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CRITICAL PERFORMAMCE ANALYSIS OF A STAR COOKING UTENSIL EQUIPED WITH COLLECTOR AND TRACKER

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ABSTRACT: A star cooking utensil with parabolic reflector and pursuit device has been designed and made-up with the assistance of obtainable materials. The huntsman used is of electronic kind to form it a lot of economical. Experiments are performed to research preparation power, standardized preparation power, and temperature distinction. Plots of temperature distinction and preparation power and temperature distinction and standardized preparation power are created.

Keywords: SBC- star box cooking utensil, Cp- heat of water , Ps- standardized preparation power , τ = length of the interval , P- preparation power.

INTRODUCTION

Renewable energy technology bridges the gap between mounting international energy demand and dwindling provider of finite standard energy sources. the 2 factors that has got to be perpetually looked into area unit the potency And economic science of putting in such an application. the radiation potential of Republic of India is four.7 kw/m2/day. Utilization of alternative energy is of nice importance to Republic of India since it lies during a temperature climate of the region of the globe wherever sun light-weight is extensive for a significant a part of the year. In varied styles of technology, star thermal applications are in energy conversion devices, heating system, and preparation, drying and even refrigeration. Parabolic star cookers area unit terribly economical. but standard parabolic cookers want frequent adjustment to trace the sun. they're conjointly high-ticket. It cooks at well constant power for 2 hours while not adjustment. Optimized for lustiness, it is made from inferior material, and really wide tolerance. it's extraordinarily reliable and really simple to use. Being economical, it cooks while not a greenhouse year-round. Variations are created to suit domestically on the market material.

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SOLAR ENERGY AND ITS APPLICATIONS

Alternative Energy and Its Applications

The alternative energy wherever sun hits atmosphere is 1017 watts, whereas the alternative energy on earth's surface is 1016 watts. the whole world-wide power demand of all desires of civilization is 1013 watts. Therefore, the sun provides USA a thousand times a lot of power than we want. If we will use five-hitter of this energy, it'll be fifty times what the globe would force. The energy radiated by the sun on a bright sunny day is just about one kW/m2, tries are created to form use of this energy in raising steam which can be employed in driving the prime movers for the aim of generation of power. but on account of enormous area needed, uncertainty of accessibility of energy at constant rate, thanks to clouds, winds, etc. there's restricted application of this supply within the generation of electrical power. Now-a-days the drawbacks as noticed that energy can't be hold on and it's a dilute variety of energy, area unit out dated arguments, since the energy is hold on by manufacturing chemical element, or by storing in alternative mechanical or electrical devices, or it is hold on in containers of chemicals known as mixture or part dynamical salts. These salts that store giant quantities of warmth during a comparatively tiny volume soften after they area unit heated and unleash heat later as they cool and crystallize. The energy is concreted in star furnaces of 5000o C. The facts speak in favor of alternative energy, as we've got seen in analysis of business energy sources, that world's reserves of coal, oil and gas are exhausted inside a number of decades. energy involve tidy hazards and nuclear reaction has not nevertheless overcome all the issues of even basic analysis, compared with these technologies, the feasibleness of that remains unsure and contested , the technical utilization of alternative energy will prove helpful. Utilization of alternative energy is of nice importance to Republic of India since it lies during a temperature climate of the region of the globe wherever sun light-weight is extensive for a significant a part of the year.

SOLAR COOKER

Solar Cooking Utensil

A star cooking utensil could be straightforward, inexpensive device exploitation targeted sunshine to cook rice, boil water, etc. it's a foil or otherwise sun-directing device that uses daylight as its energy supply. They use no fuel and value nothing to run and area unit usually employed in things wherever bottom fuel consumption is vital, or the danger of accidental fires is high. star cookers capture the sun's rays and use their energy to cook food or boil water. Exploitation extra reflective surfaces, a star cooking utensil becomes even hotter than the within of the automotive as high as 600F. Employing a star cooking utensil saves cash, helps the atmosphere and produces delicious baked or dried food like tomatoes or fruit. Significant improvement of star cookers needs understanding 2 necessary processes:

Generating heat

Conserving heat

A star box cooking utensil uses AN insulated box with a glazed high. Hinged to the highest of the box could be a reflective panel that directs light-weight into the box. Box cookers are also made from wood, metal, plastic or perhaps cardboard. Temperatures within a box cooking utensil will reach 200F. A panel cooking utensil uses many reflectors placed over a dark, insulated box. Dark-colored containers work best for preparation during a panel star kitchen appliance. The reflective panels fold sure storage. The panels are also made from reflective metal or cardboard coated with foil. this sort star cooking utensil reaches preparation temperatures of concerning400F. a chunk of glass is placed over the highest of the box to retain heat. High-temperature star cookers use parabolic mirrors to focus daylight into the preparation instrumentation. These star cookers will reach temperatures of 600F terribly quickly.

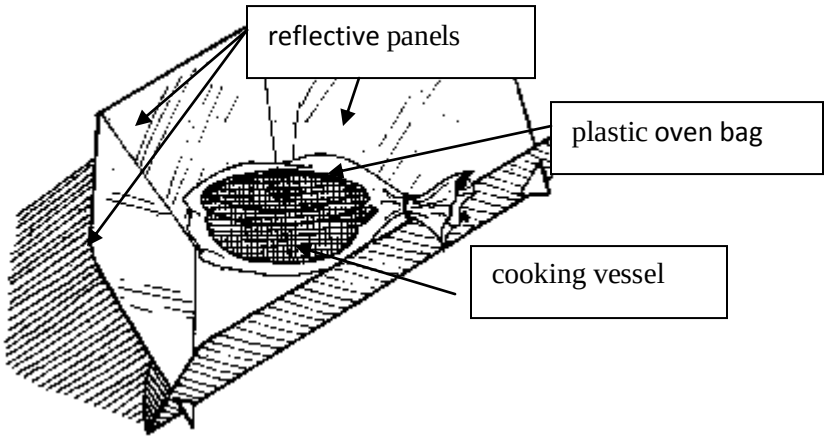
The star Box cooking utensil (SBC) or star kitchen appliance consists, largely, of some variety of heat trappings enclosure. very often, this takes the shape of a box made from building material with one face of the box fitted with a clear medium, like glass or plastic. this permits the box to require advantage of the atmospheric phenomenon and incident radiation cooks the food inside the box. The ability of a star cooking utensil to gather daylight is directly associated with the projected space of the collector perpendicular to the incident radiation. as an example, an oversized box with a glass lid can perform as a star box cooking utensil however the losses thanks to heat loss over a bigger expanse can, a minimum of partly, offset the extra gain through having a bigger collector surface. Instead, what's generally done is to make AN insulated box with a glazed surface cowl and use reflectors to extend the apparent collector space. These mirrorors is made up of a range of materials and their primary purpose is to reflect daylight through the glazing material and into the preparation area inside the box. In most cases, these reflectors area unit flattened in pure mathematics, with parabolic and alternative geometries reserved for the lot of difficult category of star cookers that utilize high concentration ratios. Whereas a high concentration quantitative relation permits a probably higher temperature and flux, high concentration quantitative relation devices generate nearly origin foci that need regular and frequent pursuit to follow the sun. while not this pursuit, the main focus can quickly deform, leading to AN uneven flux and probably damaging heat gain. A star Box cooking utensil can cook meals unattended for long periods of your time as a result of the sun is in a position to stay inside the read of the cooking utensil.

Panel Cookers

plastic kitchen appliance bag

cooking vessel

reflective panels Panel Cookers



Displays the layout of the Solar Cookie

The panel cooker is quite similar in operation to the SBC. The same principles are employed but instead of an insulated box, panel cookers typically rely on a large (often multi-faceted) reflective panel, as seen in Figure. At the focus of the reflector rests the cooking pot contained within a transparent medium, such as an oven bag or a glass bowl. Energy from the sunlight is reflected into the bowl or oven bag, heating up a dark painted pot and whatever may be inside of it. The pot in this case is generally less insulated from the environment than the pot in the case of the SBC. The panel cooker relies much more heavily upon reflected sunlight and less so on heat retention as compared to the SBC. This can make the panel cooker more portable and cheaper to construct but the panel cooker will suffer from generally somewhat poorer performance, particularly on days of marginal insulation or intermittent cloudy conditions.

SOLAR TRACKER

Figure displays the layout of the star Cookie

The panel cooking utensil is sort of similar operative to the SBC. an equivalent principles area unit utilized however rather than AN insulated box, panel cookers generally deem an oversized (often multi-faceted) reflective panel, as seen in Figure. At the main focus of the reflector rests the preparation pot contained inside a clear medium, like a kitchen appliance bag or a glass bowl. Energy from the daylight is mirrored into the bowl or kitchen appliance bag, heating up a dark painted pot and no matter is also inside it. The pot during this case is usually less insulated from the atmosphere than the pot within the case of the SBC. The panel cooking utensil depends far more heavily upon mirrored daylight and fewer therefore on heat retention as compared to the SBC. {this can this can this could this may} build the panel cooking utensil a lot of moveable and cheaper to construct however the panel cooking utensil will

suffer from typically somewhat poorer performance, notably on days of marginal insulation or intermittent cloudy conditions.

Many researches were conducted to develop some ways to extend the potency of icon voltaic systems (solar panels). One such methodology is to use a solar panel tracking system. Star pursuit allows a lot of energy to be generated as a result of the solar array is usually able to maintain a perpendicular profile to the sun's rays. because the sun moves across the sky throughout the day, it's advantageous to possess the star panels track the situation of the sun, specified the panels area unit perpetually perpendicular to the alternative energy radiated by the sun. this can tend to maximise the quantity of power absorbed by PV systems. it's been calculable that the utilization of a pursuit system, over a set system, will increase the facility output by half-hour - hour. the rise is important enough to form pursuit a viable preposition despite of the improvement in system value. It facilitates the star cooking utensil to induce the most daylight mechanically thereby increasing the potency of the cooking utensil. The solar array tracks the sun from east to west mechanically for max intensity of sunshine.

OBSERVATIONS:

Table 1

DATE	INITIAL TIME	INITIAL TEMPERATURE (°C)	FINAL TIME	FINAL TEMPERATURE (°C)
05-07-16	10:00	28.1	10:30	39
	10:30	29	11:00	43.2
	11:00	31.2	11:30	49.5
	11:30	34	12:00	62.6
	12:00	37.4	12:30	96
06-07-16	10:00	26.9	10:30	38.8
	10:30	28.1	11:00	47.2
	11:00	29	11:30	51.6
	11:30	33.6	12:00	70.4
	12:00	36.9	12:30	95.7
07-07-16	10:00	29	10:30	50.4
	10:30	30.1	11:00	61.3
	11:00	31.3	11:30	66.7
	11:30	32	12:00	74
	12:00	33.2	12:30	97.2

CALCULATIONS:

Pi =(T2–T1)MCv /600

where:

Pi = cooking power (W)

T2 = final water temperature

T1 = initial water temperature

M = water mass (kg), 1 Kg

Cv = heat capacity(4186 J/[kg·K])

Ps = Pi* 700/Ii

where:

Ps = standardized cooking power (W)

Pi = interval cooking power (W),

Ii = interval average solar insolation (600W/m^2)

Taking K= MCv/600= 4186/600= 6.97

S=700/600=1.16

Every time Ps & Pi should be divided by a factor 1/3 for 30 minutes.

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CALCULATIONS:

DATE	FINAL TEMPERATURE (T_2°C)	INITIAL TEMPERATURE (T_1°C)	T_2-T_1	Pi=(T_2-T_1)xK (in Watt)	Ps= PixS (in Watt)
05-07-16	39	28.1	10.9	76.04	88.21
	43.2	29	14.2	99.06	114.91
	49.5	31.2	18.3	127.67	148.09
	62.6	34	28.6	199.5	231.42
	96	37.4	58.6	408.8	474.21
06-07-16	38.8	26.9	11.9	83.02	96.31
	47.2	28.1	19.1	133.25	154.57
	51.6	29	22.6	157.67	182.9
	70.4	33.6	36.8	256.74	297.82
	95.7	36.9	58.8	410.23	475.86
07-07-16	50.4	29	21.4	149.58	173.51
	61.3	30.1	31.2	217.46	252.25
	66.7	31.3	35.4	246.73	286.21
	74	32	42	281.4	326.42
	97.2	33.2	64	446.08	517.45

Table2

CONCLUSION:

Table below provides a outline of the categories of food burned and therefore the length taken to cook them on totally different preparation stoves. Because the table shows, the All Metal Stove (AMS) typically cooks quicker than the normal three stone fireplace. there's no marked distinction in length of your time in preparation food between the 2 differing kinds of charcoal stoves, however there's substantial distinction within the quantity of charcoal used.

Type of food length on 3-stone fireplace length on All Metal Stove (AMS) length on Improved charcoal stove length on star Cookers

Lady finger 30-40 minutes 20-25 minutes forty minutes – fifty minutes ninety minutes-100 minutes

Pasta half-hour fifteen minutes thirty five minutes hour

Rice thirty five minutes twenty minutes forty minutes ninety minutes

Tea quarter-hour ten minutes quarter-hour forty minutes

CONCLUSION:

Type of food	Duration on 3-stone fire	Duration on All Metal Stove (AMS)	Duration on Improved charcoal stove	Duration on Solar Cookers
Lady finger	30-40 minutes	20-25 minutes	40 minutes – 50 minutes	90 minutes-100 minutes
Pasta	30 minutes	15 minutes	35 minutes	60 minutes
Rice	35 minutes	20 minutes	40 minutes	90 minutes
Tea	15 minutes	10 minutes	15 minutes	40 minutes

Table3

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