# A NOTE ON FIELD TRIALS OF A NEW PROTOTYPE SOLAR STILL

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ABSTRACT

Observations on field trials of a prototype still of modified design with respect to the quantity and quality of the fresh water obtained are reported. Average yield of 3·61 litres $m^{-2}$ $day^{-1}$ of fresh water was obtained during postmonsoon and winter months. Traces of dissolved copper, zinc and Iron were observed in the distilled water and the causes of metallic contamination have been discussed.

Basin-type solar still of various configurations have been developed earlier (Howe, 1974). Major features of a good still are that it should be made of low cost materials which are readily available and designs of the components should be such that they could be assembled and replaced easily. Over and above the still should give a fairly high fresh water yield of the acceptable quality. Keeping these requirements in view a modified basin-type solar still was developed by the author (Anon, 1976). A schematic diagram of the still is given in Fig. 1. A prototype of the modified design was got fabricated and put to field trials to study the quantity as well as quality of fresh water obtained from it.

Three litres of seawater were added afresh to the unit on alternate days and the unit was exposed to solar radiation daily during the post monsoon months. The output of fresh water thus obtained after every 24 hours, was collected, measured and then analysed for few parameters, *viz*., total dissolved solids, dissolved copper, zinc and iron.

The results of a few selected runs are given in Table 1.

It may be noted that the experiments were conducted in the months of Sept., Oct. (1976) and Jan. (1977) when the influencing physical factor, *i. e*., solar radiation intensity which has earlier been reported to be a limiting factor in the production of solar distilled water (Daniels, 1974) has been observed to vary to a great extent and to be lower than of summer months. Gomkale and Datta (1968) have also reported lower solar intensities in Goa in these months (505, 497, and 482 cal $m^{-2}$ $day^{-1}$ respectively and higher *i. e*., 565, 589 and 567 calim$^{-2}$ day$^{-2}$ in March, April (maximum) and May. Therefore, fresh water yield greater than 3·61/$m^{-2}$ $day^{-1}$, the average value of the present study can be expected from the prototype during the summer months in Goa. Keeping in view the fact the efficient solar stills have been observed to give yields varying between 2·5 – 4·0 litres per square metre of the block surface on sunny days of the summer months only (UNP, 1964), the present yield of fresh water from the prototype can be taken as fairly high. Its high yield has been observed to be due to higher transmission of solar energy through the top cover as well as the side walls made of glass sheet. Besides, their surfaces offer a larger area for the condensation of vapours.

Further with respect to quality of fresh water it is noticed that in addition

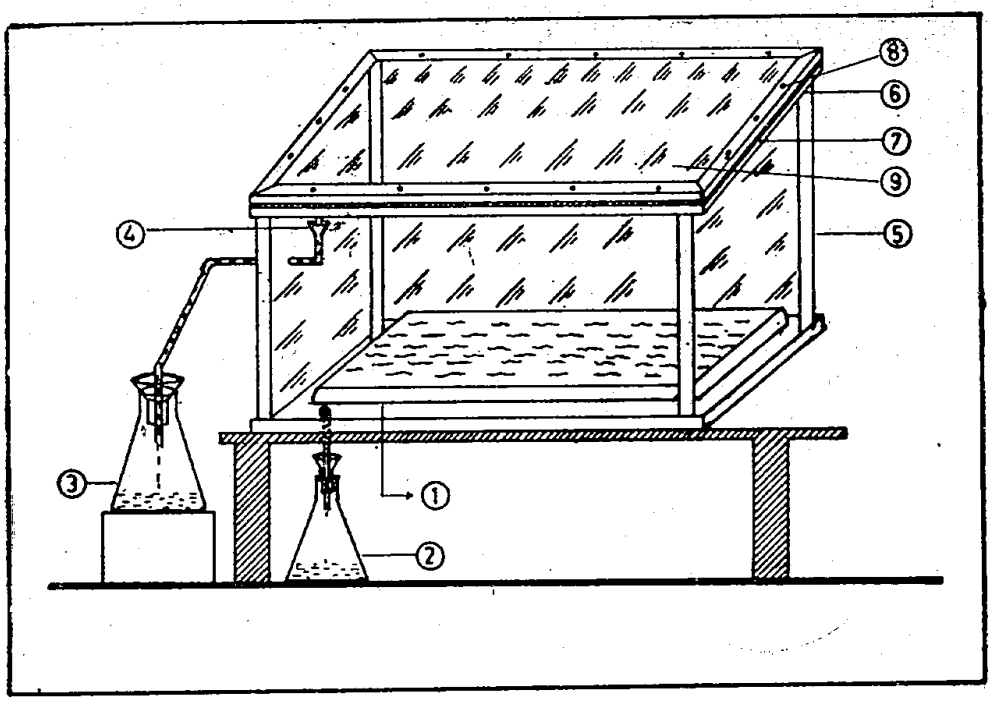


*Fig.* 1. Schematic diagram of the new prototype solar still.

(1) G. I. sheet water basin.
(2) Side walls' condensate.
(3) Top cover condensate.
(4) Condensate collection gutter made of copper sheet.
(5) Wooden pillar.
(6) Wooden beam.
(7) Rubber gasket.
(8) M. S. nut–bolt.
(9) Glass sheet top Cover.

to determining of pH and total dissolved solids, each output has been analysed for the determination of dissolved copper, zinc and iron by the Atomic absorption spectrophotometer. The data (cols. 7, 8 and 9 in Table I) indicate that their concentration ranged between 0·25–0·53 mg/l 0·025–0·075 mg/l and $<0·05$ mg/l respectively. A check regarding permissible limits of these metals in "wholesome" (WHO, 1963) and "good chemical quality" (Lange, 1961) water shows that their concentration should not exceed 1·5, 5·0 and 0·3 mg/l respectively. Thus the present fresh water samples contained copper, zinc and iron lesser by 73, 99 and $>83$ % than the prescribed limits. In a way the quantities of these metals can be regarded as negligible.

Since the condensate collection gutter (component 4 in Fig. 1) of the prototype is made of copper sheet it appears that more copper gets dissolved on account of corrosive action of water upon copper (Rainwater, 1960), which gets further increased with rise in temperature(Holden, 1970). The low pH also appears to be due to dissolution of this metal. Though few other metals, *viz*., Cd, Ba, Cr, Mg, Pb, As and Mn etc. whose presence in the fresh water in general, is permitted only in specific traces (Zajic, 1971), have not been estimated in the output waters yet their concentrations can be regarded as nil keeping in view that negligible quantities of copper, zinc and iron, the possible contaminents from the prototype components— (a) the condensate collection

*Table I :* Quantitative and qualitative results of fresh water obtained from the prototype solar still.

| Sr. No. | Date | Surface area ($m^2$) | Volume Fresh Water (litres) | pH | Total Dissolved solids(mg/l) | Dissolved Copper (mg/l) | Dissolved Zn (mg/l) | Dissolved Iron (mg/l) |
|---|---|---|---|---|---|---|---|---|
| 1. | 17·9·76 | 0·33 | 1·41 | 6·5 | 23 | 0·44 | 0·062 | <0·05 |
| 2. | 19·9·76 | ,, | 1·30 | 6·6 | 23 | 0.51 | 0·075 | ,, |
| 3. | 21·9·76 | ,, | 1·16 | 6·8 | — | 0·25 | 0·045 | ,, |
| 4. | 24·9·76 | ,, | 1·31 | 6.5 | 24 | 0·49 | 0·038 | ,, |
| 5. | 27·9·76 | ,, | 1.10 | 6·6 | 24 | 0·44 | 0·068 | ,, |
| 6. | 4·10·76 | ,, | 1·19 | 6.8 | 24 | 0·46 | 0·065 | ,, |
| 7. | 8·10·76 | ,, | 1·31 | 6·7 | 10 | 0.53 | 0·063 | ,, |
| 8. | 12·1·77 | ,, | 1.08 | 6·3 | 20 | 0·46 | 0·025 | ,, |
| 9. | 13·1·77 | ,, | 1·16 | 6·3 | 16 | 0·29 | 0·050 | ,, |
| 10. | 14·1·77 | ,, | 1·10 | 6·4 | 20 | 0·50 | — | ,, |
| 11. | 15·1·77 | ,, | (Half day) | 6·5 | 10 | 0·30 | 0·044 | ,, |
| 12. | 17·1·77 | ,, | 1.10 | 6.3 | 14 | 0.35 | 0.050 | ,, |
| 13. | 19·1·77 | ,, | 1·08 | 6.2 | 10 | 0·30 | 0·038 | ,, |
| 14. | 23·1·77 | ,, | 1·16 | 6·3 | 24 | 0·45 | 0·025 | ,, |
| 15. | 24·1·77 | ,, | 1·25 | 6·4 | 26 | 0·28 | 0·025 | ,, |

gutter, (b) the galvanised iron water basin (4 & 1 in Fig. 1) have been estimated in the present collections. Thus the analysis suggests that the observed contamination can be avoided by fabricating the components from non-toxic and cheaper materials. Further work to improve the prototype is under active progress.

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