

# REVIEW ON THE UTILIZATION OF WASTE MATERIAL AS A POTENTIAL SUBSTITUTE FOR THE PHASE CHANGE MATERIAL USED IN THERMAL ENERGY STORAGE SYSTEM

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## Abstract

Recently, great attention has been focused on the application of thermal energy storage (TES) as one of the key solution towards the most effective heat and energy storage system. TES in a form of phase change material (PCM) has been recognized as one of the efficient method for energy management and conservation system. PCM has been widely used in many applications and significant number of literatures has been published to highlight the potential use of PCM as TES material. In the last few decades, various combination of materials has been used to improve the quality and performance of PCM. However, although the information is quantitatively enormous and the application of waste has becoming a trending subject nowadays, documented researches on PCM material derived from waste material are still very scarce. Therefore, in this paper, in-depth reviews on the implementation of potential waste materials in PCM considering its purposes in improving the TES performance, economic values and environment were explored, investigated and reviewed. Overall, this review shows a potential utilization of waste materials as a new substitute to produce an efficient, cost-effective and environmentally friendly PCM in the future TES system.

**Keywords:** Thermal energy storage; Phase change material; Matrix filler; Composite; Waste materials.

## Contents

1. Introduction .....	1
2. Phase Change Material Criteria and Properties in Thermal Energy Storage Medium .....	3
2.1 Classification of Phase Change Material .....	4
2.2 Development of Phase Change Material Composite .....	7
3. Waste Material as Phase Change Material Substitution .....	9
4. Conclusion .....	12
5. References .....	14

## 1. Introduction

For decades, the limited reserves of fossil fuel, rapid growth of global energy consumption, and the increase of environmental problems has arisen the concern on the importance of effective energy utilization. In the last few decades, renewable energy have been introduced as the potential energy replacement as it has the ability to avert the growing concern of environmental problems such as climate change, greenhouse gas emission, global warming and thermal pollution. However, these energy sources are hardly to obtained due to their limited reserves location as not all cities are located near thermally active areas such as