Analysis of Single Basin Double Slope Solar Steel

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Abstract- Water to sustain life on earth for man's basic needs. The use of technical and human knowledge as well as their waste disposal with the passage of time due to water pollution, water shortages caused to lead the world. The problem of solar distillation is one of the best techniques from other available technologies to solve. However, due to its low productivity in the market cannot be commercial. So that solar is still plenty of work efficiency or productivity could be improved. Still actively using various operating parameters of the single slope solar performance theoretically studied and compared with experimental data for validation purposes, the best is still to increase productivity is to explore factors. In present study we use double slope single basin solar still and simulate the system from CFD (Fluent14.5) for 6 hours (from 10am to 3 pm) in Bhopal city. From simulation results we can now conclude that maximum purify water is obtained at 3 pm. In simulation results flow phenomenon is stable in nature so that the system will be accurate as per the given boundary conditions.
Keywords: CFD, Solar, Accurate.

I. INTRODUCTION

A traditional sunlight based still is a typical sun oriented gadget utilized for modifying plentiful saline and salty water into consumable water. Because of its minor efficiency, it is not broadly utilized. Numerous specialists have introduced streamlining or overhauling structures which have been tried hypothetically and tentatively. A schematic outline of a basic traditional sun powered still is appeared .It comprises of a dark painted protected holder where polluted water gathers at shallow profundity. The holder is secured with a slanting glass spread which is fixed firmly to diminish spillage of vapor. This holder is bolstered by a reasonable protecting wooden casing[4]. The sullied water retains sun powered radiation, so gets to be warmed. Expanding tainted water temperature fortifies water atoms to vanish. Convection happens noticeable all around over the surface of water which conveys up the vapor atoms. At the point when the immersed air with vapor comes into contact with the cool internal surface of the straightforward glass spread, build up happens in a portion of the vapor particles. This condensate water descends, amasses in a trough along the lower side of the glass cover and travels through a plastic tube out of the nook. For the most part, a greatest effectiveness of an ordinary sun powered still is around half on account of a full protection. A less protection makes a diminishment of around 14.5% in the effectiveness. In the event that wind speed is expanded from 0 to 1.6 m/s, a slight lessening of about2% in the still execution will happen.

II. LITERATURE DETAILS

C. Gnanvel, R Saravanan, M Chandrasekaran (2022): The main objective of this literature is the productivity improvement of the solar still by using the phase changing material, the experimental setup was used of aluminum basin with Phase Changing Material and without Phase changing materials and the experiment was conducted in morning 7 am to evening 6 pm hour based productivity and cumulative productivity are also calculated for with and without PCM material, Trimethylolethane and Paraffin C18 material is used and found this experiment and the result of Paraffin C18 material produce the more productivity from this experiment, the same values are validate with the CFD analysis.

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Sathyamurthy, MuthuManokar Athikesavan (2022): Study investigate the solar still model efficiency was proposed in inspecting experimental validation and the still specifications using ANSYS CFD designing. The results obtained from ANSYS were compared with results obtained by conducting experiments in still. There is only a small variation obtained when comparing both the results were shown in this paper. ANSYS is best suited tool to check the still efficiency before designing it in real time. In contrast to other solar stills, the output of V type solar still is comparatively high due to large basin area. So V type solar still is preferred.

Hiroshi Tanaka, **(2019):**utilized heat retaining materials as a part of four indistinguishable sun based stills. The initial three stills contained uncoated metallic wiry wipe, covered metallic: wiry wipe and dark volcanic rocks. The fourth one utilized as reference still does not contain any engrossing materials (dark painted). The outcomes demonstrated that uncoated wipe has the most elevated water accumulation amid day time, trailed by dark rocks and after that covered metallic wiry wipes. Then again, the general addition in overnight water gathering was 28%, 43% and 60% for covered and uncoated metallic wiry wipes and dark shakes separately.

G N Tiwari, A K Tiwari(2018): A sun oriented still works sing the fundamental standards of dissipation and build-up. The polluted saline water into sun powered still and sun's beam enter a glass surface creating the water to heat up through the nursery impact and subsequently, vanish. At the point when the water vanished inside the sun powered still, it leaves all contaminants and microorganisms behind the bowl. The vanished and now refined water gathers on the underside of the glass and keeps running into an accumulation through and afterward into an encased holder. In this technique the salts and microorganisms that were available in the first bolster water to sunlight based still, are deserted. Extra water sustained into sun based still flushes out concentrated waste from the bowl of sun based still to maintain a strategic

distance from unnecessary salt statement in the bowl.

S. S6hanmugan, P. Rajamohan and D. Mutharasu (20): joined supporter mirror (acrylic) simply over the glass front of still bowl of range 1m2. The outcomes appeared with mirror sponsor the unit yield was 4.2 l/m2/d at 890 W/m2 and upgrade was 20 to 26%.

V. Velmurugan and K. Srithar, (2015): [25] The heat execution of a solitary slant sun based still combined with sun based gatherer utilizing diverse protection thickness (1, 2.5, and 5 cm), sunlight based power, general heat misfortune coefficient, absorptive, transmissibility, wind speed, temperature contrast amongst spread and water were concentrated on and presumed that general framework productivity as far as day by day distillate yield would increment by expanding the bowl water temperature utilizing circled boiling point water from the sun based authority.

A. Omri, M. Najjari, S. Nasrallah,talked (2015): about the heat profiles at various Grashof numbers and slant of top cover and found that dividers were not at consistent temperature. The study demonstrated that common smooth movement inside the sun based still is dictated by the top spread slant. The same creators numerically examined the regular convective stream in a triangular pit of a sunlight based still.

Salah Abdallah, Mazen M. Abu-Khader, Omar Badran, (2015): made four indistinguishable sun powered stills utilized different engrossing materials utilized as a part of single incline sun oriented still like uncoated and covered permeable medium called metallic wiry wipes and staying two utilized dark volcanic rocks and with no medium in atmosphere states of Jordan. From analysis, he found that, uncoated wipe has most noteworthy water gathering amid day time took after by dark shakes and covered wiry wipes.

Setoodeh, R. Rahimi, A. Amer(2013): performed multiphase reenactment and tests heat and mass exchange. The water temperatures anticipated by

CFD were in concurrence with the trial results. In this paper, we play out a three dimensional re-enactment for common convection stream in a sun oriented still hole and report the outcomes as far as shear push and heat exchange coefficients.

M. shakthiwel, S. Shanmugasundaram, T. Alwarsamy (2010):led probe regenerative sunlight based still with and without jute fabric. Jute fabric is a medium to give extensive dissipation surface and give and give dormant heat of build up. They demonstrated that, aggregate still yield in regenerative sun oriented still with jute material increments roughly 20% and productivity expanded by 8% with minimal effort alteration as the jute fabric is exceptionally shoddy and effortlessly accessible.

Omar Badran (2010): utilized dynamic sunlight based single incline sun powered as yet utilizing diverse operational parameters like distinctive protection thickness, sun powered force, successful absorptive and Transmissibility hypothetically and contrasted with trial information with pick best component improving sun powered still profitability. He demonstrated from study that dynamic sun powered stills can be of the alternatives for improving profitability of still.

III. METHODOLOGY

Computational fluid dynamics, sometimes abbreviated as CFD, could be a branch of mechanics that use numerical analysis and algorithms to unravel and analyze issues that involve fluid flows. Computers are accustomed perform the calculations needed to simulate the interaction of liquids and gases with surfaces outlined by boundary conditions. With high-speed supercomputers, higher solutions may be achieved. Current analysis yields software system that improves the accuracy and speed of complicated simulation situations like sonic or turbulent flows. Initial experimental validation of such software system is performed employing a structure with the ultimate validation coming back in complete testing, e.g. flight tests.

GENERAL CAD Modeling: Part / Assembly to create geometry using CAD modeling tools to build CAD models NX8.5 shown in fig.
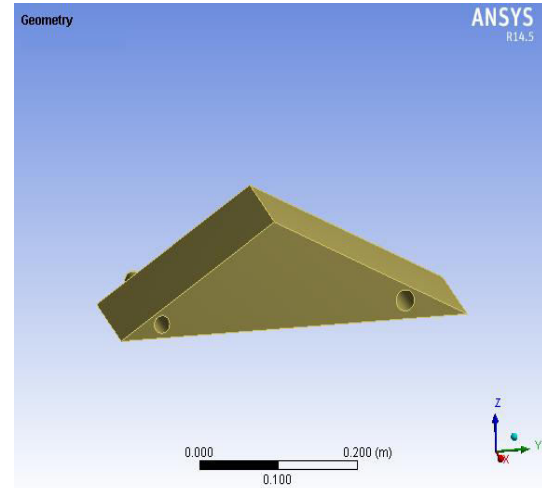

Figure 1: CAD Model

The standard size of single basin double slope solar still used in this project is overall dimension

Table 1: Geometry of solar still

Width	1 M
Length	1 M
Wood thickness	8mm
Glass thickness	4 mm
Glass Slope	30°

Meshing: meshing in CFD is an important job. In this operation, the CAD geometry is discredited large number of small elements and nodes .An appropriately called mesh nodes and a system of elements in space. Analysis accuracy and duration depending on mesh sizes and orientations. CFD analysis speed decreases with an increase in mesh size, but increase accuracy (increasing number of elements.
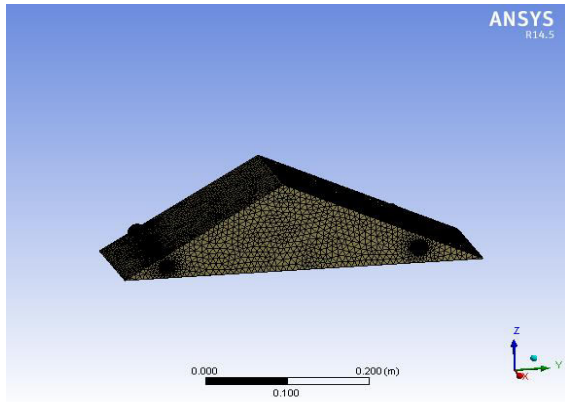
Figure 2: Mesh Model

IV. RESULT AND DISCUSION

Simulation Results: The numerical simulation was carried out in the Solar still to study the evaporation and volume of water generation performance. The working fluids in the solar still is water. **Turbulent Kinetic Energy:** Turbulent kinetic energy is the mean kinetic energy per unit mass associated with eddies in turbulent flow. Physically, the turbulence kinetic energy is characterized by measured root-mean-square (RMS) velocity fluctuations. In Reynolds-averaged Navier Stokes equations, the turbulence kinetic energy can be calculated based on the closure method, i.e. a turbulence model. Turbulent kinetic energy of the system increase and maximum turbulent kinetic energy of the system is 1.35e+01 m2/s2.
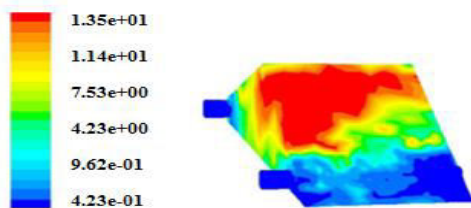

Figure 3: Turbulent Kinetic Energy (K) (m2/s2)
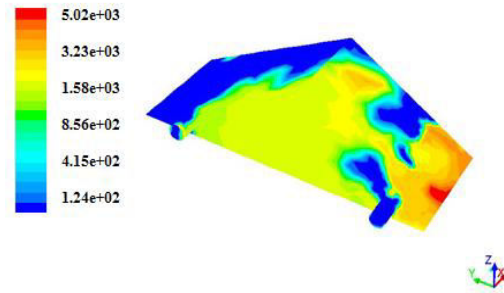

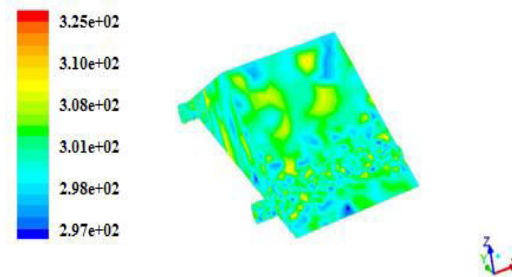Figure 4: Turbulent Dissipation Rate (m2/s3)
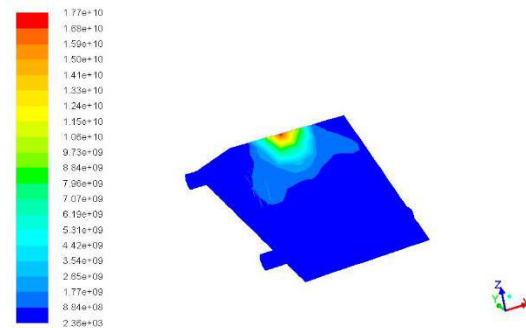

Figure 5: Temperature Variation (K)

Figure 6: Contour of Turbulent Kinetic Energy Variation

The productivity of solar still depend on several parameters such as solar radiation intensity deviation and ambient temperature variation from morning to evening for the day, latitude and longitude of the place and solar still parameters such as cover plate thickness, orientation and inclination, depth of water and properties of basin materials used for improving the energy absorption, energy storage and

evaporation heat transfer. The solar still parametric optimization is done for the given atmospheric parameters variations for a particular place. In a Solar system intensity of solar radiation increase or decrease, When temperature of water increase due to increase of intensity of solar radiation, and pressure of system also increase inside of the system, so that Nusselt number increase due to temperature and pressure variation inside and its genrate turbulent kinetic energy. Turbulent kinetic energy is directly proportional to turbulent dissipation rate, and its Turbulent dissipation rate also increases.Its produced vapor inside solar still and settle down in glass tray and collect in trace collector in form of fresh water.

V. CONCLUSION

The demand for fresh water in the world is growing every day. Pure / There are many ways to achieve fresh water and solar distillation is one of them. Solar distillation is a simple, small-scale and costs in homes or small communities to provide safe water, effective techniques. Solar stills can be used for different types of solar distillation is the simplest and most economical and still traditional basin type solar still. In present study we use double slope single basin solar still and simulate the system from CFD (Fluent14.5) for 6 hours (from 10 pm to 3 pm) in Bhopal city. and maximum amount of volume fraction of water is achieved due higher evaporation of impure water. The peak temperature is achieved due to the attack on the glass and solar rays begin to evaporate impure water. Caused by water heated by solar radiation and is vaporized. Water vapour and the temperature difference between the surface of glass in the glass leads to condensation of vapour. Condensed water droplets are collected in the bottom of the slide and distilled channel. Water collected in the amount of fresh water production rate of the channel is considered. Finally we see that the water content of the final simulated results.

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