ABSTRACT

UTILIZATION OF SOLAR ENERGY FOR DESALINATION OF SEAWATER FOR DOMESTIC AND INDUSTRIAL APPLICATION

By

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The lack of basic design data for efficient desalination of seawater by solar energy is one of the reasons why this current research is being undertaken. Literature search has guided this investigator in adopting the type of solar still currently used for purposes of data collection.

Basically the solar still is a basin type with ordinary window glass as condensing surface. The basin is double-walled with an appropriate insulating material between walls. The thickness of the insulating material has been calculated to effect a minimum of convection losses from the outside wall to the atmosphere. The walls are of Gauge #18 B.I. The brine section is painted flat-black for maximum absorption of radiant energy. The glass plate is fixed at 10 degree inclination, and oriented for maximum solar incidence. The solar collecting area is 9 sq. ft.

Thermocouples are incorporated in the still (with an appropriate potentiometer) to measure glass surface temperature; and brine temperature at various sections in the still.

Results, to date, have shown that:

1. There is little effect of salinity on production, within the range 0 to 8% salinity (by weight).

2. There is marked effect of dept of the brine on production—twice the production of a 2-in. depth brine over that of a 1-in. depth brine.

3. Brine temperature must exceed 120°F to effect production.

4. Production is minimum during months of July to September, as compared to, say, May.

5. The use of a floating black fabric in the brine has shown marked increase in production.

6. On the whole, the productivity is comparable to some of the existing solar stills in other countries.

Based on the initial results it is proposed to extend the investigation to include the search for inexpensive materials of construction without sacrificing efficiency of desalination.

Work should also be exerted to arrive at a design of a still which incorporate the "good" features that result in a minimization of heat losses, faster increase in brine temperature, ease in maintenance and repair.

Work on a pilot scale solar desalination plant should be initiated.

2 in. depth
8% salinity
10° inclination of plate

(May 24, 1974 Data)

Time	*Ambient Temp., °F*		*Brine Temp.,*	*Accumulated*
	D.B.	*W.B.*	*°F*	*Distillate (ML)*
9:50	91	79	—	0
11:20	103	88	—	0
12:00	106	86	—	0
12:30	102	85	—	20
1:00	108	88	—	60
1:40	110	89	—	140
2:00	112	90	—	200
2:30	114	90	124	270
3:00	100	91	142	375
3:30	99	85	—	500
4:00	97	84	145	650
4:30	94	83	—	800
5:00	92	81	140	900

1 in. depth
0% salinity
10° inclination of plate

(April 24, 1974 Data)

Time	*Ambient Temp., °F*		*Brine Temp.,*	*Accumulated*
	D.B.	*W.B.*	*°F*	*Distillate (ML)*
9:00	92	82	91	0
9:30	99	84	95	9
10:00	92	80	102	18
10:30	100	84	106	34
11:00	94	81	109.5	69
11:30	99	84	109.5	115
12:00	100	84	117	178
12:30	105	86	120	232

TABLE :

Typical Values for Hours of Bright Sunshine per Day, Quezon City

Month	Hour 6	7	8	9	10	11	12	13	14	15	16	17	18	19	*Total*
January	0	.2	.6	.6	.7	.7	.7	.5	.6	.5	.5	.4	.1	0	6.2
March	0	.1	.6	.7	.8	.7	.7	.7	.7	.6	.4	.4	.1	0	6.9
May	0	.5	.7	.8	.8	.7	.7	.7	.7	.7	.5	.4	.2	0	6.9
July	0	0	.1	.2	.2	.2	.2	.2	.2	.1	.1	.0	0	0	2.0
September	0	0	.5	.7	.7	.6	.6	.4	.4	.4	.2	.1	0	0	5.1
November	0	.1	.5	.7	.7	.7	.6	.5	.6	.5	.5	.3	.1	0	6.3

Typical Values for Incident Radiation, (Btu/ft^2), Quezon City

Month	Hour 6	7	8	9	10	11	12	13	14	15	16	17	18	19	*Total But/ft²-day*
January	0	3.7	48	100	151	180	188	177	166	129	96	44	11	0	1294
March	3.7	18	81	143	195	221	225	210	195	162	111	66	22	0	1655
May	11	48	125	181	188	240	203	203	203	140	100	66	33	7.4	1751
July	0	22	52	74	107	118	144	133	111	77	63	37	.5	0	951
September	0	37	100	162	195	210	229	173	181	151	103	44	.8	3.7	1608
November	0	26	81	144	192	181	184	162	170	114	77	29	3.7	0	1364

1 in depth
8% salinity
10° inclination of plate

(May 22, 1974)

Time	*Ambient Temp., °F* D.B.	W.B.	*Brine Temp., °F*	*Accumulated Distillate (ML)*
9:30	98	83	91	0
10:00	104	84	102	0
10:30	96	80	111	0
11:00	93	80	113	30
11:30	98	81	116	85
12:00	97	82	116	150
12:30	98	83	121	250

1 in. depth
8% salinity
10° inclination of plate

(May 23, 1974 Data)

Time	*Ambient Temp., °F* D.B.	W.B.	*Brine Temp., °F*	*Accumulated Distillate (ML)*
10:30	103	84	103	0
11:00	99	83	112	0
11:30	105	80	116	0
12:00	93	78	124	0
12:30	95	80	129	75
1:00	96	80	136	40
1:30	105	85	152	90
1:45	109	87	157	120
2:15	108	86	157	200
2:45	97	80	143.5	250
3:15	110	86	145	290
3:30	114	87	153	330
4:00	106	84	147.5	360

2 in. depth
8% salinity
10° inclination of plate

(July 24, 1974 Data)

Time	*Ambient Temp., °F* D.B.	W.B.	*Brine Temp., °F*	*Accumulated Distillate (ML)*
9:00	92	81	85	0
9:30	96	81	87	0
10:00	96	81	92	0
10:30	96	82	96	0
11:00	90	84	102	0
11:30	94	82	106	0
12:00	94	84	110	0
12.30	89	82	112	0
1:00	94	81	112	0
1:30	99	79	120	17
2:00	88	82	116	73
2:30	87	80	114	110
3:00	88	81	112	135
3:30	91	82	166	166
4:00	90	82	114	180

2 in. depth
8% salinity
10° inclination of plate

(July 30, 1974 Data)
(with black fabric)

Time	*Ambient Temp., °F* *D.B.*	*W.B.*	*Brine Temp., °F*	*Accumulated Distillate (ML)*
10:00	93	83	89	00
10:15	93	81	94	0
10:30	92	82	99	0
11:00	92	82	103	0
11:30	95	83	107	0
12:00	100	84	116	0
12:30	95	83	123	20
1:00	95	82	124	40
1:30	99	84	124	70
2:00	101	84	128	150
2:30	92	82	129	180
3:00	83	77	125	235
3:30	81	76	121	285