

Thermal Stability and Fire Retardant Properties of Polyamide 11 Microcomposites containing different Lignins

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Table S1. Assignment of the various peaks detected in FTIR spectra.

Peak label	LL	LS	KL	DL	Peak assignment
	Peak (cm ⁻¹)				
1	3397	3415	3398	3411	O–H stretching vibration
2	2929	2929	2929	2931	C–H stretching in methyl and methylene group
3	2835	2835	2835	2835	C–H stretching in methyl and methylene group
4	1760	-	-	-	C=O Stretch in unconjugated carbonyl and ester groups
5	1695	-	1693	1693	C=O Stretching conjugated carbonyl (in aromatic ring)
6	1591	1591	1591	1593	Aromatic skeletal vibration and C=O Stretching
7	1508	1504	1512	1512	Aromatic skeletal vibration
8	1450	1459	1452	1459	C–H deformation in methyl and methylene group
9	1416	1416	1421	1423	Aromatic skeletal vibrations combined with C–H in-plane deform.
10	-	-	1356	1356	Aliphatic C–H Stretch in CH ₃ , not in O–Me
11	-	1261	1265	1267	C–O of the guaiacyl ring (G unit)
12	-	1209	1209	1209	C–C plus C–O Stretching typical of G units
13	1178	-	-	-	asymmetric and symmetric –SO ₂ vibrations
14	1130	1130	1132	1138	aromatic C–H in-plane deformation; typical of G units
15	-	1076	1076	1074	C–O deformations of secondary alcohols and aliphatic ethers
16	1039	1039	1029	1029	Aromatic C–H in plane deformation (G>S)
17	-	848	848	848	C–H out-of-plane in Position 2, 5 and 6 of G units
18	-	-	810	810	C–H out-of-plane in Position 2, 5 and 6 of G units
19	657	659	-	-	sulfonic groups (S–O stretching vibration) Typical in sulphonate containing lignin

Table S2. Thermal properties of PA11/lignin microcomposites.

Samples	T _m onset (°C)	T _m Peak (°C)	ΔH _m (J/g)	T _c onset (°C)	T _c Peak (°C)	ΔH _c (J/g)	X _c (%) ± 0.5–0.7
PA ₁₀₀	179.0	187.1	52.8	161.8	157.4	47.7	27.9
PA ₉₅ -LS ₅	178.8	187.1	57.6	163.3	160.4	47.0	32.0
PA ₉₀ -LS ₁₀	179.9	187.0	52.6	162.3	158.1	43.4	30.9
PA ₈₅ -LS ₁₅	179.2	186.8	48.3	162.4	158.4	39.9	30.1
PA ₈₀ -LS ₂₀	178.5	186.7	46.0	162.5	158.8	40.8	30.4
PA ₉₅ -LL ₅	180.7	187.2	58.3	163.4	159.6	47.1	32.5
PA ₉₀ -LL ₁₀	180.5	187.0	56.5	163.5	159.7	45.9	33.2
PA ₈₅ -LL ₁₅	180.3	186.4	48.6	162.3	158.4	40.4	30.3
PA ₈₀ -LL ₂₀	179.0	185.1	44.3	160.1	155.2	38.0	29.3
PA ₉₅ -KL ₅	179.2	187.0	57.6	162.6	159.1	48.6	32.1
PA ₉₀ -KL ₁₀	179.2	186.7	53.6	161.0	156.1	45.6	31.5
PA ₈₅ -KL ₁₅	178.0	185.2	52.1	160.5	154.7	44.9	32.4
PA ₈₅ -KL ₂₀	177.8	184.8	46.7	159.2	154.2	41.7	30.9
PA ₉₅ -DL ₅	179.2	186.6	61.0	162.1	158.0	51.9	34.0
PA ₉₀ -DL ₁₀	179.4	185.9	57.7	161.9	157.8	49.5	33.9
PA ₈₅ -DL ₁₅	178.0	185.4	54.3	160.4	156.6	48.0	33.8
PA ₈₀ -DL ₂₀	177.4	184.4	41.5	157.7	152.8	44.9	27.5