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Determination of the Melting Point of Paraffin Wax Using Temperature Variation Test Method

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ABSTRACT: *Temperature variation test is an alternative simple method of determining the melting point of paraffin wax by studying the temperature of a melding paraffin wax at a regular intervals of one minute until the temperature of the melting were remains steady with time. This work aimed at determining the melting point of paraffin wax using T.V.T. method, highlighting the critical issues related to the determination and suggesting a suitable way of improving the melting point of paraffin wax to suit a latent heat and thermal energy storage application. The experimental results also conform that paraffin wax is a crystalline solid.*
KEYWORDS: *Paraffin wax, temperature variation test, organic phase change materials, melting point, global warming, home cooling.*

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I. INTRODUCTION

Paraffin wax is an organic phase change material with high heat of fusion which in melting and solidifying at a certain temperature is capable of storing and releasing large quality of thermal energy. Melting point is the temperature variation property of paraffin wax that makes it the best choice organic phase change material used in latent heat and thermal energy storage. It is the melting point paraffin wax that allows it to be excellently used in preventing global warming and in home cooling.

Heat is absorbed when paraffin were changes from solid phase to liquid phase (melting) whereas heat is released when it changes from liquid phase to solid phase (solidification). Paraffin wax can be embedded in building according to their melting points. Studies on the melting point and Energy storage unit of paraffin wax are carried out by many researchers. The Touzri et al (2014) presented the melting process of phase change material (pcm) such as paraffinwax. He carried out the numerical study of modeling the melting process. Rathod and Banerge (2005) studied the thermal performance of a latent heat storage unit of paraffin wax experimentally. The melting point is also evaluated between 58^0 and 60^0C. Piia Lamberg et al (2004) investigated the melting and freezing processes in phase change material storage using numerical and experimental method. Zhang (1999) presented a T-history method that determined the heat of fusion of a change phase materials without a differential scanning calorimeter. Marin (2003) extended Zheng work and made a modification to T-history method for measuring temperature variation properties. In this paper a temperature variation test method is used to determine the melting point of paraffin wax.

II. PURIFICATION OF PARAFFIN WAX

The typical component of paraffin wax is untricontane, $C_{31}H_{64}$. Paraffin wax is a colourless soft solid derived from petroleum containing between twenty and forty carbon atoms. It is a solid at room temperature and begins to melt at about 37^0C.

The first step used in purification of paraffin wax is deoiling or dewaxing of the slack wax. The oil is separated. Through crystallization which involves saturating the slack wax with propanone nd then cooling the saturated solutionto deposit wax while oil remains in the solution. This solution is filtered into two stream; solid (wax and propanone) and liquid (oil and propanone). The propanone is then recovered by distillation to obtain the product or press wax and foots oil. The more refined the wax is depends on the small amount of oil in the wax. The product wax is further refined by decolourization and deodourization. To improve the melting point of a product wax, it is blended with n-octadecanoic acid.

III. APPLICATION OF PARAFFIN WAX DUE TO ITSMELTING POINT

Paraffin wax has melting pint in the desired operating temperature range. It melts congruently and freezes without much super-cooling. These features enables paraffin wax to find application in:

- Thermal energy storage systems
- Green-house gas mechanism to prevent global warming
- Home building cooling
- Candle making
- Lubrication
- Constructing photoelectric cells

In home building, a suitable paraffin wax is embedded ina drywall. In the day time it will melt and absorb heat radiation from the surroundings. In the night the melted wax will released the heat absorbed to the outside of the building.

IV. PARAFFIN WAX USED IN THIS STUDY

The paraffin wax used in this work is being manufactured by Alexandria manufacturing company India. The Batch number is 600:68. The thickness of the paraffin wax slab is approximately 45mm. The paraffin wax used was supplied by Mr. Jekwu Okoli CEO of Jek Chemicals (NIG) at C_6 No 10 Ogbete main market Enugu State, Nigeria.

V. EXPERIMENTAL ANALYSIS

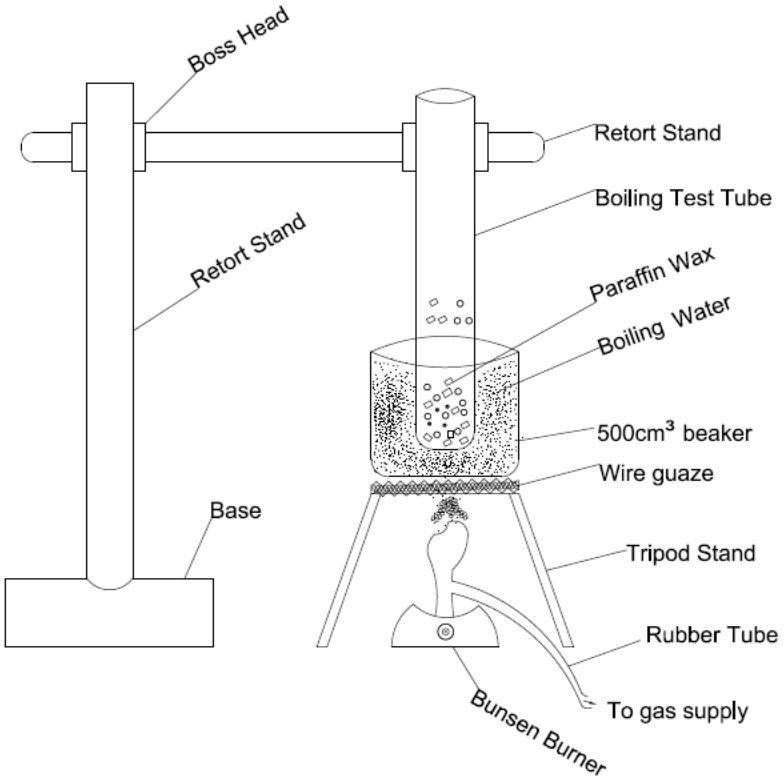

Fig 1: experimental setup for determination of the melting point of paraffin wax

5.1 List of Equipment/materials and uses

a) Bunsen burner – supplies heat to melt the wax
b) Tripod stand – supports the crucible on heating
c) Wire guage – prevents direct heating
d) Boiling test tube – contains the wax on heating
e) Tong – holds the tube with arms
f) Retort stand with clamp – holds the standing tube erect.
g) Beaker – contains the water and the wax sample
h) Resistance thermometer – measures the temperature of the wax.
i) Gas cylinder – supplies heat to the burner

j) Hot water – supplies heat to the solid wax

5.2 Experimental procedure

a) Put some 500g pieces of solid paraffin wax into a large boiling test tube placed inside a beaker of boiling water.
b) Inserted a resistance thermometer into the test tube
c) Read and recorded the temperatures of the melting wax at the interval of one minute as the water is constantly heated with Bunsen burner fuelled by a gas cylinder.
d) Stop heating the wax when the temperature of the liquid wax became constant with time
e) Read and recorded the constant temperature of the liquid paraffin wax
f) Recycled the process by allowing the liquid wax to cool undisturbed at the interval of one minute
g) Read and recorded the falling temperature in every one minute until the temperature remained constant with time.
h) Plot graphs of temperatures versus time for each of the melting and cooling processes as shown in Figure 2.

VI. RESULTS AND DISCUSSION

The tables below shows the results obtained from the experiment

Temperature or heating/^{0}C	Time/minutes
30.00	1
34.00	2
37.00	3
42.00	4
47.00	5
53.00	6
60.00	7
61.00	8
61.00	9
61.00	10

Table 1: Heating of paraffin wax

Temperature or heating/^{0}C	Time/minutes
61.00	1
60.00	2
57.00	3
53.00	4
48.00	5
45.00	6
41.00	7
38.00	8
37.00	9
36.00	10

Table 2: Cooling of paraffin wax.

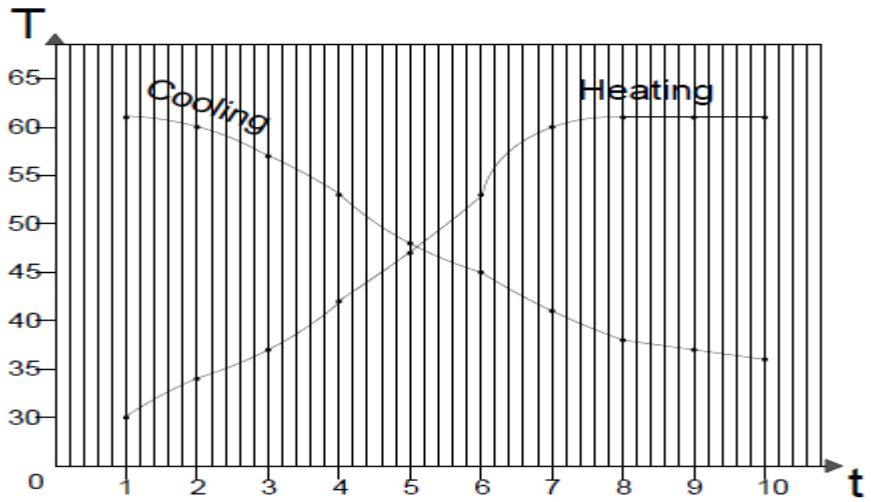

Fig 2: Graph of heating and cooling of paraffin wax

6.1 Discussion

From the graph at figure 2, the point of intersection between the two graphs is the required melting point of the paraffin wax. Therefore 54^0C is the melting point of the paraffin wax in this study. The room temperature for the experiment is 25^0C and the room pressure is taken to be the atmospheric pressure. The cooling temperatures nearly conform with heating temperatures which shows that paraffin wax is a crystalline solid. It is also on record that the melting point of a paraffin wax increase with increase in the carbon content and vice versa. Melting point of paraffin wax depends on purity. Pure paraffin wax is crystalline and has higher melting point than impure ones.

VII. CONCLUSION & FUTURE WORK

An experimental study has been conducted to determine the melting point of paraffin wax by temperature variation test. The melting point of paraffin wax is the main property that enables its engineering latent heat and thermal energy storage applications. The result obtained from this study also agreed with other researchers who used different method. The melting point of paraffin can also improved by adding paraffin wax with disulphurdi-chloride liquid S_2Cl_2.

REFERENCES

[1]. Touzri D., Bourterra M, Elefcy A, Belghith A. and Le Palec G. (2014). Numerical study of melting point of a paraffin wax as PCM Energy stored and melt fraction, Journal of Science, vol. 02, No. 2, 77-90.
[2]. Rathod M. K. and Banerge (2005). Experimental Investigation on latent heat storage unit using paraffin wax as phase change material, International Journal of Green energy, vol. 2, Issue 1, 40.55.
[3]. Piia L., Reijo L, and Anna-maria H. (2004). Numerical and experimental investigation of melting and freezing processes in phase change material storage, International Journal of Thermal Science, vol. 43, Issue 3, 277-289.
[4]. Zhang Y. P., Jiang Y, Jiang Y, (1999). A simple method, T-history method of determining the heat of fusion, specific heat and thermal conductivity of PCM, Journal of measurement science & Tehnology, vol. 10, No. 3, 201-205.
[5]. Marin J. M., Zlaba, B., Cabeza L. F., and Mechling H., (2003). Determination of enthalpy-temperature curves of phase change materials with the temperature-history method: improvement to temperature dependent properties, Journal of measurement science and technology, vol. 14, 184-189.

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