

Synthesis and characterization of shape-stable bio-char composite PCM material for solar desalination application

K. Ravikumar¹, G. V. Nagesh², R.Venkateswara Rao², T. Gunavardhana Naidu³, A. Saikiran⁴, R. Swapna⁵, S. Hariprasad^{3*}

¹*Department of Mechanical Engineering, National Institute of Technology, Tiruchirappalli-620015, Tamil Nadu, India*

²*Department of Physics, Lendi Institute of Engineering and Technology, Jonnada-535005, Vizianagaram, Andhra Pradesh, India*

³*Department of Physics, Basic Science & Humanities, Aditya Institute of Technology and Management (AITAM), Tekkali-532201, Srikakulam, Andhra Pradesh, India*

⁴*School of Marine Engineering and Technology, Indian Maritime University Chennai Campus, Chennai -600119, Tamil Nadu, India*

⁵*Department of Physics, Basic Science & Humanities, Avanthi Institute of Engineering and Technology, Tagarapuvalasa-531162, Vizianagaram, Andhra Pradesh, India*

***Corresponding author:** sh.prasad5@gmail.com

Abstract: In the present study, three different D-Mannitol based activated bio-char composite shape-stable phase change materials (PCM) were developed for medium temperature energy storage applications like solar desalination, solar thermal storage and waste heat recovery with varying bio-char compositions. The activated bio-char (A-BC) composite-based samples were prepared from sawdust by using the pyrolysis method. The phase composition, morphology, latent heat capacity and phase change temperature of the fabricated samples were assessed by XRD, SEM, differential scanning calorimetry (DSC) and Fourier transform infrared spectroscopy (FTIR). The fabricated bio-char composite materials exhibited good thermal properties and structural stability compared to pure PCM. The phase change material with a blend of minimum 15 wt.% activated bio-char and 85% D-Mannitol was observed to be leak resistant. FTIR and XRD results confirm that the chemical properties of the bio-char composite remain the same as the pure PCM, which confirms that there are no chemical interactions between the PCM and bio-char. PCM sample with 15% activated bio-char exhibited an enhanced thermal stability compared to the pure PCM.

Key words: *Phase change material; Activated bio-char; Thermal energy storage; Thermal conductivity, Solar desalination.*