International Research Journal of Natural and Applied Sciences
Vol. 3, Issue 5, May 2016 IF- 3.827 ISSN: (2349-4077)
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SOLAR COOKING – REDIFINED

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ABSTRACT

A solar cooker is a simple device that cooks food and boils water using only the light of the sun. The current work focusses on using a simple glass bowl placed at a suitable angle in a paraboloid and evaluation of the temperature parameters for cooking conditions. The work also focusses on coating the glass bowl with a black spray paint on both the inner and the outer surfaces as well as a stainless steel bowl coated with black paint and evaluation of temperature parameters for cooking conditions. It is observed that the stainless steel bowl with a black coating has shown superior increase in temperature when compared to the other counterparts.

Key Words: Solar cooking, Paraboloid, Spray coating, Black surface.

1.0 INTRODUCTION

Parabolic cookers are a trend of innovative cooking that harvets sunlight, one of the most abundant and sustainable energy sources, to cook. A solar cooker is a smart device that collects sunlight and converts it to heat directly. By eliminating the step of converting to electricity back and forth, a high performance solar cooker can convert more than 80% of the incoming sunlight into heat. Using solar cookers and similar heating devices at home cuts down the energy cost and reduces the carbon emission from using gas or fossil fuels. However, the solar cooking has not caught the imagination of the people, except in places where acute shortage of conventional fuel

like fire wood and the like has become very acute (1). There is extensive potential in the solar rays yet to be harnessed. The existing methods, apart from being inefficient in ransferring energy, it fails to store the heat effectively. Introduction of Phase change materials (PCM) has done the trick of harnessing sun's energy to cook. By doing so, the heat energy storing efficiency is increased and thereby effectively increases the process of cooking. With prices of LPG elevating, using this method proves to be cost effective and energy conserving. Unlike induction stoves, the resedential solar cookers use energy from the solar rays and is cost effective. In the absent of sunlight, the PCM setup still increaes the efficiency of heating the utensils (2). There have been many estimates of the potential contribution of solar cookers to reducing global climate change. One optimistic estimate cites a potential reduction of fuel wood use by 36% due to solar cookers, which correspods to approximately 246 milion metric tons of wood each year (3). Assuming an average of 6,28 Mj/kg for wood and 90 grams equivalent CO_2 emissions per MJ provided by fuelwood, this corresponds to equivalent CO_2 emissions of 565 grams per kilogram of wood burned. Therefore, the optimistic estimate would provide for a net green house gas offset of nearly 140 million metric tons per year (4)

2.0 EXPERIMENTAL PROCEDURE

An aluminium parabolid dish is utilized for the purpose of the study. A glas bowl with water is placed at the center of the parabolid and is focussed towards the sun. Potatoes peeled and cut into tiny pieces are added into the glass bowl after the water in the bowl just begins to pick up heat. Temperature measurements are made by using an infrared thermometer.

The second phase of the work focusses on coating the glass bowl with a coating of black colour and evaluating the same temperature parameters as discussed above. After temperature measurements , a stainless steel bowl is also coated and temperature parameters similar to the previous setups are evaluated.

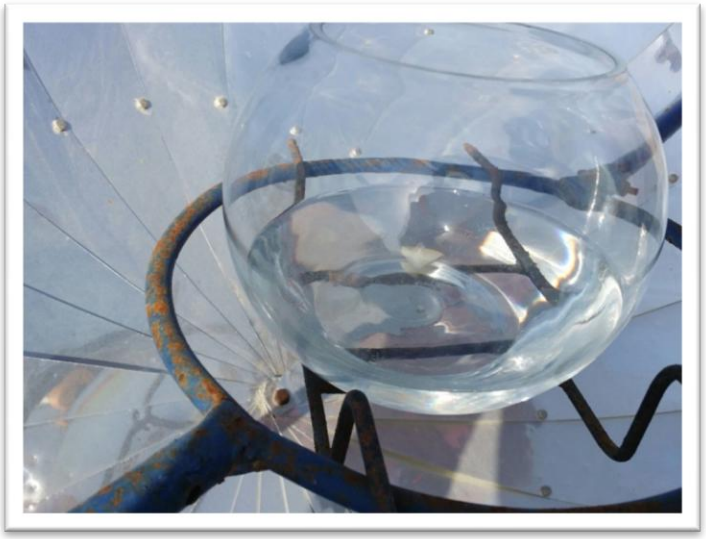

Fig.1 Glass bowl – uncoated

Fig.2 Glass bowl – uncoated with water and potato

Fig.3 Coated Glass bowl with a lid and food in a paraboloid.

Fig.4 Coated Stainless steel bowl with water and potato

3.0 RESULTS AND DISCUSSIONS

3.1 GLASS BOWL

Material used for solar cooking	Temperature ^{0}C	Cooking material used
Glass Bowl – Without a lid covering	40	Water
Glass Bowl – With a lid covering	68	Water
Glass Bowl – With a lid covering	63	Potato
Glass Bowl – With a lid covering	62	Egg

Table 1:Variation of Temperature using a glass bowl

3.2 COATED GLASS BOWL

Material used for solar cooking	Temperature ^{0}C	Cooking material used
Glass Bowl coated – Without a lid covering	60	Water
Glass Bowl coated – With a lid covering	99	Water
Glass Bowl coated – With a lid covering	90	Potato
Glass Bowl coated – With a lid covering	89	Egg

Table 2:Variation of Temperature using a coated glass bowl

3.3 COATED STAINLESS STEEL BOWL

Material used for solar cooking	Temperature ^{0}C	Cooking material used
Stainless Steel coated – Without a lid covering	62	Water
Stainless Steel coated – With a lid covering	80	Water
Stainless Steel coated – With a lid covering	78	Potato
Stainless Steel coated – With a lid covering	76	Egg

Table 3:Variation of Temperature using a coated stainless steel bowl

It is observed from the results that the glass bowl with a coating shows optimum results of cooking with food products and even without it (only water used). The fact that black absorbs more heat and also retains it can be attributed to the fact that a coated bowl shows better results. On the other hand, it is observed that heat retention is not very prominent in stainless steel even with a coating.

4.0 CONCLUSION

- Water and food products like potato and egg have been successfully cooked using solar energy
- Coated glass bowl has been able to demonstrate maximum increase in temperature.
- Stainless steel bowl with a black coating has shown lesser rise in temperature when compared to a glass bowl
- The work has demonstrated a cost effective method of cooking with a reduction in the carbon foot print.

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