Supplementary Materials

From fossil to bio–based AESO–TiO_2 microcomposite for engineering applications

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Test S1: Characterization of the acrylated and epoxidized soybean oil (AESO)

The presence of the acrylate group in AESO was demonstrated via the ^{1}H–NMR technique. Figure S1 depicts the ^{1}H–NMR spectrum of AESO. The signal peaks at 5.7–6.2 ppm are consistent with acrylate ester entities. The signal peaks from 5.1–5.3 ppm and 4–4.5 ppm denote the –CH_2–CH–CH_2– glycerol methine and glycerol methylene protons, respectively, from the triglyceride backbone [1]. The weak signals in the range 3.2–4 ppm correspond to each hydroxyl group created for every acrylate moiety bonded to a triglyceride. The low intensity peaks in the range 2.8–3.2 ppm describe the protons of the epoxide ring owed to incomplete acrylation. A complete acrylation reaction of epoxidized soybean oil has not yet been reported, due to the bulkiness of the triglyceride molecule [2]. The following peaks are also attributed: –(CH_2)n– at 1.1–1.4 ppm, terminal –CH_3 at 0.9–1.1 ppm, α–CH_2–(C=O)–O– at 2.2–2.4 ppm and β–CH_2–(C=O)–O– at 1.6–1.8 ppm [2]. In order to calculate the number of acrylate groups per molecule AESO or acrylation degree the peak of terminal –CH_3 groups (0.9–1.1 ppm) was used as internal standard. The acrylation degree was estimated from the ratio of peak areas $A_{5.7–6.2\ ppm}/A_{0.9–1.1\ ppm}$ and found to be 2.42. This is in good agreement with literature data, according to which the acrylation degree for the commercial AESO Vikoflex© 7170, for example, is 2.76 [2].

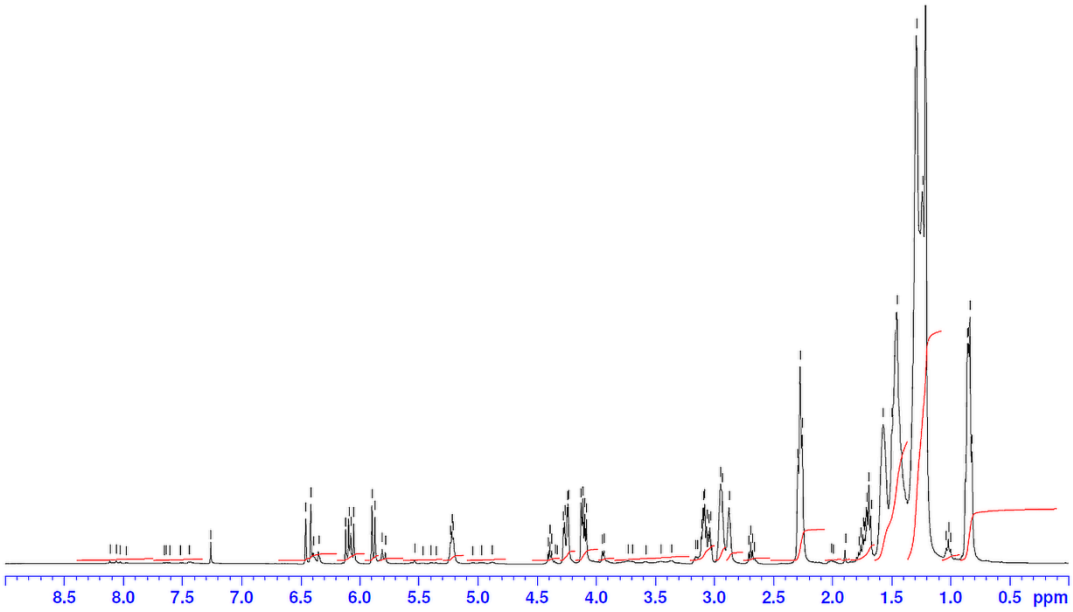

Figure S1. The ^{1}H–NMR spectrum of AESO

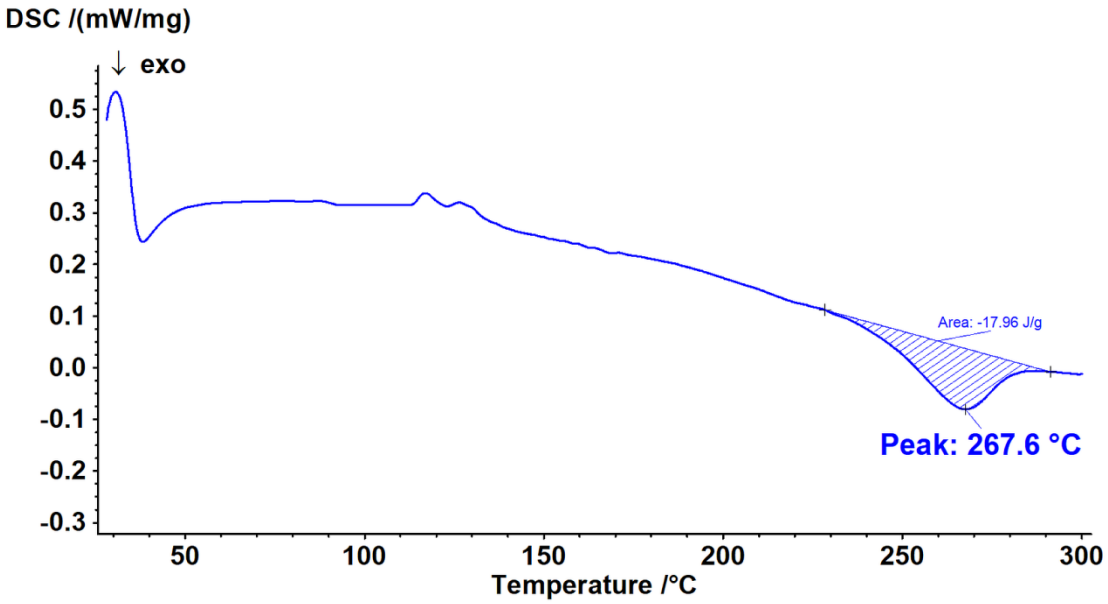

Figure S2. The first DSC heating curve of AESO –TiO_2 formulation.

Table S1. Thermal analyses data.

Sample	Stage	T_s (^oC)	$T_{5\%}$ (^oC)	T_{peak} (^oC)	$T_{30\%}$ (^oC)	M (%)	R (%)	T_g (^oC)
AESO	I	150	197	390	380	64.31	5.46	–
	II			420		17.83		
	III			454		12.35		
AESO–m	I	180	340	393	387	57.14	7.49	–20
	II			426		19.85		
	III			460		14.71		
AESO–TiO_2	I	183	342	400	395	48.89	5.52	–10
	II			430		28.17		
	III			462		16.49		

T_s – static heat resistant index; $T_{5\%}$ – temperature at 5% mass loss; T_{peak} – temperature of maximum rate of decomposition; $T_{30\%}$ – temperature at 30% mass loss; M – percentage of mass loss for each stage; R – percentage of mass residue remained at 700 ^oC; T_g – glass transition temperature

References

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2. Saithai P, Lecomte J, Dubreucq E, Vanrattanakul V (2013) Effects of different epoxidation methods of soybean oil on the characteristics of acrylated epoxidized soybean oil–co–poly(methyl methacrylate) copolymer. Express Polym Lett 7:910-924. doi: 10.3144/expresspolymlett.2013.89