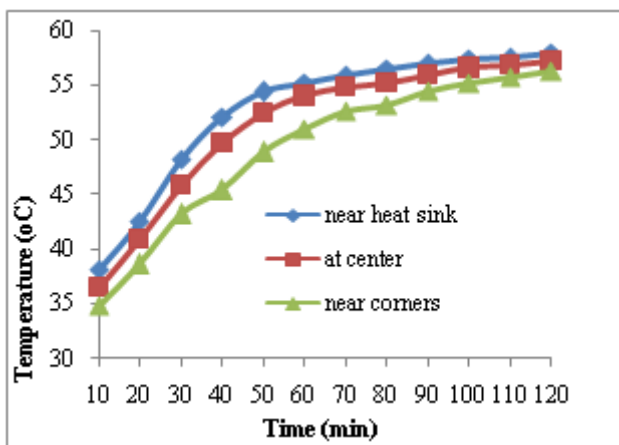


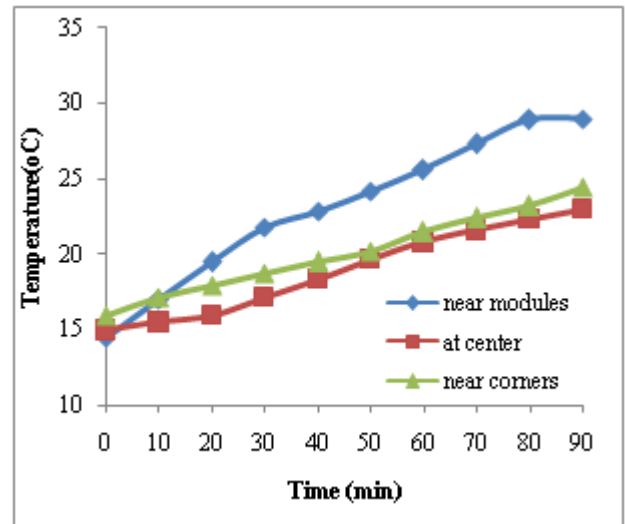
**Figure 6:** Temperature values inside the cold box (vs) time at power ON condition

The temperature values (°C) inside the cold box vs the time (min) are plotted as shown in Fig.6 at power ON condition. The temperature readings are taken at different positions inside the cold box at ambient temperature of 34°C for every 10 minutes up to 120 minutes. The minimum temperature at the centre of the cold box is 14.8°C.



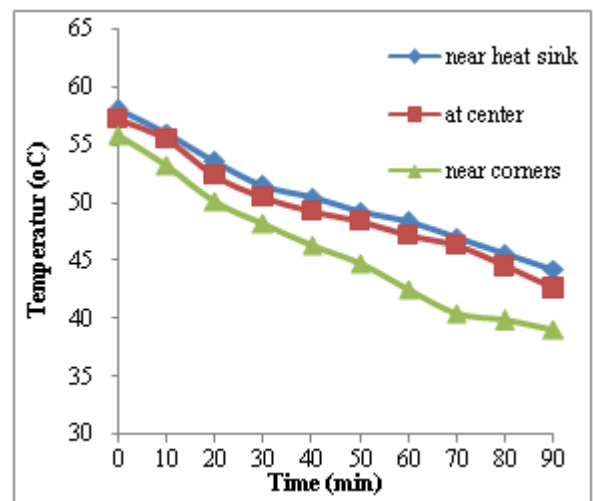
**Figure 7:** Temperature values inside hot box (vs) time at power ON condition

The temperature values (°C) inside the hot box vs the time (min) are plotted as shown in Fig.7 at power ON condition. The temperature readings are taken at different positions inside the hot box at ambient temperature of 34°C for every 10 minutes up to 120 minutes. The maximum temperature at the centre of the hot box is 55°C.



**Figure 8:** Temperature values inside the cold box (vs) time at power off condition

The temperature values (°C) inside the cold box vs the time (min) are plotted as shown in Fig.8 at power OFF condition. The temperature readings are taken at different positions inside the cold box at ambient temperature of 34°C for every 10 minutes up to 90 minutes. Up to 20 minutes we can maintain the same temperature of 14.8°C at centre of the cold box.



**Figure 9:** Temperature values inside the hot box (vs) time at power off condition

The temperature values (°C) inside the hot box vs the time (min) are plotted as shown in Fig.9 at power OFF condition. The temperature readings are taken at different positions inside the hot box at ambient temperature of 34°C for every 10 minutes up to 90 minutes. Up to 20 minutes we can maintain same temperature of 55°C at centre of the hot box.

### Calculations

Heat absorbed inside the cold side box ( $Q_{abs}$ ) is the convective heat transfer inside cold box.

$$\text{Convective heat transfer inside the box } (Q_{abs}) = h \cdot A \cdot \Delta T$$

Where  $h$  = Free convective heat transfer coefficient of air = 24 W/m<sup>2</sup>K

$$A = \text{Area inside the cold box} = 0.0406 \text{ m}^2$$

$\Delta T$  = Temperature difference

Input power given ( $Q_{in}$ ) = 120 W

Heat absorbed inside the cold box ( $Q_{abs}$ ) = 28.53 W

COP (Coefficient Of Performance) =  $Q_{abs}/Q_{inp} = 0.24$

COP of the TER system is 0.24

Heat output in the hot box ( $Q_{out}$ ) =  $h \cdot A \cdot \Delta T$

Where  $h$  = Forced convection coefficient of air = 60 W/m<sup>2</sup>K

Heat output ( $Q_{out}$ ) = 60.9 W

Efficiency of the system =  $Q_{out}/Q_{in}$

= 50.75%

The efficiency of the TER system is 50.75%.

## 6. Conclusion

A portable Thermo Electric system for both cooling and heating applications has been fabricated. The temperature inside the cold box obtained is 14.5°C and the temperature inside the hot box obtained is 58°C for 2 hours. The COP of TER (Thermo Electric Refrigeration) system is 0.24 and the efficiency of the system is 50.75%. The cooling effect used for storage purpose of materials like medicine, vegetables etc... The heating effect used for heat storage purposes such as hot packs. Hence the fabricated TER (Thermo Electric Refrigeration) powered by solar energy is utilized for both cooling and heating applications.

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