NCON-PGR_2022_016

Synthesis and Characterization of Stearic Acid/Waste Filler Materials as Composite Phase Change Material in Thermal Energy Storage Application

Siti Amirah Abdul Ghani*[a], *Mohd-Nasir Nor Shafiqah*[a] *and* *Sumaiya Zainal Abidin*[b]

[a]Department of Chemical Engineering, College of Engineering, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300, Gambang, Kuantan, Pahang, Malaysia

[b]Centre for Research in Advanced Fluid & Processes (FLUID CENTRE), Universiti Malaysia Pahang, 26300 Gambang, Kuantan, Pahang, Malaysia

**Corresponding author:* sumaiya@ump.edu.my

Abstract

This paper investigates the potential of waste materials, i.e. recycled aluminum cans and carbon biochar (carbon BC) wastes as fillers in stearic acid as PCM supporting matrix material. Using recycled aluminum powder (recycled Al powder) and carbon BC, a new invention of composites phase change material (C-PCM) was established. These C-PCM, which has been was incorporated with different waste fillers, were prepared at different waste mass loading and further characterized using scanning electron microscope (SEM), Fourier infrared spectroscopy (FTIR), differential scanning calorimetry (DSC), pycnometer density analysis, and thermal thermogravimetric analysis (TGA). The result showed that both C-PCM were uniformly dispersed into stearic acid (SA) and portrayed a good contact surface area. The C-PCM with recycled Al powder filler results in higher melting and freezing latent heat than C-PCM with carbon BC filler. Thermal cycle test analysis of selected C-PCM exhibited good thermal stability, reliability, and effective latent heat storage. From the thermal evaluation test, the storage performance of C-PCM was found to perform better compared to lone SA as PCM (SA-PCM). Despite having low latent heat compared to lone PCM, the addition of waste materials into SA has increased C-PCM's thermal stability. Al/SA C-PCM is identified as the most effective TES medium since it gives the best thermal stability and latent heat values.

Keywords: Waste material filler; Recycled aluminum can; Carbon biochar; Phase change material composite; Thermal energy storage.