ARTICLE

Heterogeneous-catalyzed methanolysis for efficient chemical recycling of bio-based PEF

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Supporting Information

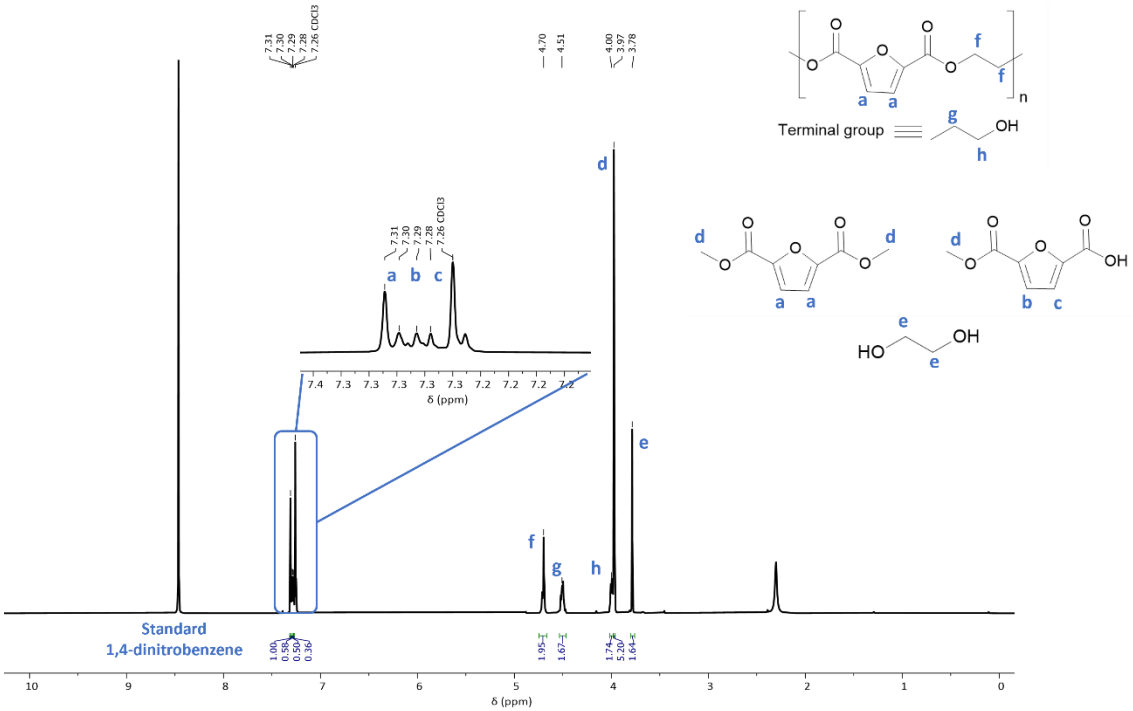

Figure S 1 ^{1}H NMR spectrum of crude depolymerization reaction mixture using Amberlyst 70 (175 °C, 2h, 50 %wt), with the proton resonances corresponding monosubstituted FDCA derivative highlighted (b,c) .

Table S 1 PEF conversion and DMFDC yield for different loadings of zeolite and reaction temperatures (2-hour reaction).

Zeolite HY loading (wt%)	Time / h	Temperature / °C	PEF Conversion (wt%)[a]	DMFDC yield (wt%)[b]
50	2	175	85.6	55
		200	92.2	98
30		175	95.8	64
		200	95.3	100
10		175	98.7	100
		200	99.4	100
5		175	99.4	100
		200	98.6	100

a) Calculated using equation 1; b) Calculated using equations 7, 8 and 9.

Table S 2 PEF conversion and DMFDC yield for different loadings of zeolite H-Y and reaction temperatures (1 hour reaction time).

Zeolite H-Y loading (wt%)	Time / h	Temperature/ °C	PEF Conversion (%)[a]	DMFDC yield (%)[b]
10	1	175	99.1	100
		200	99.4	100
5		150	63.0	58
		175	99.8	100
		200	99.3	100

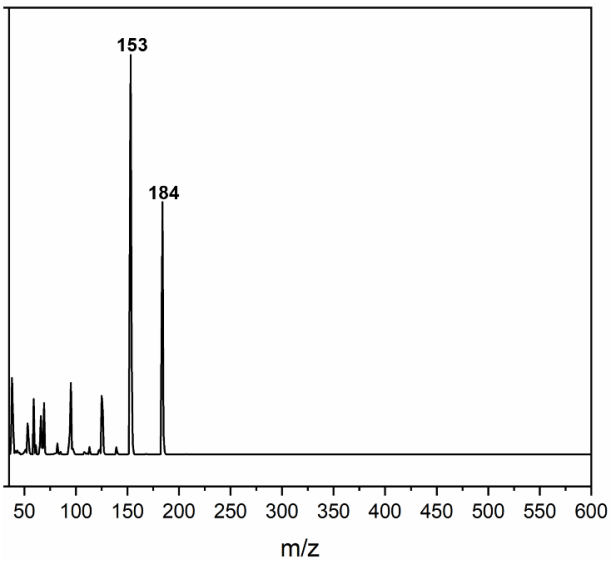

Figure S 2 MS spectra of crude DMFDC obtained from the methanolysis reaction (5 wt% of zeolite, 1 hour, 175 ºC, and PEF conversion = 99.8% and DMFDC yield = 100%).

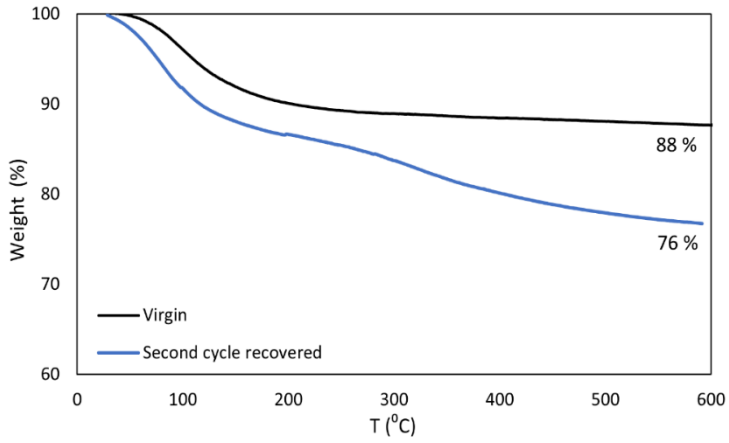

Figure S 3 TGA traces of virgin zeolite and recovered zeolite from the second depolymerization cycle.

Table S 3 Weight (m) and molecular weight (MW) values considered for the process Green Metrics calculations.

	PEF	Zeolite[a]	Methanol[b]	Ethylene glycol	DMFDC
m (g)	0.50	0.025	55.4	0.07	0.50
MW (g/mol)	182.1	-	32.04	-	184.1

a)5 %wt of zeolite, which can be isolated and recovered with 12% mass loss; b) total methanol used for depolymerization and purification, which can be partially recovered;

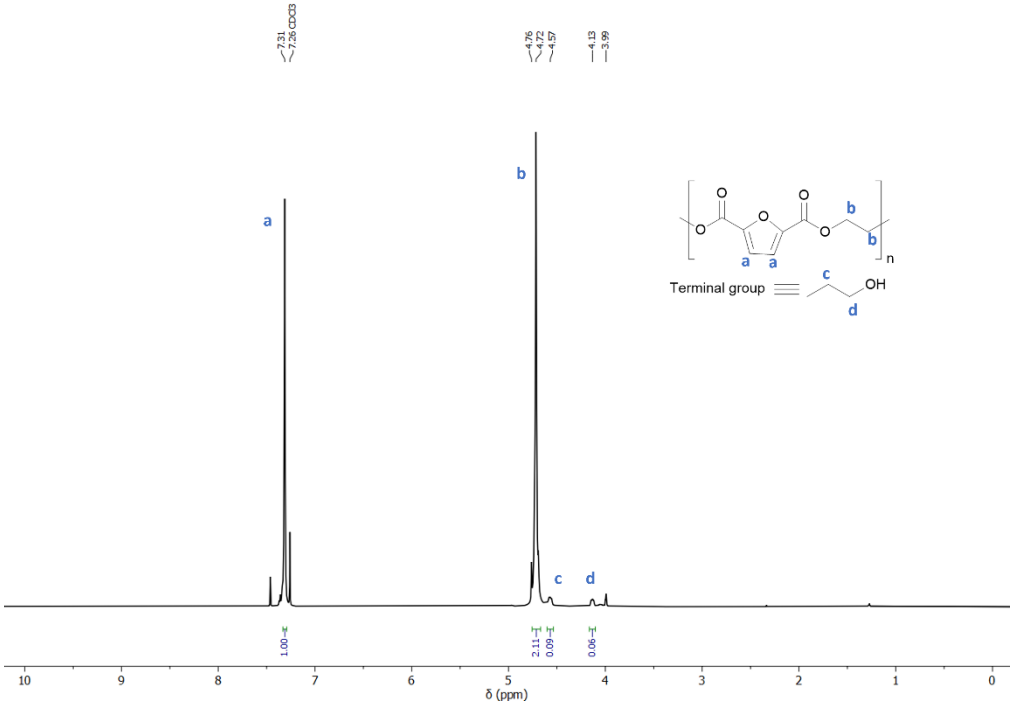

Figure S 4 ^{1}H NMR spectra of rPEF synthesized using the monomer recovered from the methanolysis reaction.

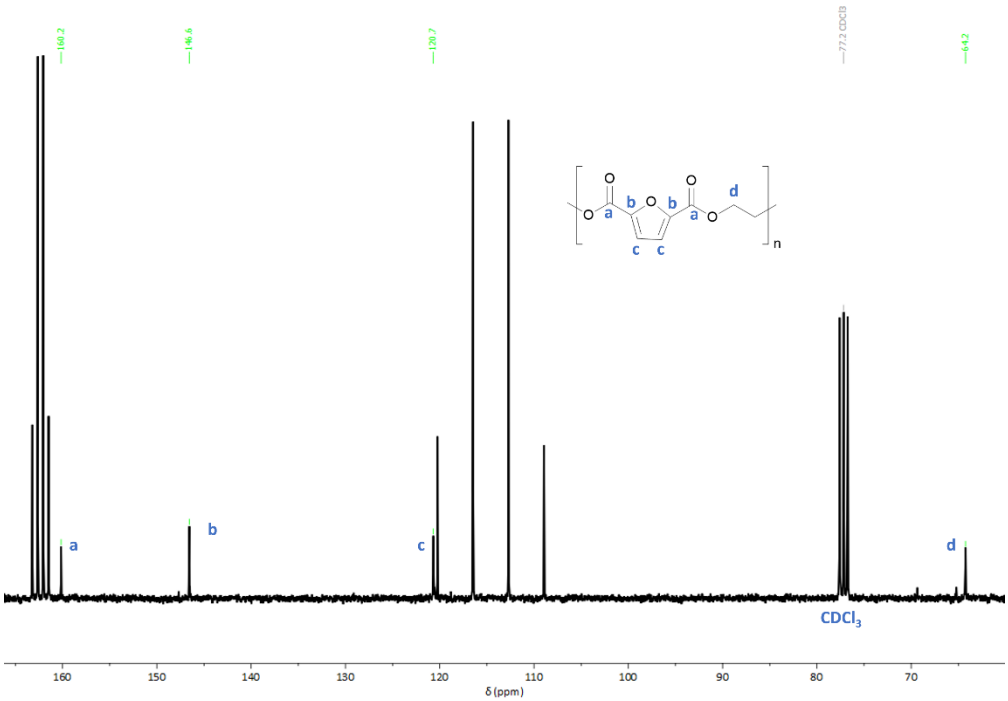

Figure S 5 ^{13}C NMR spectra of rPEF synthetized using the monomer recovered from the methanolysis reaction.

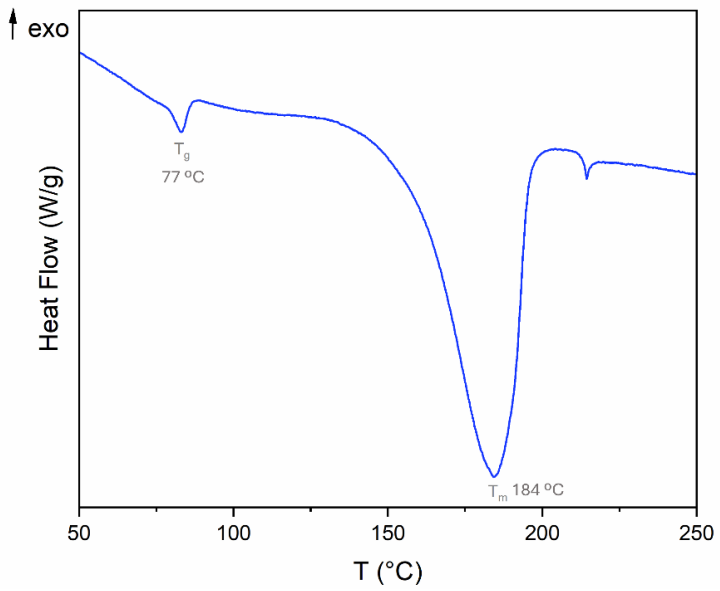

Figure S 6 DSC thermogram of rPEF, first heating scan recorded at 10 ºC/min, under N_2 atmosphere.

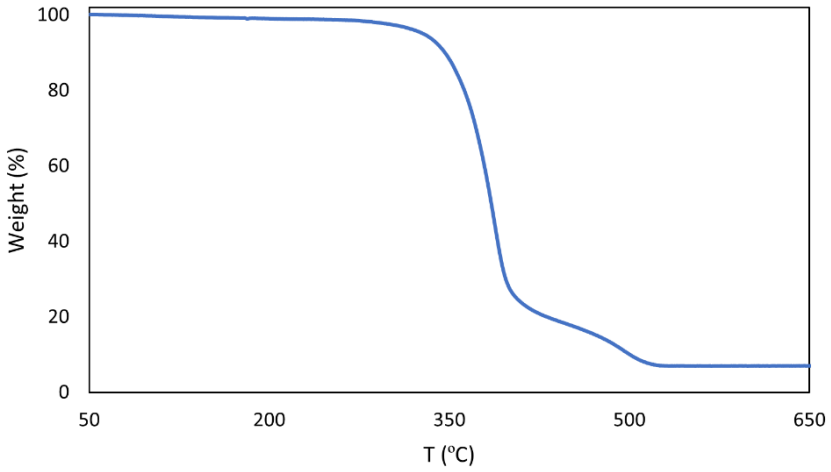

Figure S 7 TGA traces of PEF synthetized using the recycled monomer from PEF methanolysis.