Electronic Supplementary Material (ESI) for Polymer Chemistry.

Electronic Supplementary Information (ESI)

Synthesis and characterization of responsive poly(anionic liquid) microgels

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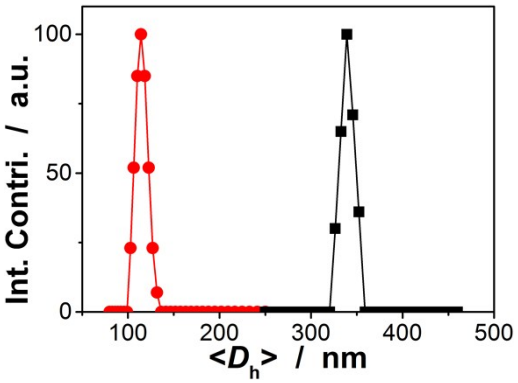

Fig. S1 DLS size distribution of the microgels synthesized with different feeding amount of SDS (■: 0 g; ●: 0.0150 g). The feeding amounts of TPSS and MBAAm were set to 0.7843 g and 0.0113 g, respectively, in the synthesis. All measurements were made on 10.0 μg/mL microgel aqueous solutions at 25.0 °C.

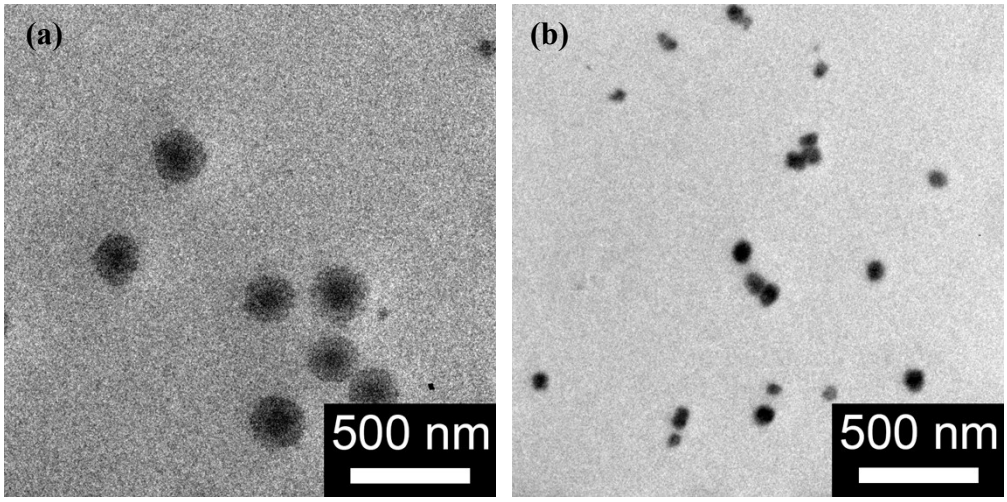

Fig. S2 TEM images of the microgels synthesized with different feeding amount of SDS: (a) 0 g and (b) 0.0150 g. The feeding amounts of TPSS and MBAAm were set to 0.7843 g and 0.0113 g, respectively, in the synthesis.

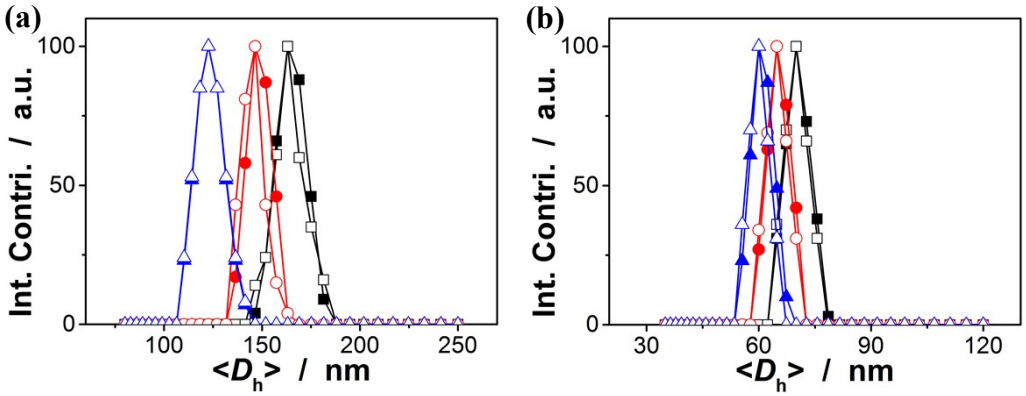

Fig. S3 DLS size distribution of (a) PTPSS microgels and (b) CPIL microgels in water at 25.0 °C (■,□), 43.0 °C (●,○), and 61.0 °C (▲,Δ), respectively, upon heating (solid symbols) and cooling (open symbols) cycle. All measurements were made on 10.0 μg/mL microgel aqueous solutions.

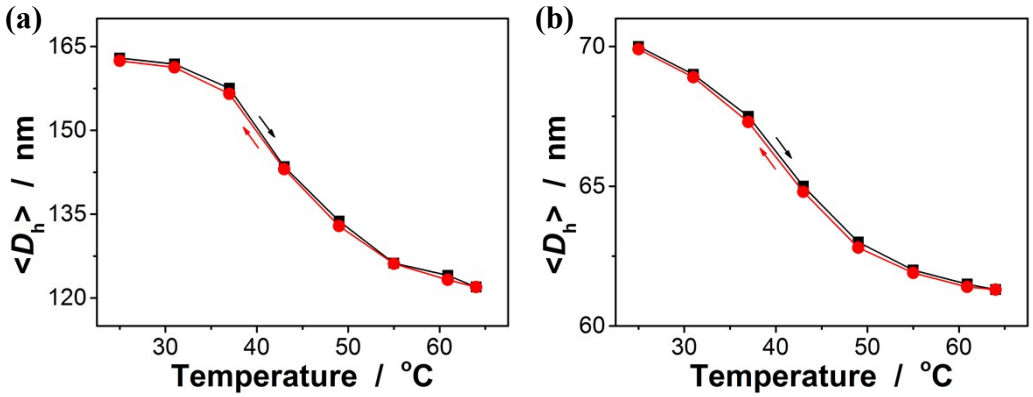

Fig. S4 Temperature-dependent <D_h> of (a) PTPSS microgels and (b) CPIL microgels in water upon heating and cooling. All measurements were made on 10.0 μg/mL microgel aqueous solutions.

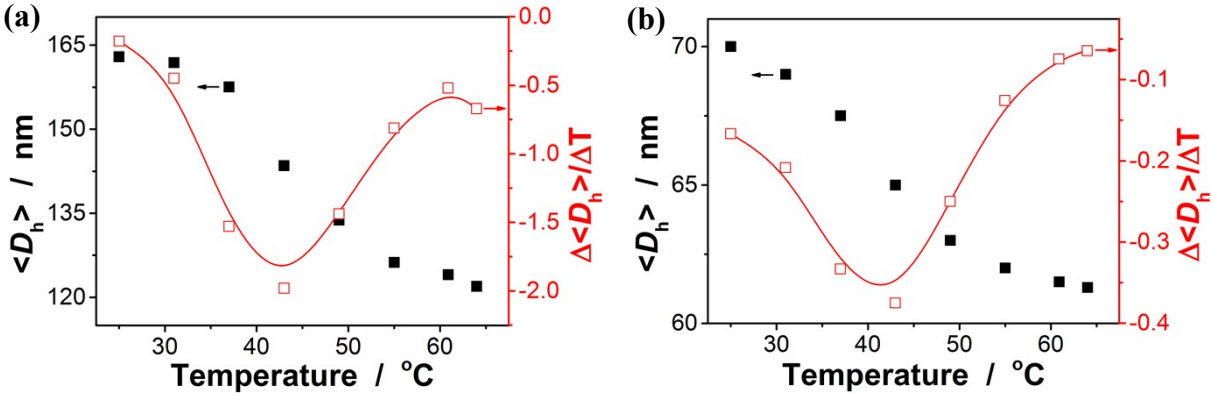

Fig. S5 Typical Δ<D_h>/ΔT–T plots of (a) PTPSS microgels and (b) CPIL microgels in water. All measurements were made on 10.0 μg/mL microgel aqueous solutions.

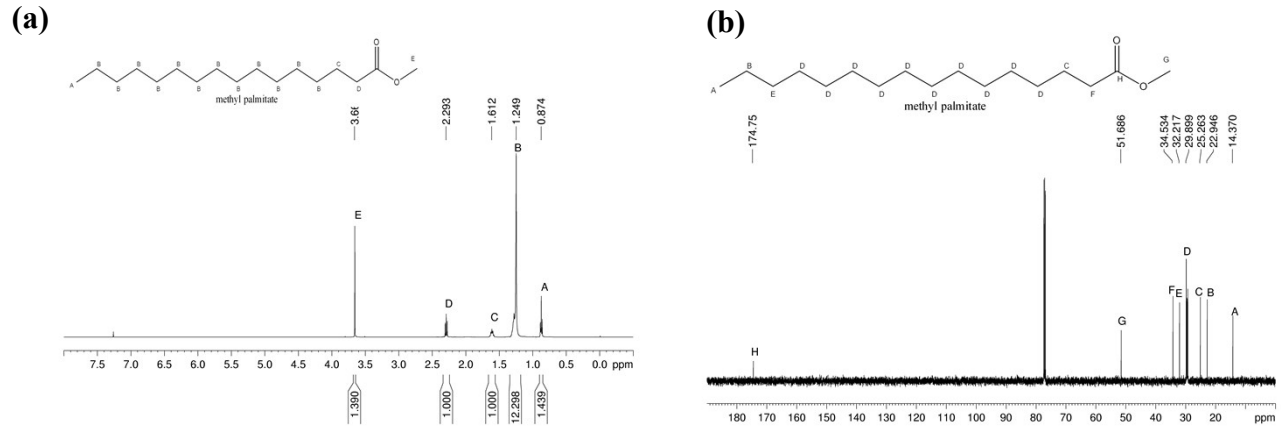

Fig. S6 (a) ^{1}H NMR and (b) ^{13}C NMR spectra of methyl palmitate yielded from the model reactions. $CDCl_3$ was used as the d-solvent.

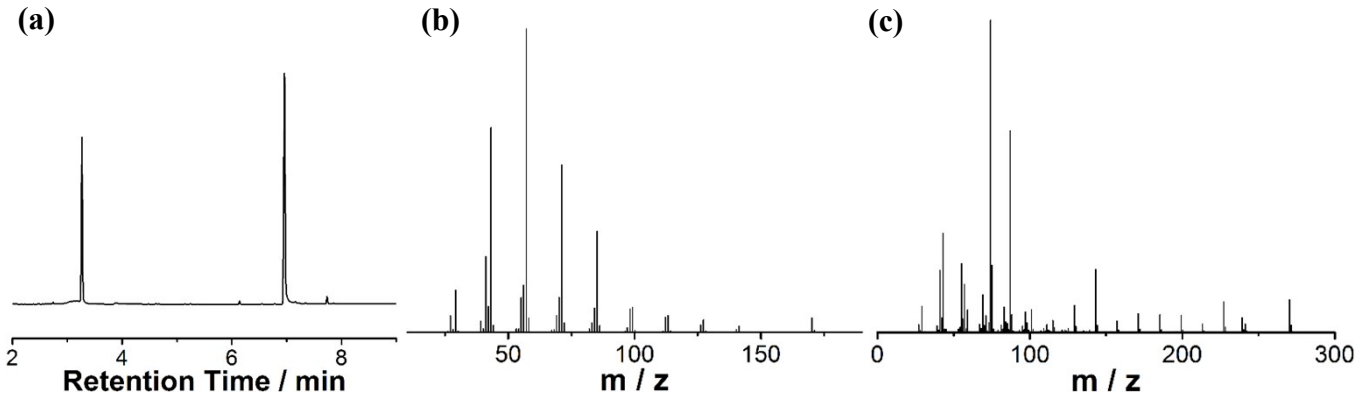

Fig. S7 GC-MS analysis of methyl palmitate yielded from the model reactions: typical (a) GC spectrum of methyl palmitate mixed with dodecane, which is used as an internal standard substance, and MS spectra corresponding to the GC peaks at 3.27 min (b; dodecane) and 6.96 min (c; methyl palmitate).

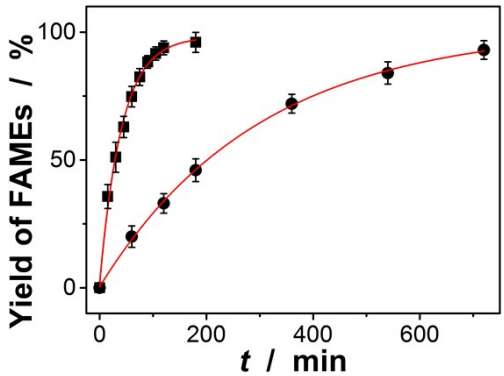

Fig. S8 Time trace of yield of FAMEs during the model reactions catalyzed by free $–SO_3H$ (by adding 0.1 mmol benzenesulfonic acid and 6.9×10^{-2} mmol TPSS directly) at 65 °C. The lines are exponential fits.

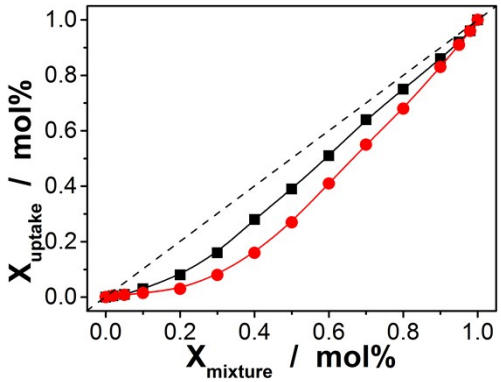

Fig. S9 A comparison of the uptaken mol fraction of methyl palmitate (■) and glycerol (●) in the equilibrated CPIL microgels in the presence of methanol at a constant temperature (at 65 °C oil bath), and the corresponding mol fractions in the initial bath mixtures.

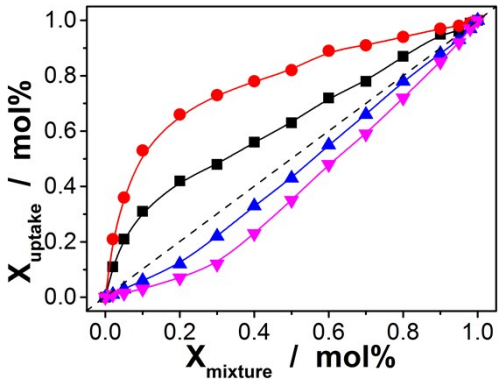

Fig. S10 A comparison of the uptaken mol fraction of PA (■), tripalmitin (●), methyl palmitate (▲), and glycerol (▼) in the equilibrated PTPSS microgels in the presence of methanol at a constant temperature (at 65 °C oil bath), and the corresponding mol fractions in the initial bath mixtures.

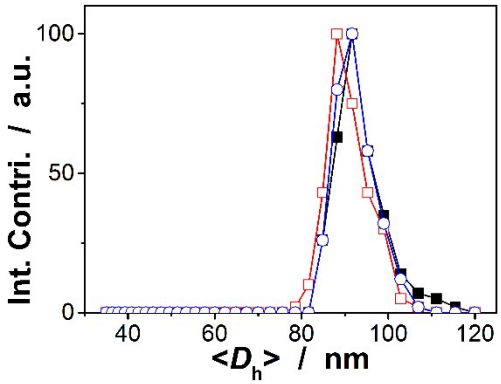

Fig. S11 DLS size distribution for CPIL microgels before (■) and after five cycles' of use for the model esterification reaction of PA (□) and the transesterification reaction of tripalmitin (○). DLS measurements were made in methanol at 25.0 °C.

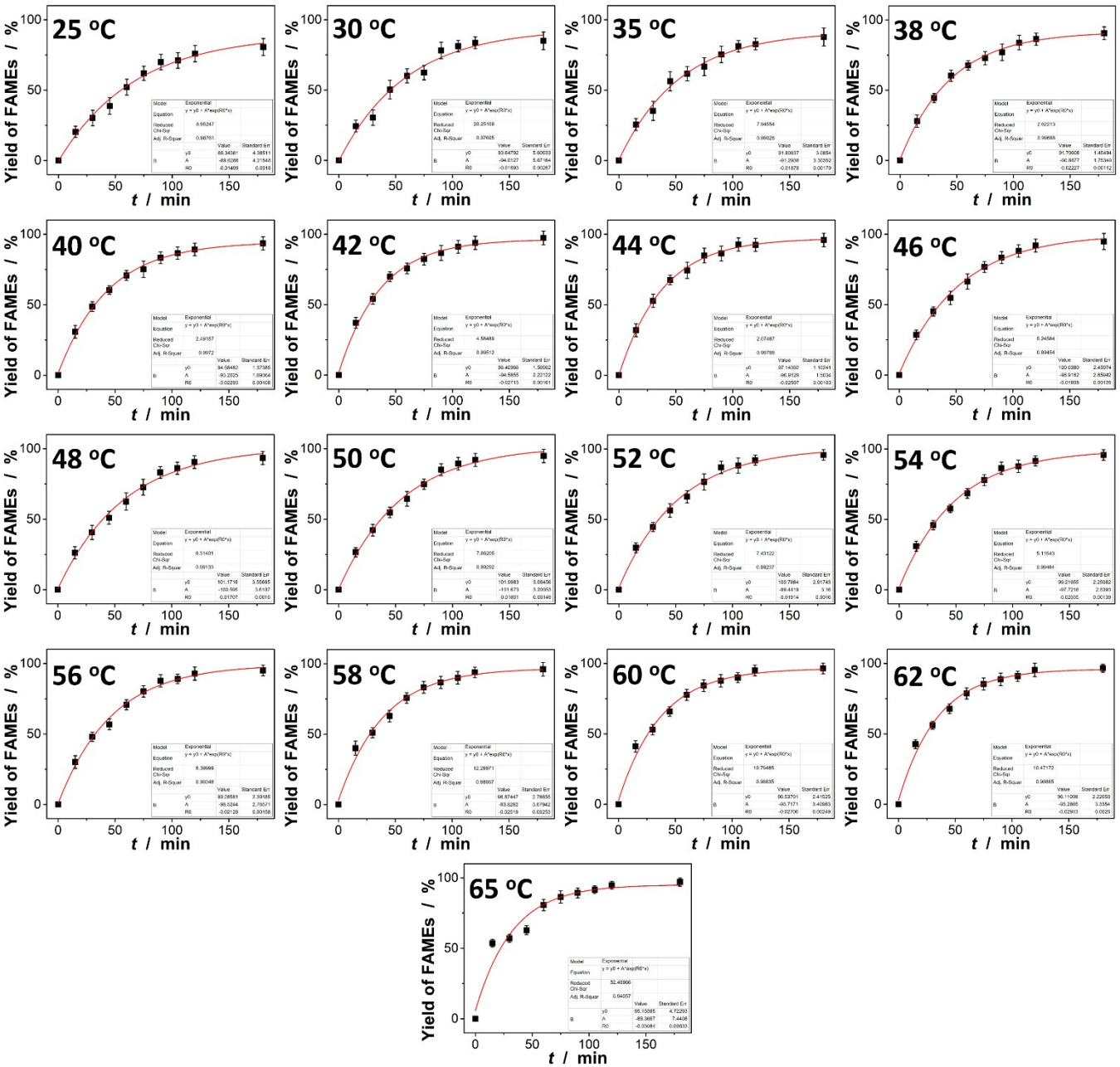

Fig. S12 Time trace of the yield of FAMEs during the model esterification reaction of PA catalyzed by CPIL microgels at different temperatures. Results are mean ± SD (n = 3). The lines are exponential fits.

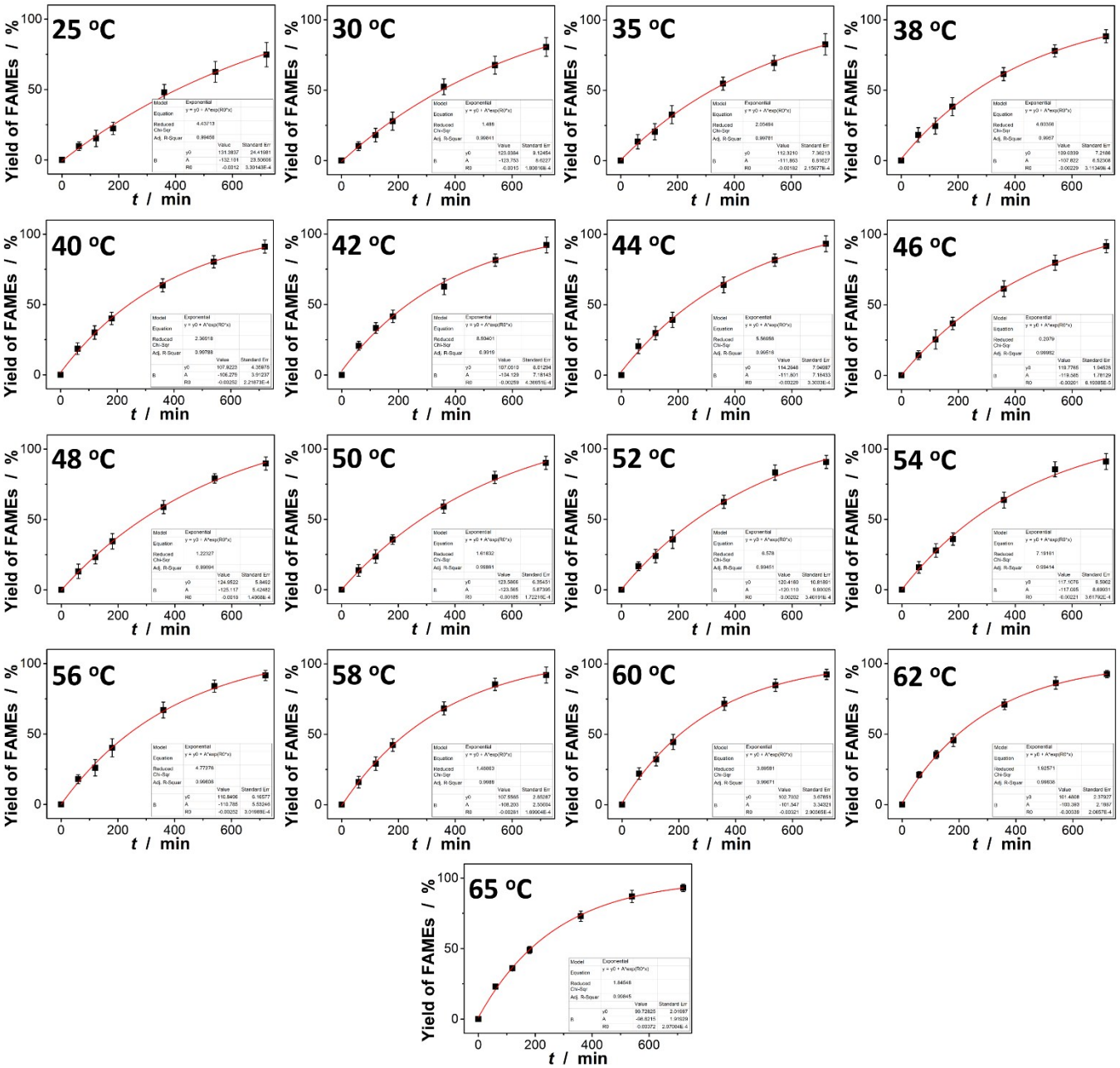

Fig. S13 Time trace of the yield of FAMEs during the model transesterification reaction of tripalmitin catalyzed by CPIL microgels at different temperatures. Results are mean ± SD (n = 3). The lines are exponential fits.

Table S1. Additional results on the model esterification/transesterification reactions over CPIL microgels.

entry	reaction conditions					yield of FAMEs
	methanol / water (mL / mL)	PA / tripalmitin (g / g)	CPIL (g)	temperature (^{o}C)	time (h)	
1	1.00 / 0.00	0.5128 / 0.0000	0.0500	65	18	> 99
					10	> 99
2	1.00 / 0.00	0.5128 / 0.0000	0.0100	65	18	> 99
					10	> 99
3	1.00 / 0.00	0.5128 / 0.0000	0.0050	65	18	83
					10	82
4	1.00 / 0.00	0.5128 / 0.0000	0.0010	65	18	88
					10	88
5	1.00 / 0.00	0.5128 / 0.0000	0.0005	65	18	95
					10	94
6	0.90 / 0.10	0.5128 / 0.0000	0.0500	65	18	99
7	0.85 / 0.15	0.5128 / 0.0000	0.0500	65	18	93
8	0.80 / 0.20	0.5128 / 0.0000	0.0500	65	18	76
9	0.75 / 0.25	0.5128 / 0.0000	0.0500	65	18	69
10	0.70 / 0.30	0.5128 / 0.0000	0.0500	65	18	49
11	1.00 / 0.00	0.0000 / 0.5651	0.0500	65	18	> 99
					10	89
12	1.00 / 0.00	0.0000 / 0.5651	0.0100	65	18	96
					10	85
13	1.00 / 0.00	0.0000 / 0.5651	0.0050	65	18	89
					10	77
14	1.00 / 0.00	0.0000 / 0.5651	0.0010	65	18	88
					10	75
15	1.00 / 0.00	0.0000 / 0.5651	0.0005	65	18	90
					10	76
16	0.90 / 0.10	0.0000 / 0.5651	0.0500	65	18	98
17	0.85 / 0.15	0.0000 / 0.5651	0.0500	65	18	86
18	0.80 / 0.20	0.0000 / 0.5651	0.0500	65	18	75
19	0.75 / 0.25	0.0000 / 0.5651	0.0500	65	18	70
20	0.70 / 0.30	0.0000 / 0.5651	0.0500	65	18	56
21	1.00 / 0.00	0.5128 / 0.0000	——[a]	65	18	> 99
		0.0000 / 0.5651	——[a]	65	18	> 99

[a] By adding 1.2×10^{-1} mmol benzenesulfonic acid and 6.9×10^{-2} mmol TPSS directly, with the amounts close to those of $-SO_3H$ and TPSS on the 50.0 mg CPIL microgels.

Table S2. Physical properties of the waste cooking oil used for the biodiesel production.

property	unit	test method	waste cooking oil
acid value	mg KOH/g	pr EN 14104	2.37
water content	mg/kg	EN ISO 12937	trace
viscosity at 40 °C	mm^2/s	EN ISO 3104	31.05
density at 15 °C	g/cm^3	EN ISO 3675	0.92
flash point	°C	ISO CD 3679c	270

Table S3. Composition of fatty acids of the waste cooking oil used for the biodiesel production.[a]

fatty acid (methyl ester)	C12:0	C14:0	C16:0	C16:1	C18:0	C18:1	C18:2	C18:3	C20:0	C20:1
waste cooking oil (wt%)	0.35	0.18	58.36	1.90	1.29	30.12	1.56	5.71	0.21	0.32

[a] Results are mean values (n = 3).

Table S4. Some common properties of the biodiesel produced from the waste cooking oil.

property	unit	test method	the yielded biodiesel	EN 14214 specification	conventional diesel (0#) in China
acid value	mg KOH/g	pr EN 14104	0.12	<0.5	0.07
water content	mg/kg	EN ISO 12937	391	<500	trace
viscosity at 40 °C	mm^2/s	EN ISO 3104	4.52	3.5-5.0	3.0-8.0
density at 15 °C	g/cm^3	EN ISO 3675	0.88	0.86-0.90	0.82-0.85
flash point	°C	ISO CD 3679c	157	>101	>55