**Impact of fin material properties and the inclination angle on the thermal efficiency of evacuated tube solar water heater: An experimental study**

**Uncertainty analysis**

The underlying causes of errors in various equipment are influenced through variables such as the calibration errors, equipment uncertainty, and data gathering errors. The experiment involves the direct measurement of several parameters, including sun irradiation $(I\_{s})$, flow rate ($m\_{wt}$), outlet temperature ($T\_{out}$), and inlet temperature ($T\_{in}$). The ambiguity of measurement and the propagation of error were examined (Kline and McClintock, 1953; Wang et al., 2017; Harrabi et al., 2020). The uncertainty analysis was conducted as follows:

$$U= \sqrt{\sum\_{i}^{R}a\_{i}S\_{i}^{2}}$$

Where, $a= \frac{1}{√N}$

$\frac{δη\_{t}}{η\_{t}}$ =$\sqrt{\left(\frac{δm\_{wt}}{m\_{wt}}\right)^{2}+ \left(\frac{δI\_{s}}{I\_{s}}\right)^{2}+ \left(\frac{δ(T\_{0}-T\_{i})}{(T\_{0}-T\_{i})}\right)^{2}}$

$\frac{δη\_{t}}{η\_{t}}$ (%) = $\sqrt{0.03²+0.05²+0.01² }$= 0.059 = 5.9%

The variables in the equation are as follows: ($U$) represents the overall uncertainty, ($a$) denotes sensitivity, (*N*) is the number of measurements used to determine the equipment uncertainty, and (*S*) indicates the standard deviation. The uncertainties associated with the measuring instruments (Kline and McClintock, 1953; Wang et al., 2017; Harrabi et al., 2020) employed in the experiment is reported in section 2 and 3. The maximum uncertainty in$η\_{t}$was determined to be 5.9%.

**Table S1** ETSWH thermal performance comparison with prior research.

|  |  |  |  |
| --- | --- | --- | --- |
| References | Type of ETSC | Design | Results |
| Maximum $η\_{t}$ attained | Maximum $T\_{out}$achieved | Optimum tilt angle |
| Dabra et al., 2013 | All glass ETSC | ETSC setup with two distinct tilt angles i.e. 30° and 45°. | ---- | ---- | 30° |
| Gholipour et al., 2020 | Vacuum tube collector | Vacuum tube collector with three distinct types of inserts. | 55.1% | ---- | 30° |
| Ayompe and Duffy, 2013 | ETSC | ETSC incorporated with heat pipe. | 52.0% | 70.3 °C | ---- |
| Xia and Chen, 2020 | ETSC | ETSC integrated with mini-CPC reflector. | ETC with mini-CPC had a 27.2% higher $η\_{t}$ than the traditional collector. | ----- | ---- |
| Naik et al., 2021 | U Tube ETSC | U-tube ETSC integrated with parabolic reflector. | The $η\_{t}$ of the collector increases by 14.1% using a parabolic reflector. | ---- | 60° |
| Present study | ETSWH | ETSWH integrated with copper and aluminium as fin materials at different inclination angles. | 58.57% with copper fins. | 55 °C | 30° |