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United Arab Emirates University

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Master Thesis Defense

Entitled

DEVELOPMENT OF WASTE-BASED-THERMOPLASTIC COMPOSITE HEAT INSULATORS

by

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Abstract:

The main scope of this research is to develop polymer-filler thermal insulators utilizing natural and industrial local waste such as date pit powder (DPP), devulcanized tire rubber (DVR) and buffing dust (BD). An objective of this work was to study the effect of combination of these local wastes with polystyrene (PS) on the physical, mechanical and thermal properties of the developed thermal insulators. PS was used as a matrix, mixed in different proportions with the waste fillers. The results established that DPP, DVR and BD were suitable as fillers in thermal insulation materials. Use of DPP and DVR waste in ratios ranging from 0 wt. % to 30 wt. % affected thermal conductivity minimally and resulted in an acceptable reduction in mechanical properties. All prepared composites with a waste filler concentration below 30 wt. % displayed good mechanical properties, compared with available commercial thermal insulators. Moreover, replacing one-third of the thickness of a building wall with DPP-polystyrene, DVR-PS and BD-PS composites reduced the heat transfer coefficient by 85 %, 87.8 % and 83 %, respectively. Therefore, recycling of the local wastes DPP, BD and DVR as filler materials in thermal insulators presents an opportunity for significant benefit to the UAE economy.

Keywords: Thermal insulators, composites, polystyrene, waste, buffing dust, date pits, tire devulcanized rubber