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The Performance of Sunlight based Solar Cooker with Extraordinary Accentuation on the Altered States of Utensils

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***Abstract*---**The different types of cooking vessels are contemplated. Understanding the part of different methods of heat exchange forms inside the cooker will prompt a best plan which over comes a portion of the inadequacies of present day cookers, for example, long cooking type and absence of homogeneity in the cooked nourishment. An endeavor has been made toward the path to build the temperature of the substance of the vessel, adjustment to the cooking vessel, creating numerical model and approval with the perceptions are investigated and examined in the work. A box cooker is made and cooked by utilizing distinctive vessels like low cover vessels, focal barrel shaped cavity vessels and variety of temperature by 5% to 6% is established. It has been watched that vessels with various setup and introduction produces higher temperature of the substance of the vessel and gives better infiltration of heat to the substance of the cooking vessel. The examined designs are Conventional barrel shaped vessel on drags, vessel with focal round and hollow hole and vessel with discouraged cover and vessels with fins. Vessels with balances perform well than vessels with carries, discouraged tops and focal round and hollow hole that are 5% to 6%.

***Key words*---**Box type and pipe type sun based cookers with and without fins, lugs, heat transfer.

I. INTRODUCTION

The plan and investigation of different types of vessels, for example, discouraged top vessel, focal round and hollow cavity vessel, vessel with drags and vessels with and without fins in box cooker and channel cooker. The vessels are warmed on the cooker; heat transfer investigation is finished with and without fins.

The subject of a few hypothetical and trial concentrates everywhere throughout the world were the types of sun oriented cooker. The aftereffects of the trial examination have been thoroughly investigations and demonstrated that the stagnation temperature for box-type sun oriented cooker furnished with a conventional safeguard plate by A. Harmim et al [1]. The time required for warming water up to bubbling temperature in box-type sun oriented cookers is considered. This covers a past filled with sunlight based cooking innovation, itemized depiction of different types of sun powered cookers, geometry parameters influencing execution of sun oriented cookers, for example, promoter mirrors, , safeguard plate, cooking pots by A.V.Narasimha Rao et al [2] have examined the impact of the cooking.

Saxena et al [3] discuss parcel of work , has been done in later past years on the planet which unmistakably demonstrated the usage of sunlight based vitality towards the best needs of humankind clearly sun oriented cooking, fuel sparing, non-contaminating condition and to spare and create power. Arezki Harmim et al. [4] have proposed another shape for the cooking vessel. It is a common tube shaped vessel by which outer side surface is furnished with rectangular balances along its circuit.

In this work, box type sun based cookers with plain and finned safeguard plates are tentatively researched in Warangal atmosphere conditions. Performance is assessed on the premise of exergy investigation. It is found that sunlight based cooker with finned base is of A grade. The exergy effectiveness of finned base box-type sun oriented cooker is higher than the unfinned base box type sun oriented cooker [5]. Funk and Larsor [6] and Funk [7] learned about new parameters for estimation of sun powered cooker execution.

II. RELATED WORK

2.1. Cooking vessels with Lugs

Vessels are put on the drags which are otherwise called wire terminations by keeping vessels on carries the productivity is

expanded by 5% than the typical vessel. So cooking vessels on drags are checked by putting vessels on carries both on box type and channel cooker. Drags are accessible in tinned copper which stays away from the consumption issue at the pleat and under the screw terminal and battery carry. Drags can be acquired protected or non-protected. Protected hauls are for the most part utilized on the off chance that they are pleated in the field. Non-protected drags are utilized if warm psychologist tubing is connected over the end after the haul is creased or potentially fastened. When patching, slide a bit of heat therapist up the protected conveyor, apply a fluid or glue rosin flux to the wire, embed into the haul, apply heat to the barrel of the drag and embed bind into the finish of the barrel until it is drawn into the strands. Try not to utilize excessively patch as it will wick up the wire past the haul and make the wire lose adaptability. Slide the heat recoil over the barrel after it cools and utilize a heat weapon to contract the tubing set up, fixing the protection and carry to keep dampness from wicking up the conductor.

Fig1. Insulated Spring Spade

Fig 2. Non-protected Ring

Fig3.Closed End

Hauls for 6 AWG and bigger conductors ought not to be welded as it is hard to apply enough heat for a decent association because of the mass of the drag and conductor. Utilize shut end drags to seal the finish of the conductor and apply warm therapist tubing to seal the protection to the barrel. The pressure carries are anything but difficult to use in the field however should be measured for the particular conductor and carry. Substantial shut end carries require a particular pleating instrument to guarantee a sufficient association.

Fig4. Rounded hook type

Fig5. Hook type lug

2.2 Vessels with focal barrel shaped cavity

Cooking vessel with focal barrel shaped pit continued carries gives hot air dissemination openly through the focal round and hollow depression of the vessel. The focal round and hollow cavity lessens the heat low way length and encourages better exchange of heat to the thermic liquid kept in the vessel, from both the spiral bearings i.e., from within the vessel and from the outside of the vessel.

The upgraded zone of heat exchange and the enhanced dissemination of the hot air through the focal tube shaped opening decrease the cooking time. It is found from the test and displaying that the cooking vessel with focal tube shaped depression on drags comes about higher temperature of thermic liquid contrasted with customary round and hollow vessel on floor on carries. The normal change of execution of the vessel with focal tube shaped pit continued hauls is observed to be 5.9% and 2.4% more than that of regular round and hollow vessel on floor and on drags separately.

By outlining different substantial and little breadth vessels with focal tube shaped pit and cooking on every one of them found that how much lesser the distance across that is all the more little measurement of round and hollow depression is preferable enhanced one over the higher focal tube shaped hole. Underneath figures are the pictures of various distances across focal round and hollow pits both in box cooker and channel cooker.

Fig6.Central Cylindrical Cavity for Box cooker

Fig7.Centralcylindrical Cavity and lids

Fig 8. Sun based box cooker

2.3 Vessels with depressed lids

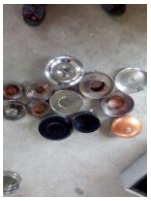

Fig 9. Vessels with depressed lids

Fig10.Cooker with coated vessels

Fig11. Box cooker with depressed lids and vessels

The top of the cooking vessel captures most extreme measure of occurrence vitality. Typically the cover is isolated from the sustenance by an air hole. In this manner very little heat could be exchanged specifically to the sustenance by the conduction. Cooking vessel with discouraged top gives coordinate contact amongst top and the nourishment. Since the top is in direct contact with the substance of the cooking

vessel, the heat exchange from the top is more viable, in this way bringing about higher temperature of thermal liquid/water introduce in the cooking vessel. This wonder was observed to be right amid the test led on box type of sun oriented cooker stacked with regular barrel shaped vessel on hauls and another vessel in discouraged cover in carries both even in channel cooker moreover. The normal change of execution of the vessel with discouraged cover is observed to be 8.4% more than the regular barrel shaped vessel.

III. MODELLING

Plan of various types of vessels is done in CATIA version 5.

3.1 .Design of vessels on lugs

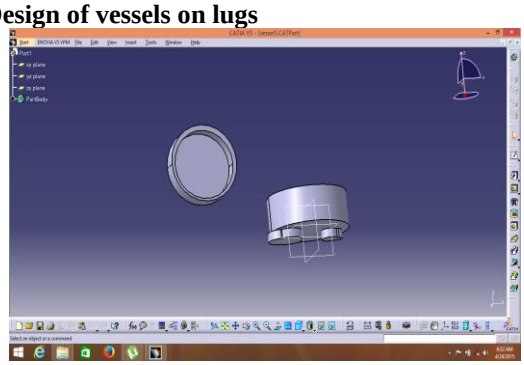

Fig 12. Vesseld on Lugs

3.2. Design of vessel with focal round and hollow cavity

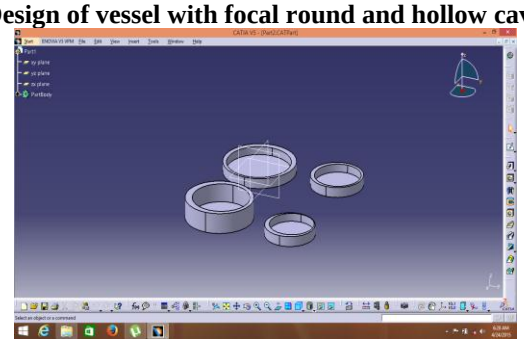

Fig 13. Vessel with focal round and hollow cavity

3.3. Outline of vessel with depressed tops

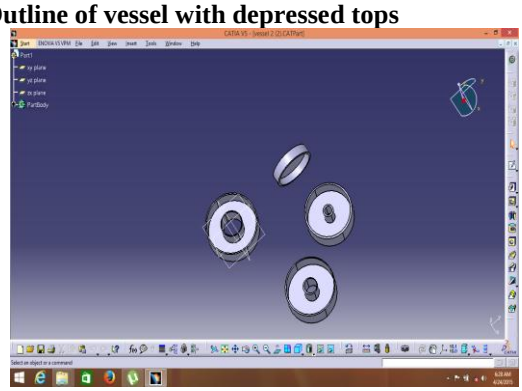

Fig 14.Vessel with depressed tops

IV. NUMERICAL MODELING OF A BOX TYPE SOLAR COOKER

4.1. Numerical Model

The vitality adjust conditions have been derived for different parts of the cooker viz. safeguard plate, cooking vessel, cooking liquid, air encased and glass covers as clarified underneath. Taking after suspicions are made to improve the model:

1. The sun powered radiations gotten by the vertical dividers of the vessel are immaterial.
2. There is great warm contact between the vessel and safeguard plate.
3. The temperature angle over the thickness of spreads and cooking vessel has been disregarded.
4. The heat trade through air encased in the cooking vessel is insignificant

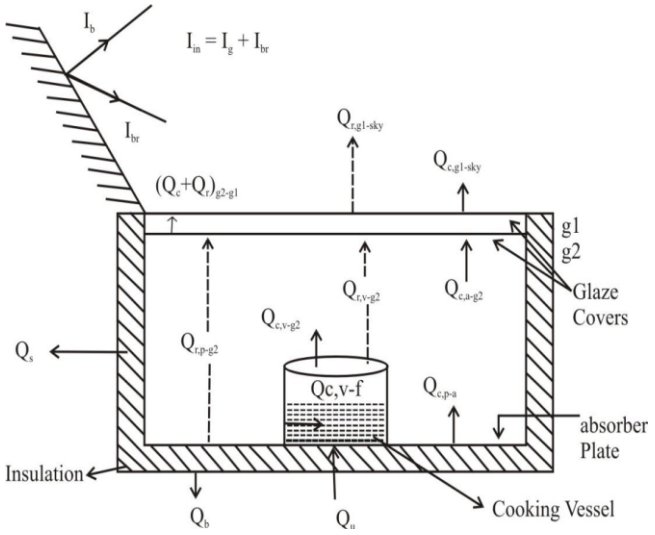

Fig 15.Different methods of heat transfer in a box type solar cooker

The total input solar energy *Qtotal = s g (τα) I A* which is equal to the summation of the stored internal energy inside the cooker (Qi*)* and the energy loss from the top side (*Qtop)*, and the energy loss from both bottom and lateral (Qbottom*)* Well established model which neglects the heat capacity of the pot is presented by Jansen 1985 and Kreith and Kreider 1978. It applies the following expression: Heat total losses are from top and bottom

$$Q_{total} = Q_i - Q_{top} - Q_{bottom}$$

On account of settled cooker, the τα (transmittance – absorptance item) changes at various height edge as the sun changes its position hourly. While, on account of following framework τα is at greatest of 0.9.

V. ASSESSMENT OF COOKING POWER

5.1 Cooking power

The adjustment in water temperature for each predefined time interim should be increased by the mass and particular heat limit of the water contained in the cooking vessel(s). This item should be separated by the 600 seconds contained in a ten-minute interim, as:

P_{cook} = *m*C_v * (T2–T1)/600 ;

Where P_{cook} = cooking power (Watts), T2 = last water temperature, T1 = beginning water temperature; m = water mass (kg), C_V = heat capacity (4186 J/kg•K)

5.2. Recording

The normal water temperature of all cooking vessels in one cooker will be recorded at time interims not to surpass ten minutes, and ought to be in units of Celsius to the closest one tenth of a degree. Sun based insolation (W/m^2), surrounding temperature (^oC), and wind speed (m/s) should be recorded. Recording and announcing is accomplished for manual following. Azimuth angle(s) will be finded amid the test. The test site scope and the date(s) of testing are noted down. The normal estimations of are computed for insolation, surrounding temperature.

5.3 Standardizing cooking power

Cooking power for every interim should be remedied to a standard insolation of 700 W/m^2 by duplicating the interim watched cooking power by 700 W/m^2 and separating by the interim normal insolation recorded amid the comparing interim.

Ps = Pi * 700/Ii ; where:
Ps = institutionalized cooking power (W)
Pi = interim cooking power (W) ;
Ii = interim normal sunlight based insolation (W/m^2)
The vessel substance temperature found for every interim.

5.4 Temperature distinction

This Standard indicates that test outcomes be displayed as cooking force, in Watts, standardized for surrounding conditions, with respect to the temperature contrast between cooker substance and encompassing air, both as a plot and as a relapse condition for no less than 30 add up to perceptions more than three diverse days. This Standard determines that cooking force be introduced as a solitary number found from the conditions for a temperature distinction of 50 °C.

5.5 Uncontrolled (climate) factors

Wind: Tests should be directed when wind is less than 1.0 m/s, measured at the rise of the cooker being tried and inside ten meters of it. Ought to wind surpass 2.5 m/s for over ten minutes, dispose of that test information. On the off chance that a wind safe house is required, 1) it should be composed in order to not meddle with approaching aggregate radiation and 2) the wind instrumentation might be co-situated with the cooker in a similar wind shadow.

VI. RESULTS and Discussions

Date of Experiment done	:	25-March-2015
Place	:	Warangal
Latitude	:	18 Deg N
Longitude	:	79.5 Deg E
Altitude	:	275 m above Sea level

The time (Vs) Energy output and time (Vs) Efficiency graphs are shown in Fig.16 and Fig.17 respectively. As from the morning to afternoon the heat up rate i.e. energy output is in increasing order, whereas from afternoon to evening it's in decreasing order. The efficiency also follows the same type of curve as Energy output curve.

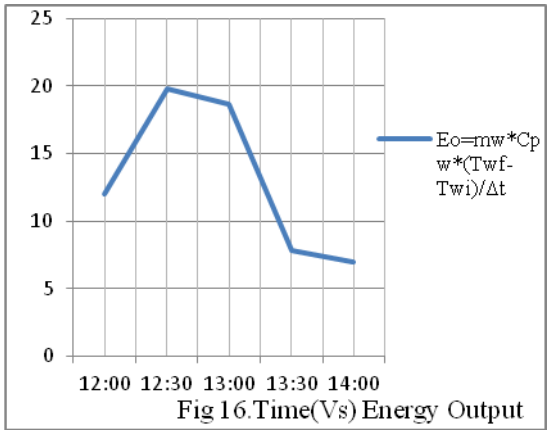

Fig 16.Time(Vs) Energy Output

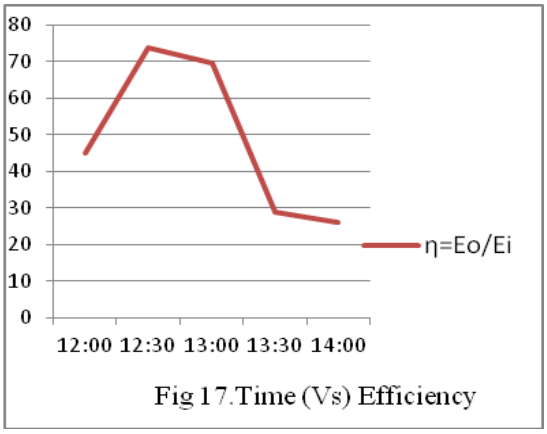

Fig 17.Time (Vs) Efficiency

VII. CONCLUSION AND FUTURE SCOPE

Heat exchange through vessels construct more for the vessel with respect to hauls than that of the vessel on floor. Comparative pattern is watched not withstanding for the heat

exchange from vessel to substance of the vessel. Thermic liquid kept in vessel upheld on drags accomplishes the greatest esteem almost 1hour prior when contrasted with that in vessel continued the floor of cooker. The execution on hauls is 6-8% more than that of the vessel on floor; this is on account of vessel on drags give hot air course between base of the vessel and the safeguard plate. Vessel with focal round and hollow cavity performs better that the barrel shaped vessel on floor or on lugs. The normal change of the execution of the focal tube shaped hole is observed to be 5.9%and 2.4% more than the regular tube shaped vessel on floor and carries respectively. Vessels with discouraged covers alongside drags and focal tube shaped hole combinely performs 10% more productivity.

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Mr.Yakoob Kolipak pursed B.Tech, Mechanical Engineering from Kakatiya Institute of Technology&Science, Warangal (affiliated to Kakatiya University) in 1998. He pursed M.Tech. from JNTU, Hyderabad in 2003.He is pursuing PhD in Osmania University. He is a Life member of ISTE since 2005.He has 14 years of teaching experience.

Prof. (Dr.) AMK Prasad obtained B.Tech degree from Government Engineering College, Ananthapur in 1977, M.Tech from PSG College of Technology Coimbatore in 1979 and Ph.D from Osmania University. He joined as a Lecturer in Mechanical EngineeringDepartment,University College of Engineering(UCE),Osmania University(OU) in 1979 and served 35 years in various positions and retired as Senior Professor in 2014.He served as HOD for 2 years and also as a Chairman, Board of Studies(Global) for 2 years . And also he served as Chairman, BOS (Autonomous), UCE, OU for 2 years. He published more than 110 national and international research papers. He have conducted 11 small scale industries management assistance programs sponsored by SIDBI.He was also expert member for quality assurance of Kalwakurthy Lift Irrigation Project, Kollapur, Mahaboobnagar District, Telangana. He was appointed as a Expert Committee Member for AMVI, APSCHE, A.P, Hyderabad, Also committee member for recruitments like JNTU, AU,IIIT, Rajiv Gandhi Technology University, Hyderabad, Geetam University, BRAHMOS etc.,. He was Life Member of ISTE.

