MATERIALS FOR CONSTRUCTION OF SOLAR STILLS

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Contents

Summary

The selection of materials for use in solar still systems will vary due to a variety of factors including the availability of these materials locally, as well as other financial and human factors. The above criteria and guidelines serve mainly to illustrate the minimum standards that must be met in order to ensure a long, useful and productive life with minimal maintenance under field conditions. Obviously as new construction materials are developed, consideration must be given to their potential use in solar distillation applications. Economic factors will play a very important role in determining when these newer materials will be available for widespread use of this technology. In the final analysis, the overriding goal in the proper selection of materials for a solar still is that fresh water is being produced for use primarily as drinking and cooking water for people. It must therefore be of the highest quality to avoid illnesses developing.

1. Introduction

Construction materials for solar stills are generally basic and standard. It is only through using standard available components that solar still systems can be envisaged from a technical and economic point of view. As these stills are generally located in remote and often inaccessible areas, it is important that as many of these materials as possible can be prefabricated in such a manner that they can be easily packaged and shipped to a remote area for assembly and use.

Many designs of solar stills exist. The aim of this selection is to specify the criteria by which materials of construction of the different solar still components can be categorized. In designing solar stills, it is important that these criteria be fully respected

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otherwise it is impossible to ensure that these units can have a long and productive life.

2. General Specifications of Solar Stills

There are certain basic requirements which must be met. In general, the unit must fulfill the following conditions.

1. It must be easily assembled in the field;
2. It should be packageable so as to reduce transportation costs. (this is particularly true not only for shipment from one country to another, but especially for internal movement within a given area, i.e. From the port to final destination);
3. It should be lightweight for ease of handling and shipping;
4. It must have an effective life, with normal maintenance, of 10 to 20 years;
5. The still must be equipped with access ports for ease of maintenance;
6. It should not require or depend upon external power sources;
7. It should also serve as a rainfall catchment surface;
8. It should be able to withstand the effects of severe storms;
9. It must be manufactured from materials which will not contaminate the collected rain water or the distillate. (we must continually stress that solar stills constitute the water supply system for the communities served and hence must be non-toxic in every respect to the fresh water produced); and
10. It must be fabricated so that the maximum solar still component size can be directly related to economic shipping dimensions as specified by freight carriers.

There are other considerations which must be taken into account depending on local conditions. In summary, the solar stills must meet generally accepted civil and structural engineering standards. The rest of this paper deals with the general specifications of solar still system components.

3. Transparent Cover

This serves to cover the equipment and transmit solar radiation to the interior. Properties required are listed below:

1. The material must withstand the effects of wind, sunlight, rain, dust, etc.;
2. The material must have a transmissivity for short wave solar radiation (between the limits of 0.3 to 3.0 microns) of over 85 per cent, and preferably higher;
3. Essentially, it must be nearly opaque to long wave (over 3.0 microns) radiation;
4. It should not have a high water absorptivity, both from its use as a rainfall catchment surface on the outside and its probable use as a condenser on the inside;
5. The solar reflectivity at normal incidence should not exceed 10 per cent;
6. The solar absorptivity of the material should be low, especially if the cover is also to be used as a condenser;
7. The heat capacity should be high in order to reduce the cover temperature;
8. The material properties should not alter with age and exposure to the elements;
9. The material should not possess electrostatic properties which would concentrate dust particles on the outside surface;
10. If the cover is to be used as a condenser, the material must withstand temperatures

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of up to 80°c. In addition, one side will experience extremely high relative humidities (up to 100 per cent), while the other surface must concurrently withstand the low humidities prevalent in arid regions;

11. The cover must be able to withstand the ravages of small animals;
12. The cover must be able to withstand a wind load of up to 45 m sec^{-1}.

There are other considerations which must be taken into account which will depend on local conditions.

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