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Performance Studies On Aeroprofile Box Type Solar Cooker

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ABSTRACT

Experimentation carried out with conventional and aero profile box type solar cooker under same operation condition. Convective heat loss for conventional cooker is nearly 20% when compared to aeroprofile. The overall thermal performance aero profile is nearly 13% when compared to conventional one.

Keywords: Aeroprofile, Box type, Glass cover, Transmittance, solar cooker.

1. INTRODUCTION

Box type solar cooker is effective technology for cooking and is used in domestic sector. It is ease of operation and handing method is very simple. It can be move to any place and cook at any location. Hence condition improvement in box type will satisfy the human needs.

The detailed description of various geometry parameter affecting performance of solar cooker such as mirrors, glazing, absorber plate, cooling pots and insulating materials has been reviewed by Paras soni and chourasia[1]. The hybrid solar cooker has been experimentally analyzed by Nollens et al[2]. this type os cooker used in cloudy days which is run by electrical energy and sunny days works by solar energy. A wiper type mechanism used to remove the water droplets from the bottom of the glazing has been expediently verified by saxena et.al.[3] and resulted that the due to this above the overall performance of the system has been increased.

Performance analysis of Finned and unfinned cooling pot with solar cooker has been analyzed by Rikoto and Garba [4]. Results show that 120 min cooking time required Finned and 150 min required for unfinned type. The black base and black with coal paint has been painted in box type cooker and experimentally verified by Pandyal et.al.[5] results shows that black with coal improve the overall efficiency from 32.3% to 43.8%. Reflector plays a major role in solar cooker which has been

experimentally proved by Yusuf et.al.[6] results shows that the overall thermal performance increases from 96% to 99% due to this reflectors.

Performance analysis of solar cooker has been carried out by Cuce and cuce.[7] Experimental carried out by finned and conventional absorber plate in solar cooker. Results show that finned absorber plate has higher efficiency then conventional one. Performance evaluation of double glazed box type cooker has been verified by Joshua Folaranmi [8]. Results reports that double glazing cooker perform well and cooking time also reduced when compared to single glazing. The cost estimation and breakeven point of solar cooker has been analyzed by Abhishek et.al.[9] the author reported that box type solar cooker has an efficiency of 34% with payback period of 5.33 years.

Hence the research is mainly focused to reduce the convective heat loss and improve the overall thermal efficiency by the way of aeroprofile design.

2. EXPERIMENTAL SETUP

The experimental setup consists of box type solar cooker and additionally fixed a aeroprofile design at the 3 sides of wall of cooker shown in Fig.1 and Fig.2. The box type has dimension of length x breadth x height. The top of the cooker is covered by 5 mm thick transparent glass cover and black coated cooking utensils are kept inside of the cooler. 1 liter of water filled in all cooking utensils inside the cooker. T-type thermocouple are used to measure the atmosphere, glass, absorber cover and cooking temperature at 15 min interval kipp & Zonnen pyrometer used to measure the solar intensity. The conventional and aeroprofile cooker kept at open atmosphere and readings are recorded.

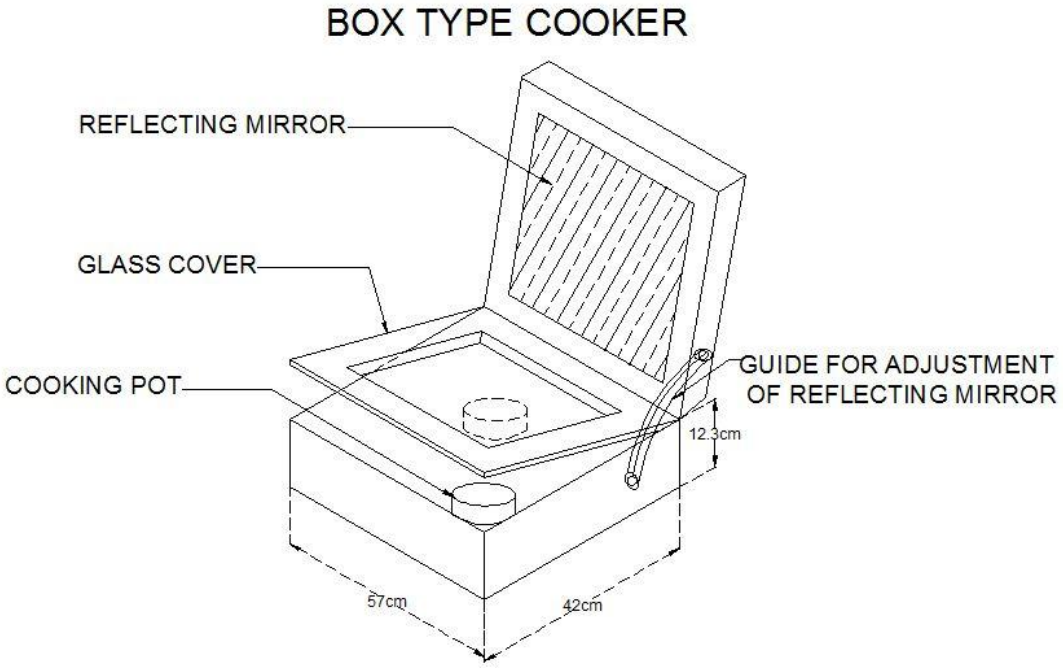

Fig.1. Conventional Box Type Solar Cooker

Fig.2. Photographic view of Aeroprofile Box Type Solar cooker

3. FORMULA USED

Heat gain of the solar cooker has been calculated as follows

$$Q=mc_p\Delta T \quad (1)$$

The overall efficiency of the system calculated by

$$\eta = Q/Ac \times Ht \quad (2)$$

4. RESULT AND DISCUSSION

The heat gain, glass temperature and thermal efficiency are compared with conventional and aeroprofile design.

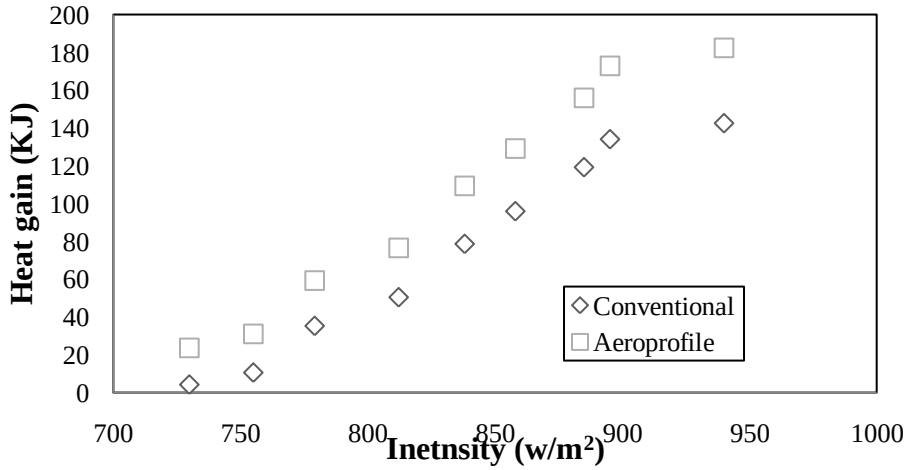

Fig.3. Intensity Vs Heat gain

The intensity Vs heat gain explains in Fig.3. It is clear from that, the increasing solar intensity increase the heat gain. Compared to conventional cooker higher heat gain obtained by aeroprofile cooker. Because the maximum obtained heat by glass cover directly transmit to the cooking utensils. In conventional cooker the atmospheric wind carry over the heat from the glass surface.

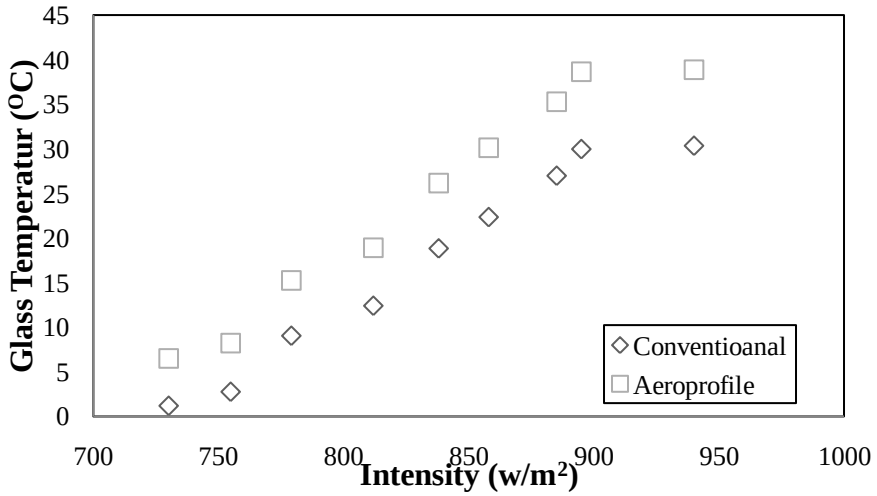

Fig.4. Intensity Vs glass temperature

Fig.4. depicts the Intensity Vs glass temperature. The increasing intensity increases the glass surface temperature. Compared to conventional, aeroprofile has been obtained the higher glass temperature. Because the conventional cooker, the atmospheric wind pass over the glass surface and carry over the heat. But in aeroprofile design it is restricted. Hence the convective heat loss can be reduced by the aeroprofile design.

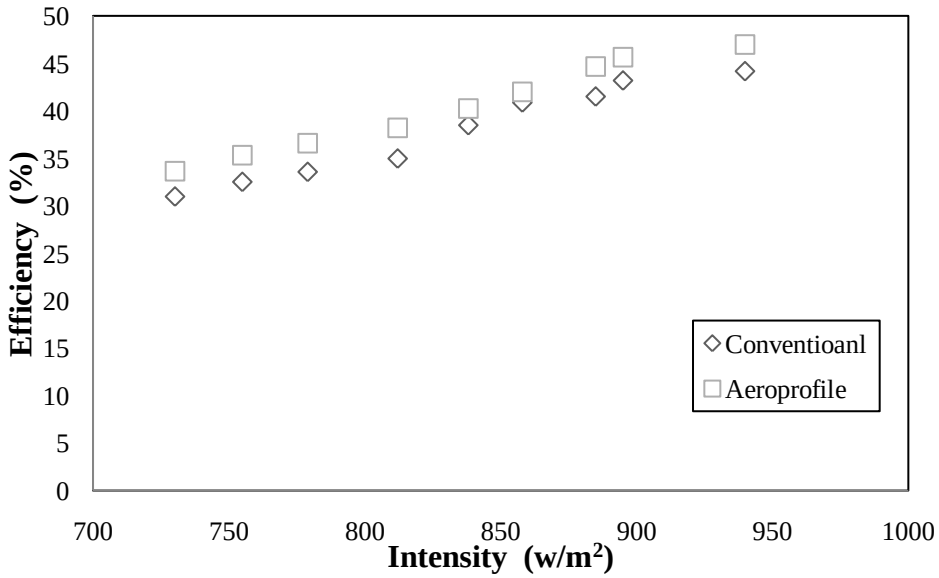

Fig.5. Intensity Vs efficiency

Fig.5. explains about the intensity and efficiency of solar cooker. The increasing intensity increases the efficiency of solar cooker. Compared to conventional, aeroprofile obtained higher efficiency. Because the maximum solar energy which transmit by the glass cover directly pass over to the cooking utensils. The convective heat loss by the wind can be eliminating by the aeroprofile design. Hence the higher efficiency attained by aeroprofile cooker.

5. CONCLUSION

The experimentation carried out by conventional and aeroprofile cooker. Results proved that the higher heat gain attained by aeroprofile cooker. The overall thermal efficiency foe aeroprofile cooker is 30.86% when compared to conventional and is 30.31%.

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