

INCREASING EFFICIENCY OF SOLAR COOKER BY USING CO₂ GAS

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ABSTRACT- A local survey was made to find whether people are not using solar cooker because it is time consuming even after receiving enough sunlight. To decrease the time of cooking of solar cooker temperature of cooking box should be increased for that a greenhouse gas - CO₂ is used. The easiest and economical way of producing CO₂ - adding lemon juice to baking soda was used. To verify this fact a comparative study was done which concluded that the temperature can be increased. Also the expenditure for this was calculated which shows that use of this technique will be economical than using conventional way.

KEY WORDS:- solar cooker, temperature rising factor, greenhouse gas, CO₂, lemon juice, baking soda, less expenditure.

1 INTRODUCTION

Conventional energy resources are limited and non-eco friendly. So, scientists invented many non-conventional energy devices. The non-conventional energy can be used in many ways but most of the people are not using it even after having energy crisis.

One of such non-conventional energy device is solar cooker and it is mainly ignored because it is time consuming and less efficient. For reducing the time taken by the solar cooker for cooking we have to increase the temperature of the cooking box of the solar cooker.

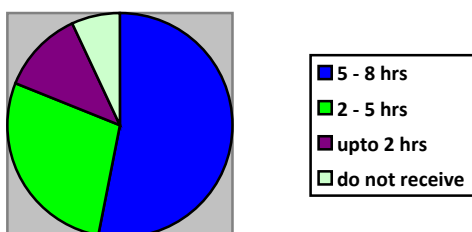
In order to increase the efficiency of solar cooker, this effort is made so that more people will use it.

2. SURVEY ANALYSIS

A local survey of 100 people was carried out from which it was observed that

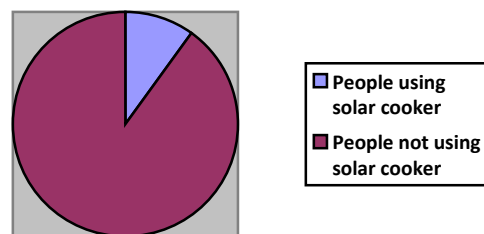
- 53% people receive 5-8 hrs direct sunlight, 28% people receive 2-5hrs direct sunlight, 12% people receive less than 2 hrs and 7% people do not receive sunlight at all.

Duration of Sunlight Received



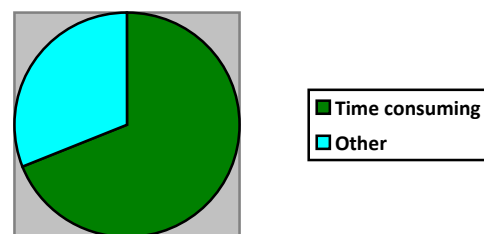
- 10% people use solar cooker while 90% people don't use it.

Use of Solar Cooker by people



- 68.89% people do not use solar cooker because they think solar cooker is time-consuming and 31.11% people don't use it due to some other reasons.

Reason of not using solar cooker



3. MATERIALS AND METHOD

2 identical chambers similar to cooking box of solar cooker, 2 thermometers, Baking soda, Lemon, stopwatch are

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used for this experiment.

Carbon dioxide (CO₂) gas was introduced in chambers similar to cooking box of solar cooker and it was kept in sunlight along with a similar chamber without Carbon dioxide (CO₂). Temperature of both of them was noted after every 15 minutes.

4. RESULT AND DISSCUSSION

The solar cooker is a device which works on the principle of greenhouse effect. Green house gas is the temperature rising factor of the cooking box of solar cooker. But there the greenhouse gas present is water vapour (others are present in negligible amount).

The Carbon dioxide (CO₂) is a green house gas i.e. it absorbs heat and re-radiates it, so the temperature of the atmosphere increases.

Water vapour and CO₂ both are green house gases but temperature rise due to CO₂ is more than that of water vapour.

So, we introduced Carbon dioxide (CO₂) gas in the cooking box of solar cooker, to increase the internal temperature of cooking box.

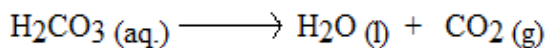
The cheapest way of production of Carbon dioxide gas at domestic level is reacting Baking soda with lemon juice. The lemon juice contains citric acid which gives out CO₂ when reacted with Sodium bicarbonate i.e. baking soda.

The reaction is as follows



Citric Acid Sodium bicarbonate Sodium citrate Carbonic acid

(from lemon) (Baking soda)



Thus, the CO₂ gas is evolved which shows greenhouse effect.

Two chambers similar to the cooking box of solar cooker were used, which have their five surfaces made of insulators and only one is made of plastic so that solar radiation can enter in the chamber but heat can't exit from it. CO₂ was introduced in one chamber and both chambers were kept in sunlight. It was noticed that the temperature of chamber with CO₂ is more than the other.

DAY 1 - Temperature in degree celcius

Time (min)	Box with-out CO ₂	Box with CO ₂
0	21	21

15	46	48
30	50	50
45	54	52
60	57	55
75	60	58
90	52	56
105	54	58
120	54	58
135	54	60
150	55	60
165	57	60
180	59	60
195	58	60
210	59	59
225	59	59
240	57	58
255	54	56
270	53	55
285	49	50
300	48	50
315	47	50
330	46	49
345	45	48
360	44	46

DAY 2 - Temperature in degree celcius

Time (min)	Box with-out CO ₂	Box with CO ₂
0	22	22
15	48	48
30	49	50
45	50	52
60	52	54
75	52	55
90	52	54
105	54	57
120	54	57
135	54	56
150	54	56
165	52	55
180	52	55
195	51	55
210	59	62
225	58	61
240	56	59
255	53	56
270	51	55
285	50	52

300	47	50
315	44	48
330	41	36
345	39	43
360	34	38

135	54	57
150	54	57
165	57	60
180	56	59
195	55	57
210	53	57
225	54	56
240	55	56
255	52	54
270	46	50
285	44	48
300	41	46
315	41	45
330	39	43
345	37	40
360	36	39

•DAY 3 - Temperature in degree celcius

Time (min)	Box without CO ₂	Box with CO ₂
0	21	21
15	48	48
30	50	50
45	50	52
60	52	53
75	52	54
90	53	55
105	54	56
120	54	56

5. EXPENDITURE

- For one day :- Baking soda + lemon = Rs. 5
- For 6 months :- Baking soda + lemon = Rs. 900
- Cost of Solar Cooker = Rs. 2000
- Total cost = Rs. (2000 + 5) = Rs. 2900
- Cost of 6 commercial cylinders = Rs. 5900
- Therefore, economically it is cheaper to use solar cooker with introduction of CO₂ than using the LPG gas.

6. CONCLUSION

The temperature of cooking box of solar cooker can be increased by introducing CO₂ in it. As the temperature increases the efficiency of solar cooker also increases.

REFERENCES

[1].Development and performance testing of solar cookers - C Z M Kimambo - Journal of Energy in Southern Africa • Vol 18 No 3 • August 2007 (Page No. 41-51)
 [2]. Case study: India Solar Cooker - <http://iefworld.org/elcindiasolar.htm>
 [3].Principles of Solar Box Cooker Design

By Mark Aalfs, Solar Cookers International -

APPENDIX

QUESTIONNAIRE

Name: _____
 Education: _____
 Annual income of family: _____
 Address: _____

- 1) How much time you receive direct sunlight in your house/ balcony/ terrace/ yard?
 i) 5 to 8 hrs ii) 2 to 5 hrs
 iii) upto 2 hrs iv) do not receive
- 2) Do you use solar cooker? Yes/No
- 3) If you don't use solar cooker, is it because it consumes lot of time?
 Yes/No

sign

