

Detail Study of Parabolic Solar cooker SK-14

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Abstract - Solar energy is available everywhere for free of cost. Sun's energy can be directly converted in to electrical energy, mechanical or even direct thermal energy. The history of solar energy research is started in 18th century by developing solar powered steam engine by a scientist Augaste Mouchount in 1860. In this paper domestic use of solar energy is considered. The detailed structures of solar cookers is studied and compared with its efficiency and economy in production. Parabolic solar cooker SK-14 is considered for this paper.

Key Words: Parabolic reflector, ambient temperature, solar radiation.

1 INTRODUCTION

In an attempt to find alternative sources of fuel, solar energy utilization is a big milestone as it is available free everywhere and it costs nothing. The only thing we need to do is to collect it in efficient way and convert in to required form. Solar parabolic cooker is one which collects the light and concentrates at small area so all thermal energy is utilized uniformly over blackened cooker which is specially designed for it. The advantage of using solar cooker are, it emits no harmful gases, nor reason for global warming, it is very environmental friendly. Mainly it is freely available and inexhaustible energy source.

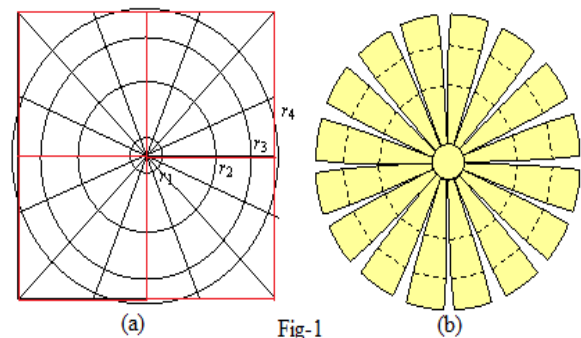
2. Fabrication

Reflectors are most important parts in parabolic solar cooker.

For unattended cooking of 2 hour the cooker needs reflectors in parabolic shape. It can be molded or stamped in required shape and quantity. Or reflectors can also be fabricated by flat sheet metal with fine surface finish.

Layout of reflectors with 140mm focal length, diameter of 800mm can be formed in 1000x1000mm squire sheet metal

Divide the sheet metal in four equal parts and draw circles as shown in fig-1(a) and diameter given in table - 1



Circle	Inner	Small	Large	Outer
Radius (mm)	75	254	400	528
Arc Length (mm)	0	11	29	50

Table-1

Each square is divided in to 4 parts at an angle of 22.5° aparts as shown in fig-1

Most exterior circle arc is trimmed off or bent to back side by 90° so that it can be used as brackets to join all pieces

together to form parabolic shape. Later it can be fixed to main support frame.

Reflector material has reflectivity of 75%. Figure-2 shows assembled unit of parabolic SK-14 solar cooker.

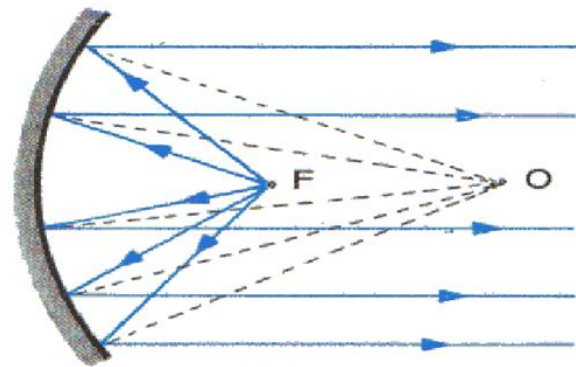
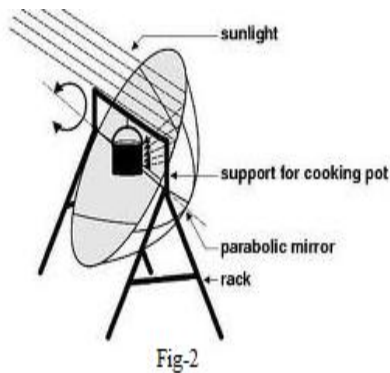
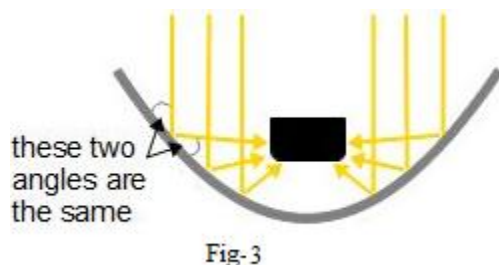


Fig-4

3. Working principle

In parabolic reflector type solar cooker, all the light falling on mirror will be reflected such a way that all light rays will concentrate at small area of cooker. For this, there is simple mathematics i.e. angle of incidence of light ray must be equal to angle of reflection as in fig-3. This parabolic cooker has 2m focal length and 1.4m diameter. $4FD=R^2$ Where F is the focal length, D is the depth of the dish, and R is the radius of its rim



4. Experimental details

Empty vessel made from Aluminum with black colour has top temperature 76°C and bottom temperature of 118°C at morning time and average radiation recorded is 685W/m². 1000ml of water reached 90°C for time span of 90min with solar radiation 754 W/m².

Quantity & items	Time for Cooking(min)	Avg solar radiation(W/m ²)
250ml water + Rice 100gm	20	686
Rice 100gm+ water 205ml+daal 30gm	40	675
400ml water + 100ml milk	35	710
100 ml milk	10	700

Table-2 experimental details

5. Conclusion

SK-14 cooker is ideal for large family as it can provide sufficient temperature for cooking. Many food items can be prepared in one to two hour at bright sunshine days. At morning hours ambient temperature affects its performance but at sunshine hours due to high surrounding temperature it has high efficiency. Main advantage is that, sun tracking mechanism though it is manual but it can increase cooking time quite bit more. Later on it can keep food stuffs warm. Parabolic cooker can cook food faster than box type cooker. This concentrating cooker heats the vessel uniformly so no burning and food vitamin will remain intact.

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