	Proposed method	Traditional method
C16:0	10.87±0.78	11.28±0.92	11.28±0.82	11.90±0.96	16.66±0.95	16.21±0.56	22.30±1.12	21.39±1.11	32.72±1.79	32.24±2.58
C18:0	6.46±0.41	6.60±0.41	6.60±0.41	6.41±0.43	9.33±0.73	9.42±0.54	11.67±0.44	10.75±0.75	16.64±2.35	15.72±1.41
C18:1	29.33±2.02	28.64±2.42	37.42±2.42	36.98±0.09	44.39±3.09	42.72±3.13	49.16±3.17	46.51±4.25	64.70±5.98	64.12±5.04
C18:2	61.36±1.85	60.29±2.04	147.29±6.44	142.41±8.20	186.13±8.26	185.07±7.32	205.48±10.05	201.36±8.05	225.72±13.41	224.14±12.21
C18:3	5.88±0.25	6.06±0.45	6.06±0.25	6.36±0.35	6.06±0.25	6.36±0.25	6.09±0.35	6.36±0.25	6.13±0.05	6.23±0.25
C20:0	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
C22:0	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ

C20:5	-	-	-	-	-	-	-	-	-	-
C22:6	-	-	-	-	-	-	-	-	-	-

Analytes	Krill oil									
	0		3		6		9		12	
	Proposed method	Traditional method	Proposed method	Traditional method	Proposed method	Traditional method	Proposed method	Traditional method	Proposed method	Traditional method
C16:0	126.72±10.01	131.37±7.02	141.37±10.02	138.79±9.54	167.42±12.18	163.25±10.25	193.15±10.45	199.24±9.72	194.10±11.67	193.21±12.41
C18:0	15.98±0.81	16.89±2.01-	17.89±0.89	17.14±0.71	21.30±1.72	20.45±2.03	26.25±1.08	24.28±1.51	27.79±1.24	25.31±2.36
C18:1	78.72±5.01	79.71±4.09	87.71±7.02	86.52±5.05	111.70±7.14	110.95±6.18	120.48±10.42	125.74±12.49	116.71±9.62	120.08±10.92
C18:2	35.18±2.56	34.67±3.14	39.67±2.09	38.20±2.02	42.86±0.96	40.79±3.06	43.35±3.18	42.28±2.21	46.62±3.65	47.88±2.65
C18:3	15.93±1.01	15.36±1.21	17.36±1.71	17.19±2.01	19.24±1.23	18.29±1.03	19.24±1.42	18.91±2.06	19.91±1.21	18.13±3.30
C20:0	-	-	-	-	-	-	-	-	-	
C22:0	-	-	-	-	-	-	-	-	-	
C20:5	298.80±10.02	290.42±10.04	310.04±10.12	316.71±15.12	321.80±14.42	327.34±12.64	323.26±21.21	322.01±23.01	323.91±15.41	325.87±16.54
C22:6	173.11±9.01	169.30±9.02	180.69±16.04	176.10±14.09	194.61±8.15	192.34±6.04	196.12±10.68	190.96±8.71	196.12±12.12	193.16±13.96