

## WHALE 'BLUBBER' AS BIO-INSPIRED PHASE CHANGE MATERIAL

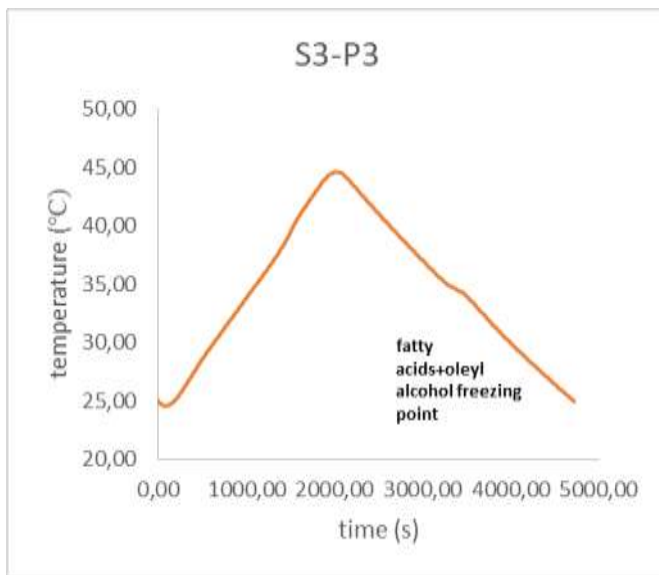
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In nature, all living things have various features to survive. For example, marine mammals have an adipose tissue system that protects them from harsh conditions in their environment. This tissue also known as "blubber" provides various features to marine mammals. Buoyancy, insulation, protection and energy storage are among the tasks of this tissue.

Thermal energy storage systems are regarded as key to sustainable use of renewables to meet increasing global energy demand. Phase Change Materials (PCM) with thermal energy storage properties are commonly used in a wide variety of applications based on melting-freezing principle. PCMs can be inorganic or organics. Fatty acids are examples of organic PCMs.

Biological systems have inspired development of many materials with improved thermal properties<sup>1</sup>. In this study, inspired by the 'blubber' found in whales and its energy storage task, a fatty acid mixture as phase change material (PCM) for thermal energy storage was prepared. The aim is to prepare a mixture of fatty acids and oleyl alcohol to achieve a 'blubber' like phase change behavior with a melting range of about 35-37°C like in different whale species<sup>2</sup>. PCMs with this phase change temperature can be used in the design of special garments for special conditions such as divers and climbers.



The PCM sample is designed to have a composition of %55.7 Oleic acid, %20.8 Palmitic acid, %12.9 Stearic acid, %10.5 Myristic acid and %0.1 oleyl alcohol based on the composition of *G. Macrorhynchus* whale. Figure 1 shows the heating-cooling curve of this developed bio-inspired PCM. The phase change regions are encircled on this figure. The melting point of the sample is around 38°C and the freezing point is about 34°C. The melting point is near the melting point of the whale 'blubber', but the freezing point is lower, which indicates supercooling of the sample. The development of PCM with different binding materials and nucleating agent to avoid supercooling are ongoing. Thermal stability, cycling and storage capacity will be determined in future studies.

### References

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