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J Material Sci Eng 2019, Volume 8
DOI: 10.4172/2169-0022-C1-126

17th International Conference on

Emerging Materials and Nanotechnolgy

March 07-08, 2019 | Berlin, Germany

Mechanical and wear behaviour of polylactic acid matrix composites reinforced with crab-shell synthesized chitosan particles

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Polylactic acid (PLA) matrix composites reinforced with chitosan particles were developed by compression moulding technique. The chitosan particles were synthesized from crab shell chemically by deproteinization, demineralization and deacetylation processes. The particles size, functional group, structure and morphology of the chitosan particles were determined with the aid of horiba dynamic light scattering particle size analyzer, Fourier Transfer Infrared Spectrophotometer (FTIR), X-Ray Diffractometer (XRD) and Scanning Electron Microscope (SEM) respectively. PLA and various weight fractions (2, 4, 6, 8 and 10 wt.%) of chitosan particles were melt-blended using a HAAKE PolyLab OS Rheomix batch mixer (Thermo Electron Co., USA), operated at a rotor speed of 60 rpm and a temperature of 162°C for 10 min. The blends were then moulded into different test specimens using carver laboratory press at a temperature of 190°C for 12 minutes under applied pressure of 0.2 kPa. The mechanical properties (tensile, hardness, impact) and wear behaviour of the developed composites were studied. The results showed that there was drastic improvement in the mechanical and wear properties of the developed PLA matrix composites. The optimum values were found at 6 wt.% chitosan particles reinforcement. The scanning electron microscopic examination of the composites revealed that there were homogeneous particles dispersion at lower weight fractions (2-6 wt.%) while particles agglomerations were noticed on the SEM images at higher weight fractions (8-10 wt.%).

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