

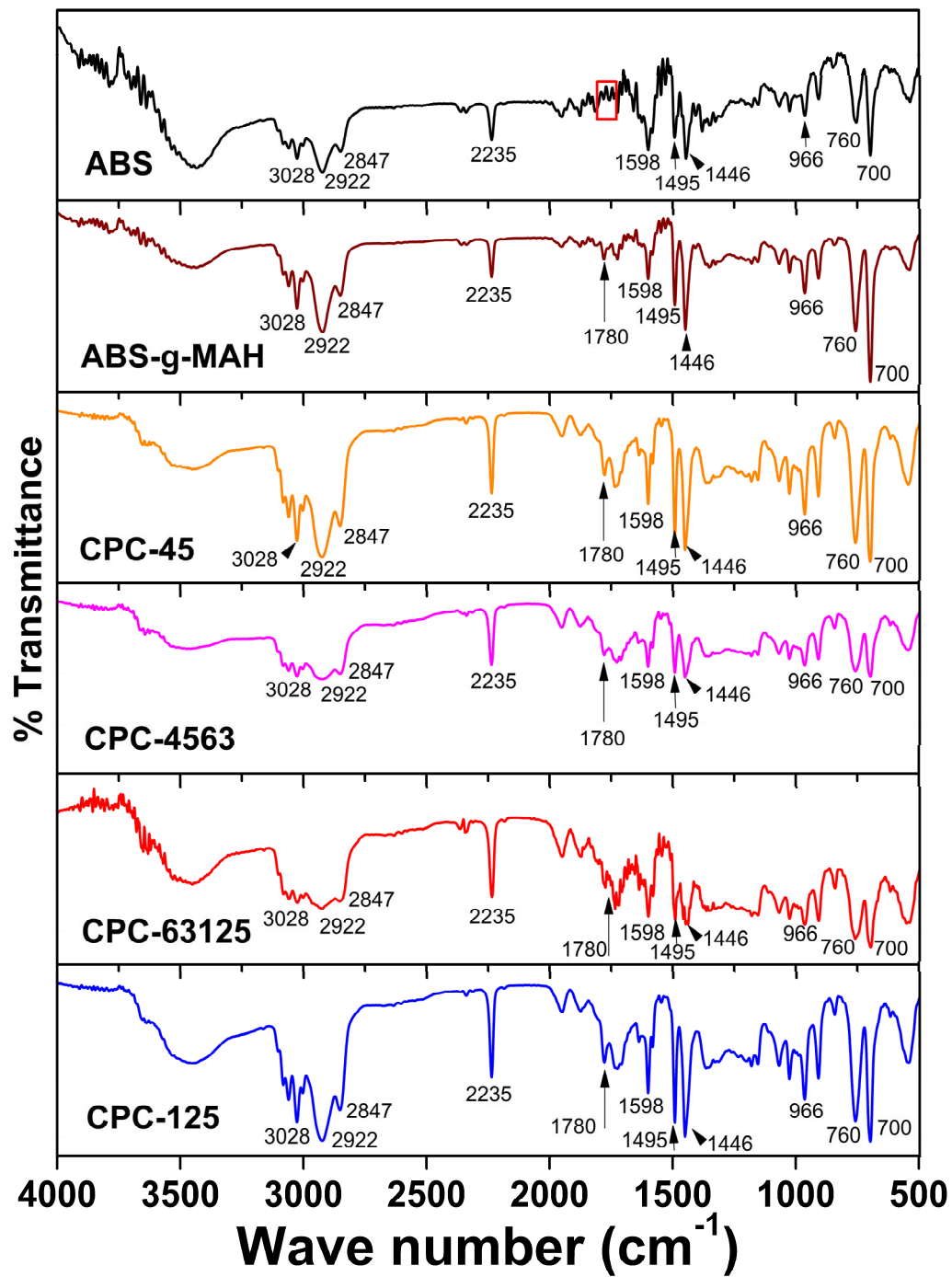
“Supplementary Information: Additional data IR, TGA characterization, and ANOVA analysis”

S1 FTIR Table 1. Characteristics bands of ABS present in all samples.

Band	Organic Group	References*
700 cm ⁻¹ and 760 cm ⁻¹	aromatic C-H bending, =CH bending	[37,43]
966 cm ⁻¹	1,4-butadiene group (associated to =C-H- bending)	[50]
1446 cm ⁻¹	aliphatic C-H bending stretching	[45]
1495 cm ⁻¹ and 1598 cm ⁻¹	aromatic ring stretching	[43,44]
2235 cm ⁻¹	acrylonitrile unit, -CN	[37,44]
2847 cm ⁻¹ , 2922 cm ⁻¹ , and 3028 cm ⁻¹	methyl group, -CH ₃	[43,44]
3300 cm ⁻¹	Additives of ABS	[43]

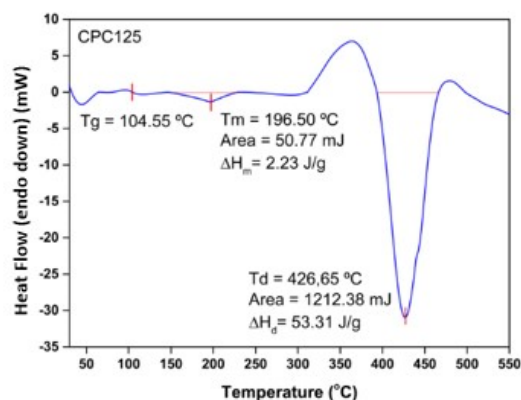
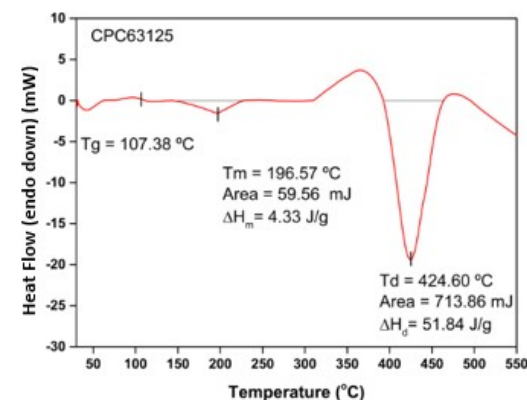
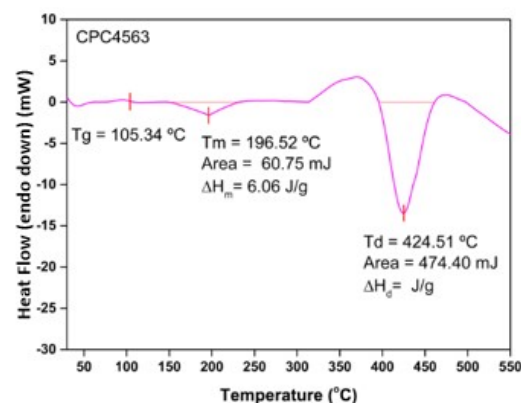
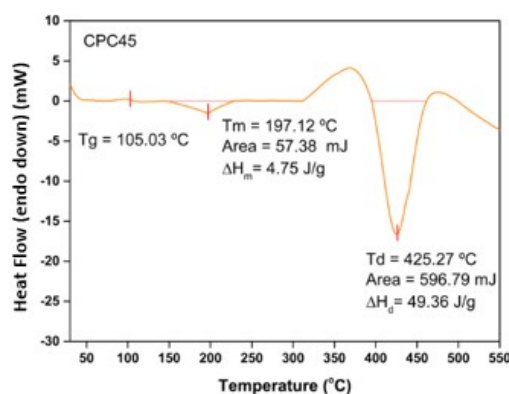
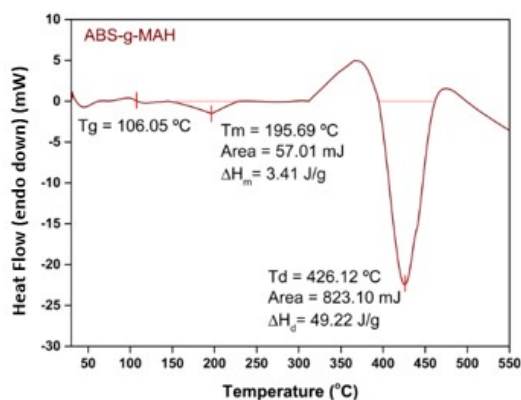
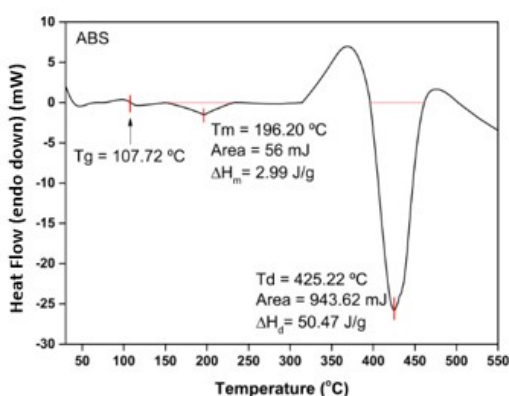
*The references can be found in the article.

S1B. FTIR spectra of ABS, ABS-g-MAH and the CPCs. The characteristics bands are highlighted.



S2 DSC curves of the studied samples

The T_g appears as a change in the baseline of the DSC curve. This occurs due to a change in the heat capacity (C_p) of the material during the transition. This change is not a peak (as in the case of the melting temperature, T_m), but rather a smooth deviation in the curve. The T_m is determined as the maximum peak of the endothermic transition in the DSC curve, which corresponds to the point where the material is absorbing the maximum amount of heat while melting. The enthalpy of fusion (ΔH_m) is calculated as the area under the melting peak. The degradation temperature (T_d) corresponds to the exothermic peak that appears during the material's decomposition. The enthalpy of degradation (ΔH_d) is calculated similarly to the enthalpy of fusion, by evaluating the area under the exothermic peak associated with the degradation process.



S3. Table 2. Mechanical properties values for CPCs.

Samples	E (MPa)	ϵ_R	σ_r
ABS	1631.30±80.06	7.80±2.83	39.45±0.21
ABS-g-MAH	1803.33±4.07	17.47±3.84	44.14±0.13
CPC-45	1576.31±46.71	2.98±0.38	36.71±1.34
CPC-4563	1449.60±41.63	3.43±0.24	36.48±0.38
CPC-63125	1508.14±16.10	3.70±0.13	40.45±0.31
CPC-125	1515.12±29.95	3.23±0.39	41.05±2.18

S4 Statistical analysis ANOVA of mechanical properties

In the following, a statistical analysis of the mechanical data is presented.

For the percentage of elongation at break (ϵ_r %), the ANOVA analysis establishes that there is a significant difference for the population average; therefore, the alternative hypothesis H_1 is accepted. Moreover, the Bonferroni model was applied to reduce the error of multiple comparisons by recalculating the 5% error to assess the significance of the factor considering the P value obtained. After this analysis using the Bonferroni method, we concluded that there was a significant difference between ABS and ABS-g-MAH, as well as between these two samples and the CPC composites. A comparison of the CPC composites with each other, there is no significant difference in the percentage elongation at break.

For Young's modulus (E), the statistical analysis indicated a significant difference for a confidence value of $\alpha = 0.05$, so the alternative hypothesis H_1 was accepted. The Bonferroni method was applied as in the previous case. Once the P-values obtained using the Bonferroni model values were analyzed, it can be concluded that there was a significant difference between ABS-g-MAH and ABS and all the other composites. There was also a significant difference between ABS and all other CPCs. A comparison of the CPC composites showed no significant differences, except for CPC45 and CPC4563.

In the statistical analysis by ANOVA for the tensile strength (σ_r) data, it has been observed, as in the previous mechanical properties, significant differences were observed between the data studied; thus, the alternative hypothesis H_1 has been accepted. Applying the Bonferroni correction and analyzing the P-values with those of the Bonferroni model, significant differences were detected between the ABS and ABS-g-MAH samples. Comparing ABS-g-MAH with other CPCs revealed significant differences. On the other hand, the analysis of the values of the statistical study of ABS compared with those of the CPCs showed significant differences for those composites with smaller cork particle sizes, i.e., CPC45 and CPC 4563. However, in the case of composites with larger particle sizes, i.e., CPC63125 and CPC125, such a difference was not observed. This trend has been maintained for the comparison of CPCs. There was no significant difference between pairs CPC45 / CPC4563 and CPC63125 /CPC125. However, a significant difference was observed between the first and second pair.

S.4.1 Statistical summary for the elongation of the studied samples.

Descriptive Statistics

	N Analysis	N Missing	Mean	Standard Deviation	SE of Mean
ABS	5	0	7,79853	2,83173	1,26639
ABS-g-MAH	5	0	17,47495	3,84044	1,7175
CPC45	5	0	2,98326	0,37753	0,16884
CPC4563	5	0	3,43375	0,2357	0,10541
CPC63125	5	0	3,70215	0,13326	0,05959
CPC125	5	0	3,22622	0,3865	0,17285

Overall ANOVA

	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	5	812,1317	162,42634	42,12871	4,10E-11
Error	24	92,5315	3,85548		
Total	29	904,66319			

Means Comparisons. Bonferroni test

	MeanDiff	SEM	t Value	Prob	Alpha	Sig	LCL	UCL
ABS-g-MAH ABS	9,67642	1,24185	7,79194	7,52E-07	0,05	1	5,62999	13,72284
CPC45 ABS	-4,81526	1,24185	-3,87749	0,01077	0,05	1	-8,86169	-0,76884
CPC45 ABS-g-MAH	-14,49168	1,24185	-11,66943	3,34E-10	0,05	1	-18,5381	-10,44526
CPC4563 ABS	-4,36478	1,24185	-3,51474	0,02665	0,05	1	-8,4112	-0,31836
CPC4563 ABS-g-MAH	-14,0412	1,24185	-11,30668	6,36E-10	0,05	1	-18,08762	-9,99478
CPC4563 CPC45	0,45048	1,24185	0,36275	1	0,05	0	-3,59594	4,4969
CPC63125 ABS	-4,09638	1,24185	-3,29861	0,04533	0,05	1	-8,1428	-0,04996
CPC63125 ABS-g-MAH	-13,7728	1,24185	-11,09055	9,41E-10	0,05	1	-17,81922	-9,72637
CPC63125 CPC45	0,71889	1,24185	0,57888	1	0,05	0	-3,32754	4,76531
CPC63125 CPC4563	0,2684	1,24185	0,21613	1	0,05	0	-3,77802	4,31482
CPC125 ABS	-4,57231	1,24185	-3,68185	0,01758	0,05	1	-8,61873	-0,52589
CPC125 ABS-g-MAH	-14,24873	1,24185	-11,47379	4,72E-10	0,05	1	-18,29515	-10,20231
CPC125 CPC45	0,24295	1,24185	0,19564	1	0,05	0	-3,80347	4,28938
CPC125 CPC4563	-0,20753	1,24185	-0,16711	1	0,05	0	-4,25395	3,83889
CPC125 CPC63125	-0,47593	1,24185	-0,38324	1	0,05	0	-4,52235	3,57049

S.4.2 Statistical summary for the Young's modulus of the studied samples

Descriptive Statistics

	N Analysis	N Missing	Mean	Standard Deviation	SE of Mean
ABS	5	0	1631,3047	80,06202	35,80482
ABS-g-MAH	5	0	1803,3311	4,0741	1,822
CPC45	5	0	1576,3136	46,71668	20,89234
CPC4563	5	0	1449,6048	41,63706	18,62066
CPC63125	5	0	1508,1471	16,09586	7,19829
CPC125	5	0	1515,1247	29,95215	13,39501

Overall ANOVA

	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	5	394473,2305	78894,64609	41,16663	5,24E-11
Error	24	45995,30545	1916,47106		
Total	29	440468,5359			

Means Comparisons. Bonferroni test

	MeanDiff	SEM	t Value	Prob	Alpha	Sig	LCL	UCL
ABS-g-MAH ABS	9,67642	1,24185	7,79194	7,52E-07	0,05	1	5,62999	13,72284
CPC45 ABS	-4,81526	1,24185	-3,87749	0,01077	0,05	1	-8,86169	-0,76884
CPC45 ABS-g-MAH	-14,49168	1,24185	-11,66943	3,34E-10	0,05	1	-18,5381	-10,44526
CPC4563 ABS	-4,36478	1,24185	-3,51474	0,02665	0,05	1	-8,4112	-0,31836
CPC4563 ABS-g-MAH	-14,0412	1,24185	-11,30668	6,36E-10	0,05	1	-18,08762	-9,99478
CPC4563 CPC45	0,45048	1,24185	0,36275	1	0,05	0	-3,59594	4,4969
CPC63125 ABS	-4,09638	1,24185	-3,29861	0,04533	0,05	1	-8,1428	-0,04996
CPC63125 ABS-g-MAH	-13,7728	1,24185	-11,09055	9,41E-10	0,05	1	-17,81922	-9,72637
CPC63125 CPC45	0,71889	1,24185	0,57888	1	0,05	0	-3,32754	4,76531
CPC63125 CPC4563	0,2684	1,24185	0,21613	1	0,05	0	-3,77802	4,31482
CPC125 ABS	-4,57231	1,24185	-3,68185	0,01758	0,05	1	-8,61873	-0,52589
CPC125 ABS-g-MAH	-14,24873	1,24185	-11,47379	4,72E-10	0,05	1	-18,29515	-10,20231
CPC125 CPC45	0,24295	1,24185	0,19564	1	0,05	0	-3,80347	4,28938
CPC125 CPC4563	-0,20753	1,24185	-0,16711	1	0,05	0	-4,25395	3,83889
CPC125 CPC63125	-0,47593	1,24185	-0,38324	1	0,05	0	-4,52235	3,57049

S.4.3 Statistical summary for the Tensile Strength of the studied samples

Descriptive Statistics

	N Analysis	N Missing	Mean	Standard Deviation	SE of Mean
ABS	5	0	39,44477	0,21018	0,09399
ABS-g-MAH	5	0	44,13856	0,13139	0,05876
CPC45	5	0	36,71446	1,33573	0,59736
CPC4563	5	0	36,4789	0,37622	0,16825
CPC63125	5	0	40,44943	0,30692	0,13726
CPC125	5	0	41,05116	2,17594	0,97311

Overall ANOVA

	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	5	207,20585	41,44117	36,47957	1,87E-10
Error	24	27,26425	1,13601		
Total	29	234,4701			

Means Comparisons. Bonferroni test

	MeanDiff	SEM	t Value	Prob	Alpha	Sig	LCL	UCL
ABS-g-MAH ABS	4,69379	0,6741	6,9631	5,04E-06	0,05	1	2,49733	6,89025
CPC45 ABS	-2,73031	0,6741	-4,05033	0,00696	0,05	1	-4,92677	-0,53385
CPC45 ABS-g-MAH	-7,4241	0,6741	-11,01343	1,08E-09	0,05	1	-9,62056	-5,22764
CPC4563 ABS	-2,96587	0,6741	-4,39977	0,00287	0,05	1	-5,16233	-0,76941
CPC4563 ABS-g-MAH	-7,65966	0,6741	-11,36287	5,75E-10	0,05	1	-9,85612	-5,4632
CPC4563 CPC45	-0,23556	0,6741	-0,34945	1	0,05	0	-2,43202	1,9609
CPC63125 ABS	1,00466	0,6741	1,49039	1	0,05	0	-1,1918	3,20112
CPC63125 ABS-g-MAH	-3,68913	0,6741	-5,47271	1,89E-04	0,05	1	-5,88559	-1,49267
CPC63125 CPC45	3,73497	0,6741	5,54072	1,60E-04	0,05	1	1,53851	5,93143
CPC63125 CPC4563	3,97053	0,6741	5,89016	6,70E-05	0,05	1	1,77407	6,16699
CPC125 ABS	1,6064	0,6741	2,38304	0,38153	0,05	0	-0,59006	3,80286
CPC125 ABS-g-MAH	-3,08739	0,6741	-4,58006	0,00181	0,05	1	-5,28385	-0,89093
CPC125 CPC45	4,3367	0,6741	6,43337	1,78E-05	0,05	1	2,14024	6,53316
CPC125 CPC4563	4,57226	0,6741	6,78282	7,71E-06	0,05	1	2,3758	6,76872
CPC125 CPC63125	0,60173	0,6741	0,89265	1	0,05	0	-1,59473	2,79819

S5 Full-resolution versions of the tensile test figures

