Supporting Information

A Potential of New Untreated Bio-reinforcement from *Caesalpinia Sappan L.* Fiber for Polybutylene Succinate Composite film

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1. FTIR spectra of CSWF, PBS, and PBS/CSWF composite films.

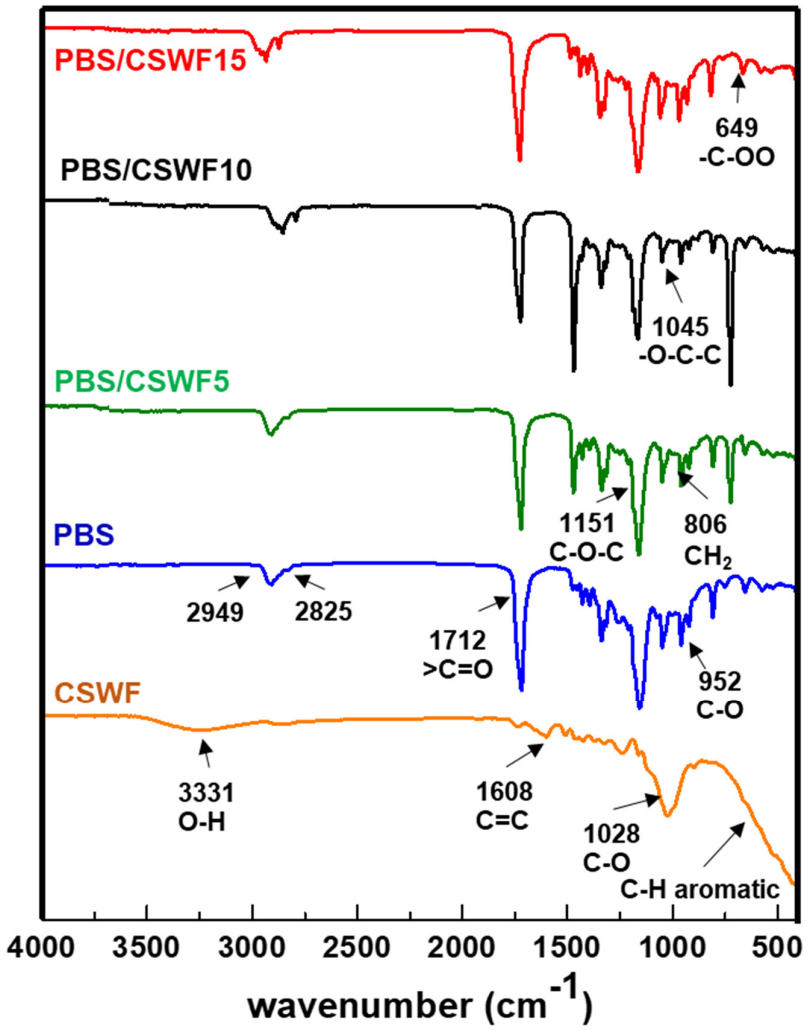

Figure S1. FTIR spectra of CSWF (orange), PBS (bleu), and PBS/CSWF composite films with 5 (green), 10 (black) and 15 (red) phr.

Figure S1 illustrates the FTIR spectra of CSWF, PBS, and PBS/CSWF composite films. The symmetric stretching of the methyl group (– CH3) and the asymmetric stretching of the methylene group (C – H) were found at 2949 and 2825 cm^{-1}, respectively, for neat PBS. The stretching vibration of the ester carbonyl group (>C=O) and C–O–C was observed to exhibit strong peaks at 1712 and 1151 cm^{-1}. The bands at 1045, 952, 806 and 648 cm^{-1} were assigned to O– C– C stretching, C–O stretching, CH_2 in $OC(CH_2)_2CO$ in plane bending, and -COO bending, respectively [1]. CSWF revealed a characteristic peak at 3331, 1608, and 1028 cm^{-1}, which correspond to O–H, C=C, and C–O stretching from cellulose and Brazilin agent in CSWF, as reported in another study [1–3]. The FTIR spectra for the PBS/CSWF composite films were comparable to neat PBS, although there were marked differences.

2. Thermal degradation characteristics of PBS/CSWF composite film by TGA and DTG

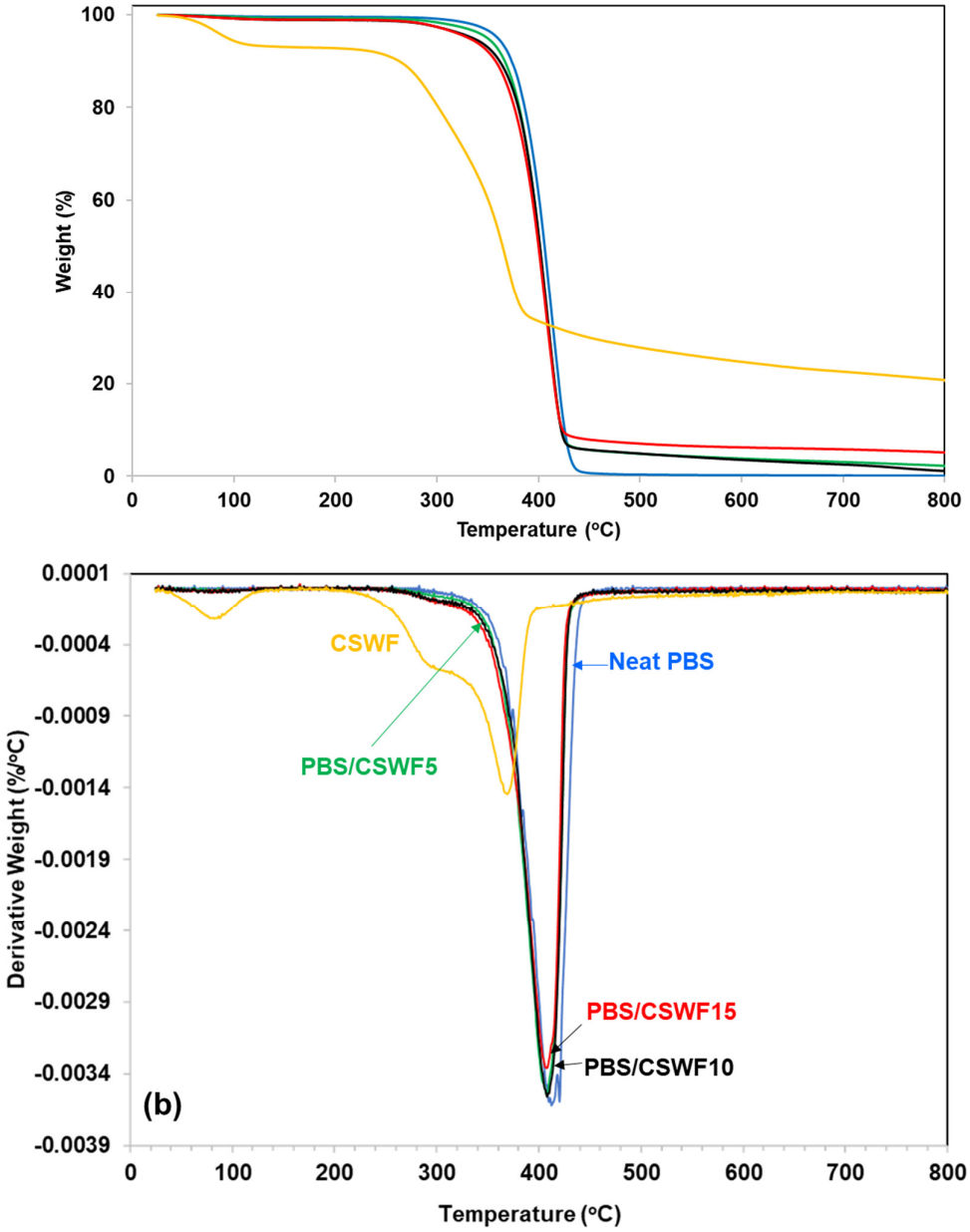

Figure S2. Thermal degradation characteristics of PBS/CSWF composite film by TGA and DTG.

The thermal degradation characteristics of PBS/CSWF composite film series are also investigated using TGA and DTG. As seen in Figure S2, the DTG curves of all PBS composite films exhibit only one distinct step of degradation. The PBS component is

responsible for the most of the degradation. Two step of degradation peaks were observed in the CSWF. The first peak, T_{max} of 85 °C, indicates a moisture loss in CSWF. The second peak, with a T_{max} of 370 °C, represents a cellulose breakdown [4–6]. The degradation temperature of neat PBS film is 413 °C. The thermal stability degradation curves of the PBS/CSWF composite films fall between those of the PBS matrix and the CSWF. The thermal stability of the composites is lowered owing to the incorporation of the CSWF, which is related to other studies [4,7]. T_{max} values decrease slightly as CSWF content increases, indicating 409, 408 and 406 °C for PBS/CSWF5, PBS/CSWF10, and PBS/CSWF15, respectively. Because the breakdown temperature of cellulose is lower than that of PBS, the T_{max} values of composite degradation are slightly reduced. Furthermore, the addition of CSWF enhanced the weight residual, related to the content of additive.

References

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