

Sustainable composites from poly(3-hydroxybutyrate) (PHB) bioplastic and agave natural fibre

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Supporting Information

1. Experimental
 - 1.1 Agave fibre

The extraction of agave fibre is a tedious process¹ and usually it is generated as a byproduct of Tequila production. Tequila is prepared by the distillation of fermented juice of agave plant, Agave tequilana. The agave fibre which we have used is obtained from Mexico, which is the main worldwide producer in this traditional industry and 75 % of agave species are from Mexico.² The properties of agave fibre will vary according to the sources. Prior to the processing, we have not adopted any treatment method or washing³ to avoid the water consumption and hence to achieve more economic green composite based on agave natural fibre and PHB bioplastic.

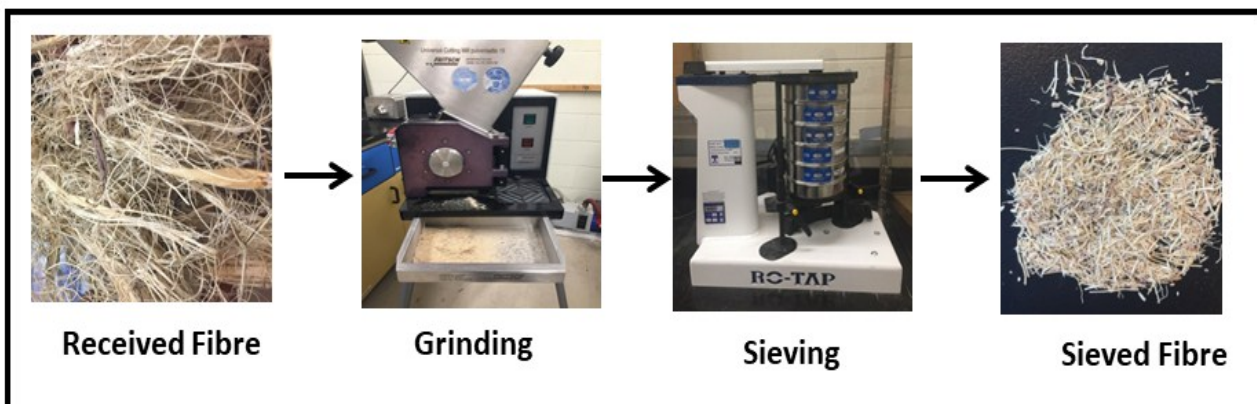


Figure S1: Digital images of agave fibre before and after grinding and sieving processes

2. Grafting Parameters

The grafting percentage (% GP) and grafting efficiency of (% GE) of PHB on agave was calculated using the following equations.⁴

$$\% \text{ GP} = (W_{\text{gPHB}} - W_{\text{AF1}}) / W_{\text{AF1}} \times 100 \text{--- (1)}$$

$$\% \text{ GE} = (W_{\text{gPHB}} - W_{\text{AF1}}) / W_{\text{PHB1}} \times 100 \text{--- (1)}$$

Where W_{gPHB} , W_{AF1} and W_{PHB1} are the weights of the grafted PHB recovered after Soxhlet extraction, initial weight of agave fibre and initial weight of PHB respectively.

Table S1: Grafting percentage and grafting efficiency of PHB agave composites

Sample ID	Grafting Percentage (%)	Grafting efficiency (%)
75/25/0	0.16±0	0.06
75/25/0.1 phr	26±6	7±2

The increased grafting percentage and grafting efficiency of PHB_agave composites after luperox addition confirms the grafting reaction between PHB and agave induced by the organic peroxide.

3. SEM analysis

The SEM images of impact fractured surfaces of 75/25/0.5phr are given in Figure S1.

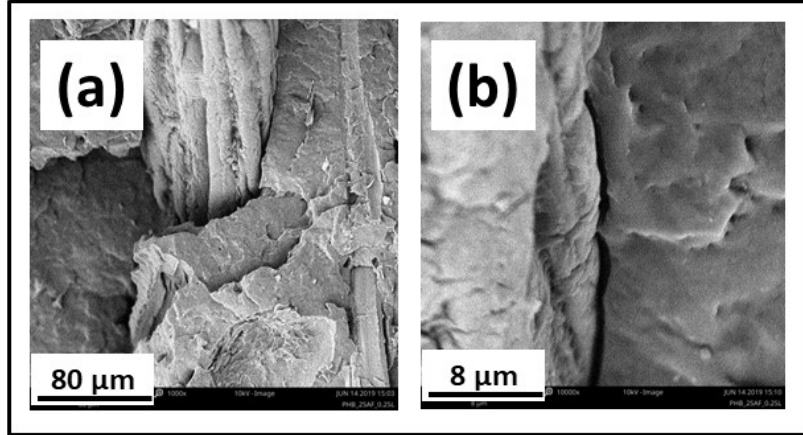


Figure S2: SEM images of 75/25/0.5phr (a) at 1000x magnification and (b)10000x magnification

4. Thermogravimetric analysis

Table S2: TGA of agave fibre, neat PHB and their composites with and without organic peroxide

Sample	Onset Degradation Temp. (°C)	Max. Degradation Temp. (°C)			Char Residue at 600 °C (%)
Agave Fibre	257.1 (1.73)	301.7 (0.33)	364.3 (0.70)	491.5 (2.23)	18.94 (1.86)
Neat PHB	272.2 (2.52)	293.1 (1.10)			0.78 (0.54)
85/15/0	275.0 (0.19)	289.5 (0.20)			3.88 (0.81)
75/25/0	275.3 (0.55)	287.6 (0.66)			5.92 (1.50)
75/25/0.05	274.6 (0.95)	286.3 (0.91)			4.57 (0.34)
75/25/0.1	270.1 (1.94)	283.8(1.29)			5.48 (0.98)
75/25/0.25	273.5 (0.39)	284.9 (0.24)			6.21 (0.81)
75/25/0.5	272.6 (0.2)	284.5 (0.21)			5.36 (0.98)

Reference

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