Electronic Supplementary Information

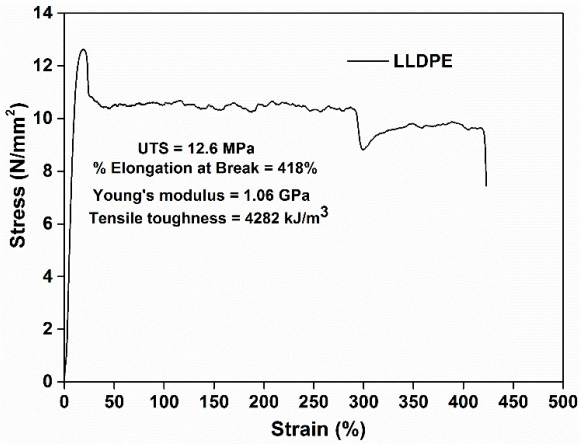
Bamboo Flour filled Cost-effective Poly(ε-caprolactone) Biocomposite: A Potential Contender in Flexible Cryo-packaging Applications

*Purabi Bhagabati, Deepshikha Das, Vimal Katiyar**

Department of Chemical Engineering, Indian Institute of Technology Guwahati,

Guwahati, Assam 781039, India

*Corresponding Email id: vkatiyar@iitg.ac.in



Supplementary Figure S1: Stress-strain plot of neat LLDPE. The UTS (MPa), % Elongation at break, Young's modulus (GPa) and Tensile toughness (kJ/m^3) values are presented.

Studies on Physical properties

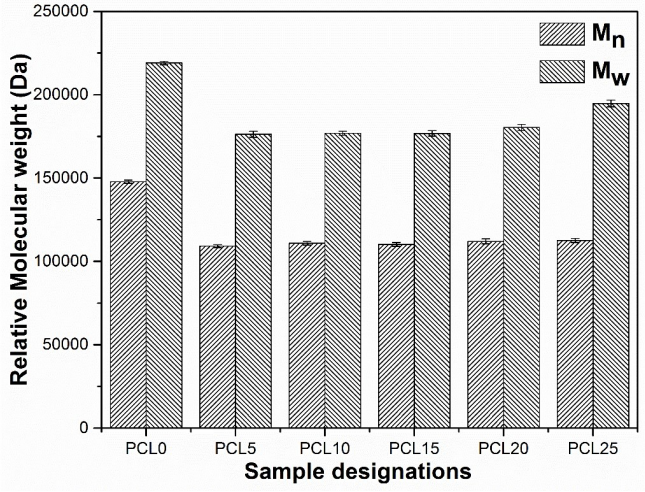
Gel permeation chromatography (GPC) analysis

Effect of processing conditions and bamboo-root flour biofillers upon the molecular weight of PCL were determined by analysing the number average molecular weight (M_n) and weight average molecular weight (M_w) of PCL matrix using gel permeation chromatograph (GPC) analyser equipped with a high-performance liquid chromatography (HPLC) system and refractive index (RI) detector (Shimadzu, Model LC-20A which is fitted into two PL gel columns in series with guard columns, Agilent). HPLC grade chloroform was used as an eluent at 74 kgf pressure with column temperature 40 °C running at flow rate of 1 mL/min. The complete GPC system was calibrated using linear polystyrene (PS) standard of narrow polydispersity index (PDI) as internal standard. In case of biocomposites with high

concentration of bamboo-root flour as biofiller, the samples were filtered using Teflon syringe filter of pore size 0.2 μm, diameter 25 mm (AXIVA) for analysis.

GPC results and analysis

The molecular weight analysis from the GPC data shows clear reduction in both number average and weight average molecular weight of PCL in the biocomposites. The GPC plots of all the samples are shown in bar format in **Supplementary Figure S2**. There is not much change in molecular weight of PCL in the biocomposites from each other. A well-defined unimodal molecular weight distribution is observed for all samples without any associated minor peak. This indicates that the processing of PCL based bamboo-root flour biocomposites did not cause any degradation in the base PCL matrix. The processing temperature being far below the degradation temperature of the neat PCL and bamboo-root flour may have combinatorial synergistic effect upon its physical properties. A consistency in PDI value of PCL biocomposites found to exist, which represents no adverse effect of temperature or oxidative degradation condition upon molecular level. However, the peak in the PCL biocomposites are slightly broader than the neat PCL indicating formation of short polymer chains, which is evident from the decreased M_n and increased PDI of biocomposites over PCL0 sample. The visible clear reduction in molecular weight of all PCL based biocomposites over the neat PCL can be due to the effect of hygroscopic biofiller induced thermo-mechanical chain scission of PCL.



Supplementary Figure S2: Number average (M_n) and weight average (M_w) molecular weight of neat PCL and PCL biocomposites obtained from the GPC analysis