

A Novel on Decontamination of Water Using Solar Energy

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ABSTRACT— Water is vital for our presence. The developing populace and industrialization have expanded the rate of contamination of water. Utilization of such water may prompt spreading of water borne sicknesses. The venture means to supply filtered water by utilizing sun powered vitality which is promptly accessible. It concentrates on compelling use of sunlight based vitality by utilizing CSP (Concentrated Solar Power) innovation through cylindrical parabolic trough that focuses sun based vitality on a line where a vacuum tube is mounted. Higher focus proportion of parabolic trough empowers to raise the temperature of water to such a level, to the point that microorganisms no more exists. Sun oriented water sanitization incorporates two perspectives; first angle is silt evacuation utilizing carbon channel then, pathogen disposal in the complex because of warmth produced by common convection because of parabolic trough. Beginning filtration is conveyed by a carbon channel. Carbons filtration is a strategy for sifting that uses a bed of enacted carbon to expel contaminants and pollutions utilizing concoction adsorption.

After this underlying filtration via carbon channel, water is then gone to emptied vacuum tubes for remaining sanitization. A parabolic trough is a sort of sun powered warm collector that is straight in one measurement (Z-pivot) and bended as a parabola in the other two (X and Y-hub), lined with a cleaned mirror like completion metal. The vitality of daylight which enters the collector parallel to its plane of symmetry is engaged along the central line where the vacuum tube is bound. The vacuum that encompasses the outside of the tube significantly lessens convection and conduction heat misfortune, in this manner accomplishing more noteworthy productivity than level plate collectors. This warming of water executes infections bringing about life forms like microscopic organisms, infections, and so on.

KEYWORDS: Pollution of water, CSP, cylindrical parabolic, carbon filters, collector parallel.

I. INTRODUCTION

Water cleaning is the procedure of expelling undesirable chemicals, organic contaminants, suspended solids and gasses from tainted water. The objective is to create water for a particular reason. Most water is sterilized for human utilization, yet water sanitization may likewise be intended for an assortment of different purposes, including satisfying the prerequisites of medicinal, pharmacological, synthetic and modern applications. The strategies utilized incorporate physical procedures, for example, moderate sand filters or organically dynamic carbon; substance procedures, for example, flocculation and chlorination and the utilization of electromagnetic radiation, for example, bright light. Cleaning water may diminish the convergence of particulate matter including suspended particles, parasites, microbes, green growth, infections, organisms, and in addition decreasing the measure of a scope of broke down and particulate material got from runoff because of downpour. Visual examination can't figure out whether water is of fitting quality.

Vital goal is use of whimsical wellspring of vitality with ease. To do as such the CSP innovation has been actualized in this anticipate is the concentrated sun based force with the assistance of the parabolic sunlight based concentrator.

The sun powered water decontamination comprise of two viewpoints

1. Residue Removal
2. Pathogen Elimination
3. Water sanitization

Pathogen Elimination - In this we have presented another idea of CSP (concentrated sun oriented Power) with the assistance of the parabolic trough which focus the sunlight based radiation to one point of convergence. From all gap region to a little territory where the borosilicate tube is found. This expands the temperature of the water around 800 Degree in order to slaughter all pathogen.

Water Pasteurization - In this the temperature which was rose to the high temperature is again brought back to the room temperature with the help of the heat exchanger.

II. LITERATURE SURVEY

Parabolic trough technology- Parabolic trough power plants [1] use parabolic trough collectors to think the direct sunlight based radiation onto a tubular beneficiary. Expansive collector fields supply the warm vitality. Parabolic trough power plants constitute the greatest offer of the introduced thinking sun based force innovation.

John Ericsson built in 1880 the primary known parabolic trough collector[1]. He utilized it to control a hot air motor. In 1907, the Germans Wilhelm Meier and Adolf Remshardt acquired the primary patent of parabolic trough innovation.

The design was the era of steam. In 1913, the English F. Shuman and the American C.V. Young men developed a 45 kw pumping plant for watering system in Meadi, Egypt, which utilized the vitality supplied by trough collectors. The pumps were driven by steam engines, which got the steam from the parabolic troughs. The constructors utilized parabolic trough collectors with a length of 62m and a gap width of 4m. The aggregate gap zone was 1,200 m². The framework could pump 27,000 liters of water for every moment.

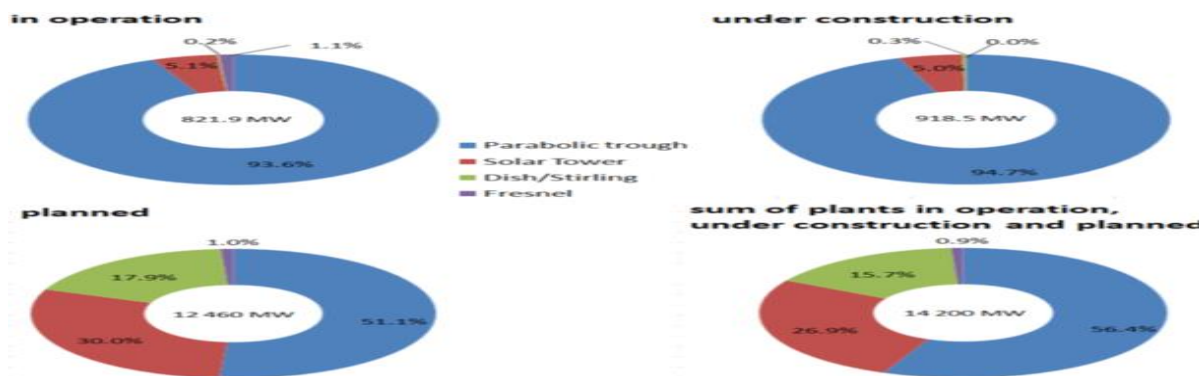


Fig 1. Percentage of different solar thermal power technologies

Collector geometry

The collector, the parabolic trough, is a trough the cross-section of which has the shape of a part of a parabola. More exactly, it is a symmetrical section of a parabola around its vertex.

Radiation concentration at a parabolic trough

Parabolic troughs have a focal line, which consists of the focal points of the parabolic cross-sections. Radiation that enters in a plane parallel to the optical plane is reflected in such a way that it passes through the focal line.

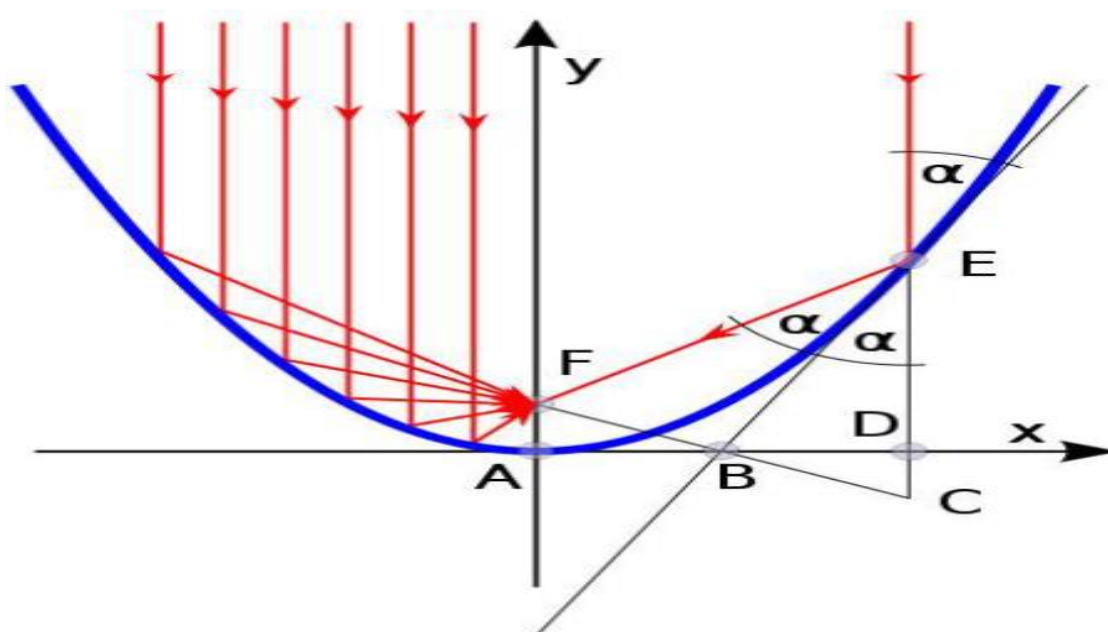


Fig. 2 Path of parallel rays at a parabolic mirror

A proof of the existence of a focal point is presented in the annex. An appropriate analytic representation of a parabola is

$$y = \frac{1}{4f} x^2,$$

Where, f is the focal length, i.e. the distance between the vertex of the parabola and the focal point.

Parameters of the geometrical descriptions of the parabolic trough.

Keeping in mind the end goal to depict a parabolic trough geometrically, the parabola must be resolved, the area of the parabola that is secured by the mirrors, and the length of the trough. The accompanying four parameters are regularly used to portray the structure and size of a parabolic trough: trough length, central length, gap width, i.e. the separation between one edge and the other, and edge, i.e. the edge between the optical hub and the line between the point of convergence and the mirror edge:

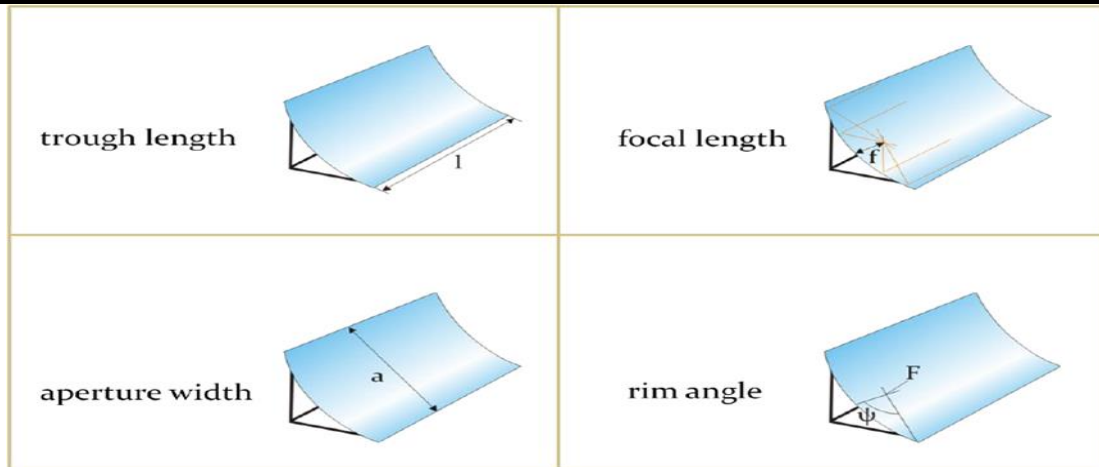


Fig. 3 Geometrical parabolic trough parameters

III. PROJECT WORKING

1. The tap water comes through the small pvc pipe and enters the pvc manifold.
2. Because of the gravity the water goes into the Borosilicate glass vacuum tube.
3. Incident radiation on the vacuum tube is absorbed with the principle of the black body absorption and to concentrate the solar radiation on the borosilicate tube the parabolic trough a new concept has been introduce.

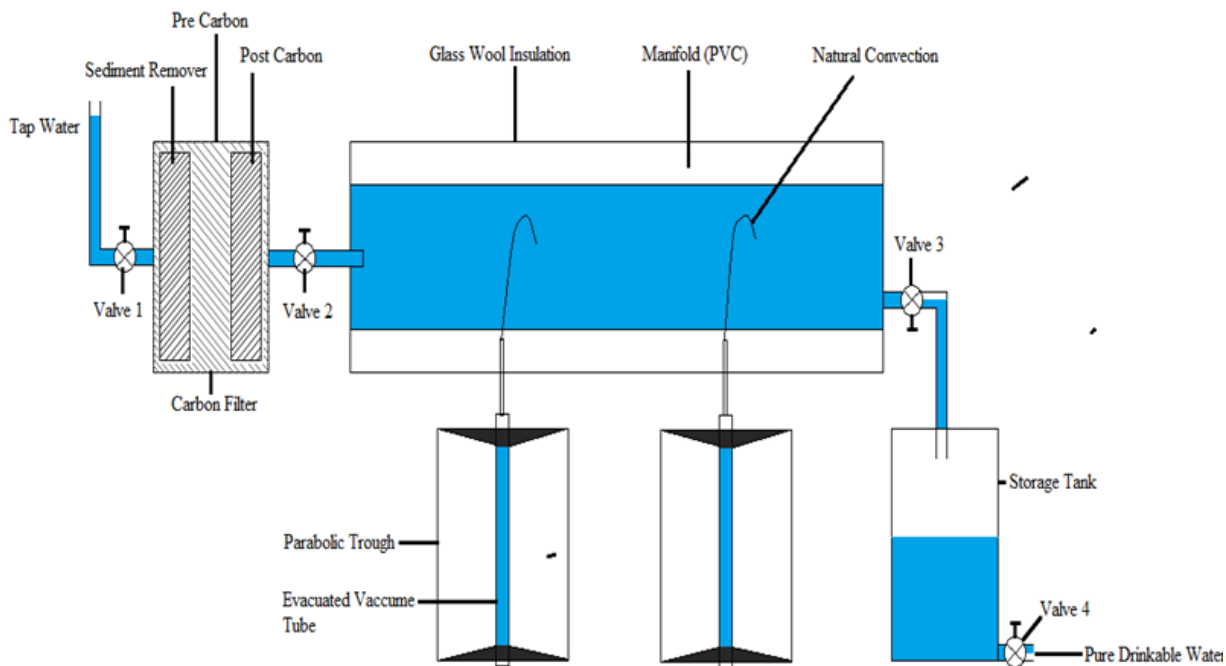


Fig. 4 project Layout

4. The parabolic trough works on the principle of the CSP(concentrated solar power)
5. So the cold water which is inside the tubes gets heated and get transferred to the pvc manifold by the phenomenon of the thermos phone effect
6. The collected water in the pvc manifold is around 75 to 80 0 degree Celsius which is sufficient to eliminate all the active pathogens.
7. The heated water is then collected in the container and it can used for drinking purpose.

IV. PROJECT DESIGN

Following are the components to be designed for our project

1. Parabolic reflector

A parabolic trough is a kind of sun based warm collector that is straight in one measurement and bended as a parabola in the other two, lined like a cleaned metal mirror. The vitality of daylight which enters the mirror parallel to its plane of symmetry is engaged along the lines, where articles are situated that are expected to be warmed. The fixation proportion for parabolic trough ranges from 10 to 80 [5].

2. Vacuum tube

A cleared vacuum tube collector comprises of two concentric glass tubes with annular space between them being emptied. The external surface of internal glass tube is specifically covered. The approaching sun oriented radiation is consumed on this surface and halfway led inwards through the tube dividers. The internal tube is loaded with water and the warmth is exchanged to the water by thermo siphon course. Because of encompassing vacuum the warmth misfortune by convection to encompassing is essentially lessened.

3. Metal construction

The development of ribs to hold the SS intelligent sheet is made utilizing aluminum and the cutting of ribs is finished by rotor cutting strategy. The stand to hold the complex and tank is developed of stainless steel grade 202.

4. Manifold

Complex was made by the gentle steel and covered with the powder covering to abstain from rusting.

V. MANUFACTURING & ASSEMBLY OF THE PROJECT

We have categorised the manufacturing procedure of the 'SOLAR WATER PURIFIER ' in following modules .

1. Manufacturing of the powder coated manifold of mild steel.
2. Manufacturing of the parabolic trough with reflective sheet.
3. Stand making
4. Carbon filter fitting
5. Final Assembly

V. RESULT AND DISCUSSIONS

The manufacture of the whole setup has been clarified in the past section. In this title we will center upon definite testing that was directed after the whole setup was created and the water test after the whole was refinement process led was sent to Lab Jalvidnyan Bhavan Nasik, which is a Government endorsed lab to check the consequences of decontamination procedure. Faucet water has been utilized as bay water which comprises of silt and in addition pathogens and it is been sanitized by "Sunlight based Water Purifier". The testing comprises of the checking different salts content in the water and on the off chance that it is inside as far as possible appropriate for drinking, silt content lastly the pathogen content in the water.

Test is likewise been led on "bore well" water to check for virtue of the specimen. Test of "bore well" water was sent to the research facility for testing different virtue checking parameters and was observed to be unfit for drinking. The specimen was filtered through our "Disinfecting of water utilizing sun powered vitality" setup and parameters were observed to be in the protected reach, in this way making water alright to drink.

The specimens were subjected to different cleaning test techniques and a sum of 11 parameters were taken for testing the examples. The different parameters tried are appeared in the table 6.1. Additionally, the pictures of the aftereffects of the specimens tried for immaculateness are appeared at indices. Taking into account the outcomes subsequent to testing the water test, the water can be termed as safe for drinking. The table 6.2 demonstrates the correlation of different filters with our channel on the following page.

Table 1. Testing result

Parameters	Result	Test Method
Colour	Agreeable	IS:3025
Odour	Agreeable	IS:3025
Taste	Agreeable	IS:3025
Turbidity	Within Limits	IS:3025
PH Value	In Range	IS:3025
Total dissolved solids	Within Limits	IS:3025
Total hardness	In Range	IS:3025
Residual free chlorine	Nil	IS:3025
Chlorides ion	In Range	IS:3025
Calcium	In Range	IS:3025
Total Coliforms	Absent	IS:1662-1981
Facecal Coliform	Absent	IS:1662-1981

The above comparison of “Decontamination of water” with the existing purifiers shows that our prototype competes with the existing purifiers i.e. Aqua guard and U.V. in terms of all major parameters that are required to make water drinkable.

Table 2. Comparison of Solar Water Purifier with existing filters

Parameters	Aqua guard	U.V Filter	Solar Water Purifier
Cost (Rs.)	6000 to 10000	5000-8000	4000-5000
Requires	Yes	Yes	No
Electricity			
Sediments	Yes	Requires additional	Yes
filtered(up to 10 microns)		Accessories	
Improves taste	Yes	No	Yes
Removes viruses	Yes		Yes
E-coli	Yes	Yes	Yes
Maintenance cost per year (Rs.)	1000-1200	1500-2000	500
Salts Removal	Yes	No	Yes
Space Consumed	Low	Low	High

Operative	Thought the year	Thought the year	Inoperative during
			dense clouding
Salt Water	Can be done	Not Possible	Not Possible
Purification			

V. CONCLUSION

Purified water at lower cost can be supplied in rural areas where the electricity is inadequate and quality of water is impure but there is abundance of solar energy. The setup does not include any electrical components and is purely mechanical. Since, the setup is purely mechanical and there are no moving parts it makes the setup operator friendly. Various water samples after purification process from the developed prototype were sent to suitable water testing laboratory (Government recognized laboratory) for testing and a total of 13 parameters were checked for water purification process and all 13 parameters of various samples sent were found to be within the specified range thus, making the water undoubtedly drinkable. Thus, it can be concluded that the objective of supplying 15liters of purified water was successfully achieved from the developed prototype and the product can be used to supply purified water at local level in those regions where electricity is inadequate and quality of water is impure but there is abundance of solar energy. The efficiency of the setup can be further improved by implementing solar tracker. The use of solar tracker will help in effective use of solar energy throughout a day. Thus quantity of output purified water can be increased. The onus should be on the compactness and aesthetics.

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