Research Paper | *Asian Journal of Home Science* | December, 2011 | Volume 6 Issue 2 :246-249

Comparative study of two models of solar cooker by using different parameters in cooking of rice

REKHA VERMA AND PARVEZ RAZIA

See end of the paper for authors' affiliations

Correspondence to:

REKHA VERMA

Department of Family Resource Management Halina School of Home Science, Sam Higginbottom Institute of Agriculture, Technology and Science, ALLAHABAD (U.P.) INDIA
rekhahari50@gmail.com

ABSTRACT

The present study was undertaken with the objective to compare the identified models of solar cookers in three seasons (summer, winter and rainy) and two metals (aluminum and stainless steel) for different parameters time and temperature in cooking of rice The study was conducted at Department of Family Resource Management College of Home Science and Women's Development Allahabad Agricultural Institute-Deemed University Allahabad, U.P. India during Jan. 2006 to Jan. 2009. There were average sunshine hours 8.5 per day and sunny days about 250 days/years. It was concluded from the average time and temperature of both solar cooker models (BSC and PSC) gave better performance during summer in comparison to other seasons and also Al cooking pots were best in rice. Better performance was observed of Parabolic solar cooker than Box solar cooker in preparation of rice cooking.

KEY WORDS : Solar cooker, Rice cooking

How to cite this paper: Verma, Rekha and Parvez, Razia (2011). Comparative study of two models of solar cooker by using different parameters in cooking of rice. *Asian J. Home Sci.,* **6** (2) : 246-249.

Article chronicle: Received: *23.08.2011*; **Revised:** *30.09.2011*; **Accepted:** *15.11.2011*

Energy is one of the most important inputs in all sectors of a country's development. Global demand of energy is inflating everyday causing concern for the world community. Energy crisis, food shortage and environmental pollution are the main problems, which are faced by mankind today. Solar energy has the greatest potential of all the sources of renewable energy. The power intercepted from the sun is thousands times larger than the present consumption rate on the earth of all commercial energy sources (Sukhatme, 1999).

Rai was found in India, energy consumed for cooking, shares major portion of the total energy consumed in a year (2006). In India about 70 per cent of people live in villages. One of the most important activities of villages with regard to energy consumption is in household activities. Singh and Sahay (2001) conducted a study at CIAE Bhopal and reported that household activities consumed 78.6 per cent energy inputs of a village. Most of the energy in rural home is for cooking. In a study of energy use pattern in a typical village of Bhopal district, Ganguli and Pandey (2001) found that nearly 74 per cent of the energy used in the village was for cooking alone.

Box solar cooker:

Box cookers cook at moderate to high temperatures and often accommodate multiple pots. Worldwide, they are the most widespread. A box solar cooker is a slow cooking device useful for small families. It can cook four dishes at a time and save around three LPG cylinders in a year if used regularly (Anonymous 2003).

Parabolic solar cooker:

A parabolic solar cooker cooks fast at high temperatures but requires frequent adjustment and supervision for safe operation. A common pressure cooker is used for cooking. The parabolic solar cooker is a fast cooking device useful for home. It can cook all type of food including chapattis for about 10 to 15 persons, each dish is cooked in about half an hour. The cooker can save around 5 to 10 LPG cylinders depending upon its use in homes or small establishments in one year. (Anonymous, 2003).

Utilization of solar energy is of the great importance in India, since it lies in a temperate climatic region of the world where sunlight is in abundance for a major part of the year. Many advanced and developing countries including India are developing several cooking devices based on solar energy. The domestic cooking devices are solar cooker, solar oven, solar steam cookers etc. The solar cooking devices have long life (10-15 years) and require easy installations. In our country energy consumed for cooking shares a major portion of the total energy consumed in a year, which is mostly, received from

conventional and commercial energy resources.

Keeping these facts in view the present study was undertaken to compare the identified models of solar cookers in three seasons (summer, winter and rainy) and two metals (aluminum and stainless steel) for different parameters, time and temperature in cooking of rice.

RESEARCH METHODS

The study was conducted at Department of Family Resource Management College of Home Science and Women's Development Allahabad Agricultural Institute-Deemed University Allahabad, U.P. India during Jan. 2006 to Jan. 2009.

There are about average sunshine hours 8.5 per day and sunny days about 250 days/years. Similar statement was given by MNES (2003) that the daily average solar energy incident at many places ranges between five to seven kWH/m^2 and there were as many as 250 to 300 clear sunny days each year.

Experiment setup:

Box solar cooker:

For operating the box solar cooker, reflecting mirror was opened and attached to a latch on the side of the cooker. The cooker was placed in a position so that the reflection of the solar radiations from the mirror fell on the glass cover over the cooking tray. The cooker was left in sun for about 30 minutes before cooking for preheating. The place selected was such that it received direct solar radiations for duration of at least 3 hours and was ensured that it did not come under the shadow of trees or building as the sun moves in the sky. Therefore, the cookers were kept on the roof. The turntable was used to change the direction frequently.

Dust, foreign particles and moisture from both mirror and glass surfaces were cleaned. Glass cover of the cooking tray was lifted and cooking pots were taken out. Cooking pots were loaded with food items to be cooked along with required quantity of water and closed the cooking pots with their lids. Cooking pots were then kept in the inner box of the solar cooker and double glass cover of the inner box was then closed. Reflector mirror was left in the open position at an angle, which permits maximum reflection of the sun's rays on the glass cover of the cooker.

Parabolic solar cooker:

The stand of experiment parabolic solar cooker was kept in the North South direction. The reflector was then oriented towards the sun, so that its focus fell on the vessel. Minor adjustments were made to ensure this. The reflector was then tilted at the desired angle. It was observed that the reflector needed adjustment only once in 60 minutes. It was rotated 15^o in an hour to ensure its face always normal to the sun.

The vessels used as cooking pots were made of aluminum and stainless steel 2 nos. each separately having same dimensions and shape. The side and the bottom of the vessels were painted with a dull black paint in order to increase their heat absorbing capacity. (Plate 3.3)The same cooking pots were used in two models of solar cooker.

Apparatus and equipment:

The following apparatus / equipments were used for taking necessary measurements to evaluate the thermal performance of the experimental cookers.

Solar meter:

It was used for measuring intensity of direct solar radiation in the normal direction to the aperture of the parabolic in such a manner that no shadow was cast on the exposed area of the dish and it was in the normal direction to the plane of the aperture. Its range was (0-120) mw/cm^2.

Anemometer:

It was used for measuring wind speed at the level of aperture of the parabolic in parabolic solar cooker and at the mirror level in box type solar cooker.

Calibrated thermometer of range (0-240^0C): It was used for measurement of water temperature in the cooking pot at regular intervals. It was installed in such a fashion that it remains immersed in the water without touching the wall or the bottom of the pots.

Weighing balance:

It was used for measuring mass having least count of 1.0 gram.

Digital thermocouple with temperature measuring device with L C of 0.01^0 C:

It was used to record temperature of food products kept in cooker pots.

Stopwatch:

It was used for recording the time having least count of 0.1second.

Measuring glasses and spoons:

These were used for measuring food ingredients.

Measuring glass and spoon having least count of 50gm and 1gm.

RESEARCH FINDINGS AND DISCUSSION

The results of mean temperature (^{0}C) rise and time (min.) taken in cooking rice during different seasons in box and parabolic solar cookers and two pot metals stainless steel (SS.) and aluminum (Al) are given in Tables 1 and 2. The data showed that average temperature (^{0}C) rise was more in summer season followed by winter and rainy seasons in both types of solar cookers and pot metals, where as cooking time was less.

Table 1: Average temperature (^{0}C) of cooking rice with respect to seasons, types of cookers and cooking pot metals

Season	Mean temperature (^{0}C) rise			
	Box solar cooker		Parabolic solar cooker	
	Ss. pot	Al pot	Ss. pot	Al pot
Summer	78.78	79.20	86.68	88.57
Winter	59.66	64.49	65.63	73.84
Rainy	49.45	51.38	52.65	53.84

	Season	Cookers	Pot metal
S.E. ±	0.57	0.46	0.46
C.D. (P=0.05)	1.65	1.35	1.35

Rice cooking was done in 80.00, 73.33 min in box solar cooker in stainless steel (SS) and aluminum (Al) pots, respectively in summer season and corresponding time taken in winter and rainy seasons was 117.33 and 108.33, and 165.00 and 158.33 min, respectively, where as in parabolic solar cooker in St and Al pots time taken in rice cooking was 43.33 and 35.67 min in summer, 70.67 and 47.33 min in winter and 127.33 and 114.33 min in rainy season, respectively.

Table 2: Average time (min.) taken in cooking rice with respect to seasons, types of cookers and cooking pot metals

Season	Mean time (min.) taken			
	Box solar cooker		Parabolic solar cooker	
	SS. pot	Al pot	SS. pot	Al pot
Summer	80.00	73.33	43.33	35.67
Winter	117.33	108.33	70.67	47.33
Rainy	165.00	158.33	127.33	114.33
Average	120.78	113.33	80.44	65.78

	Season	Cookers	Pot metal
S.E. ±	2.46	2.01	2.01
C.D. (P=0.05)	7.17	5.86	5.86

The pooled average time taken in rice cooking in PSCAl and PSCSS was 46 per cent and 33 per cent less than BSCSS and 42 per cent and 29 per cent less than BSCAl, respectively.

The statistical analysis revealed that the effect of seasons and cooking pot metals were highly significant in rise of cooking temperature in both the tested solar cookers. At the same time parabolic solar cooker gave highly significant higher temperature rise than box type solar cooker in cooking of rice in all the three seasons and both metallic pots. Similarly, aluminum metallic pot gave highly significant temperature rise than stainless steel pot in both the tested solar cookers and in all the three seasons. The temperature rise for cooking rice was also highly significant in summer than winter and rainy seasons and in winter than rainy seasons in both tested cookers and metallic pots.

The similar trends were observed in time taken for cooking rice also. Thus, from the study it may be concluded that both the solar cooker gave best results for cooking rice in summer season with aluminum pot. However, parabolic solar cooker was found better than box solar cooker because rice took less time (66-80 min) in cooking than other recipes and the orientation of cooker has little effect on solar radiation concentration.

Conclusion:

From the results summarized above, it can be concluded that both solar cookers (BSC and PSC) gave better performance during summer in comparison to other seasons and also Aluminium cooking pots were best for rice. Better performance was of Parabolic solar cooker than Box solar cooker in preparation of rice cooking.

Authors' affiliations:

PARVEZ RAZIA, Department of Family Resource Management Halina School of Home Science, Sam Higginbottom Institute of Agriculture, Technology and Science, ALLAHABAD (U.P.) INDIA

REFERENCES

Anonymous (2003). Solar cooker archive: http://solar cooking.

Ganguli and Pandey (2001). A silver jubilee publication (1976-2001) research, development and technology dissemination published by CIAE. Bhopal, Technical Bulletin no. CIAE 2001 pp. 329.

MNES (2003). *Role of solar cooker in non-conventional energy development*. Published in the souvenir of non-governmental organization, Ganatantrik Nagarik Samity, Hawrah.

Rai, G.D. (2006). *Non-conventional sources of energy*. Khanna Publishers 2 B Nath Market, Nai Sadak, Delhi.

Shukhatme, S.P. (1999). *Principle of thermal collection and storge*, Tata Me Graw Hill Publishing Company Limited, New Delhi.

Singh and Shahy, K.M. (2001). A sliver jubilee publication (1976-2001) research, development and technology dissemination published by CIAE. Bhopal, Technical Bulletin no. CIAE 2001 pp. 312.

*** ********** ***