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Estimation of Evaporation Losses From Open Surfaces

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Abstract:- In these project is deals with control evaporation losses from open surfaces using floating balls. The project is done by preparing two models and by using conventional method. These project is executed in Aurangabad and the models were kept at height of 15m from ground level which are directly in contact with sun radiation. We prepared the Model A which is a pan with open surface and Model B which is a pan whose surface is covered with floating balls. Pan /Tray is taken of dimensions 0.42m length, 0.31m breadth and surface area is taken as 0.1302 m2, then provided with initial water level of 9.7cm (at maximum temperature 43℃ and minimum tempe rature 23℃). The model A is kept open surface and model B is kept covered with floating balls. Daily readings of evaporation in Model A and Model B were taken in pre-monsoon and monsoon season. After the study, we find that proposed models is successful for evaporation losses from open surface by 49%.

Keywords:- *Control of Evaporation, Floating Balls.*

I. INTRODUCTION

Fresh water for utilization is becoming scarce worldwide, to provide balance and stable supply, water is stored during wet season in reservoir for use during drier periods. Water evaporation refers to water losses from the surface of body to atmosphere. Evaporation occur when the number of moving molecules that breaks from water surface and escape into air escape and vapor is larger than the number that re-enters the water surface of the earth and become entrapped in the liquid.

Evaporation refers to water losses from the surface of a water body to the atmosphere. Evaporation occurs when the number of moving molecules that break from the water surface and escape into the air as vapor is larger than the number that re-enters the water surface from the air and become entrapped in the liquid (Brutsaert 19820). Evaporation increases with high wind speed, high temperature and lower humidity. A sizable quantity of water is lost every year by evaporation from storage reservoirs and evaporation of water from large water bodies influences the hydrological cycle. Among the hydrological cycle, evaporation is perhaps the most difficult to estimate due to complex interactions among the components of land-plant-atmosphere system (Singh and Xu 1997).

Factors affecting evaporation:

- Temperature
- Surface area
- Humidity
- Wind speed
- Degree of saturation
- Atmospheric pressure
- Atmospheric aqueous pressure
- Economic factor

II. LITERATURE REVIEW

- Cooley K.R. (1987) describes some U.S. studies on estimating evaporation from water bodies. Procedures and techniques were done to estimate evaporation from water surfaces using pan evaporation, available weather data and new data is collected specifically for estimating daily evaporation.
- Cluff C.B. (2014) reviewed an evaporation reduction studies indicates that shades suspended above a water surface and floating covers on water surface gave best results. Floating covers are most practical and field tests using floating covers of foamed wax blocks, continuous wax, and foamed rubber reduced evaporation losses 36% to 84% over 8 year period.
- Cooley and Myers (2015) studied the floating reflective covers appear promising as a means of reducing evaporation from open surface. Eight light-colored materials were studied using buried and exposed wall tanks to stimulate a range of field conditions. Tested on the 2.1m diameter buried tanks were asphalt- concrete blocks, white butyl rubber, foamed butyl rubber, Mini-Vaps, Styrofoam and foamed wax blocks. The same foamed wax blocks and two continuous wax covers of different melting points were tested on 2.7m diameter exposed wall tanks. Efficiencies ranged from 23-79% reduction and from 36-87% reduction on the buried and exposed wall tanks respectively. Styrofoam and the lower melting point continuous wax layer were the most efficient. The three wax covers and the two butyl rubber covers were the most economical, saving water for between $0.44 to $1.07 per 1000 gal. These costs are less than most alternative methods for providing additional water supplies.
- M.M. Hassan and W.L. Peirson (2016) studied the effectiveness of near zero cost and widely available recycled material in form of floating modules to reduce evaporation has been perform in the field. The result obtained are consistent that the evaporation losses reduce approximate linearly in proportion with the

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degree surface covering.

- M. van der sterren and G.R. Dennies studied the water quality of five rainwater tanks located in Western Sydney, Australia. The results show that tank water quality was impacted by the construction materials used to fabricate both the tanks and roofs, furthermore, the overflow water quality found to be of a lower standard than the tank samples.

III. OBJECTIVE

- To study the evaporation losses from open surface.
- Prepare method to stop evaporation from open surface using floating balls method.

IV. METHODOLOGY

- Collection of literature.
- Site selection.
- Model preparation.
- Continuous reading and observations of water level on daily basis in pre-monsoon and monsoon season.
- Testing of water parameters.

V. DATA COLLECTION

A. Site Selection

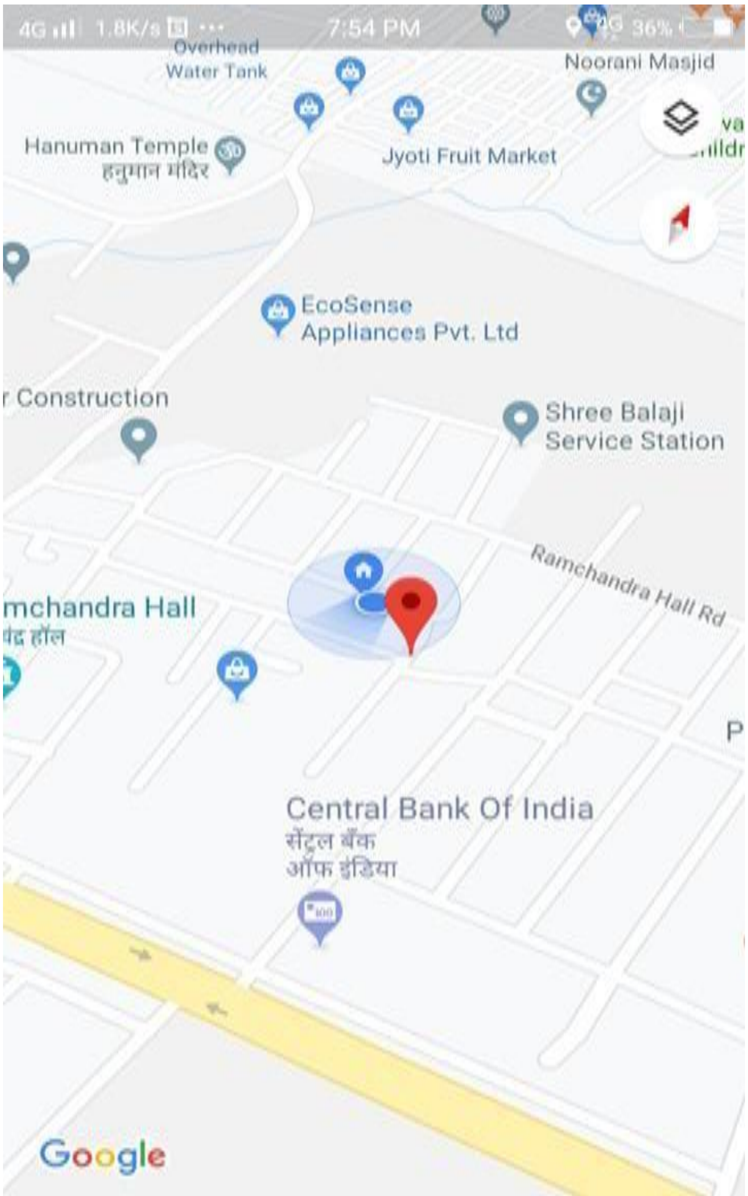

Fig 1:- Location of Site

The site we selected for our project is present in Aurangabad, Maharashtra, opposite MIT college, Beed-bypass road. Our project is kept at a height of 15m from ground level which is directly in contact with sun radiation. This is the exact location where the project is located for observation.

B. Models Preparation

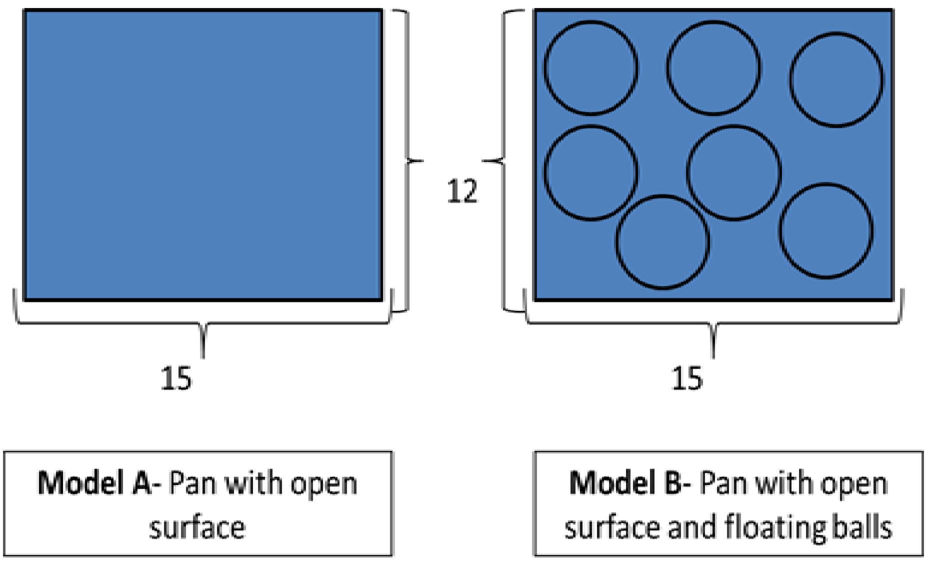

Fig 2:- Experimental Study of Models Dimensions

➢ *Model A with open surface and Model B with open surface covered with floating balls:-*

The Following Procedure Was Followed For Setting Up The Model.

- Pan/Tray of dimensions 0.42m length, 0.31m breadth and surface area 0.1302m^2 are taken as for study purpose
- Scale was mark on Pan for noting the level of water depth.
- Water was filled to top mark in Pan daily in morning and evening level was noted.
- Daily variation of temperature was recorded for IMD for given study area.
- Procedure was repeated every day.

Fig 3:- Actual Setup of Models 'A' and 'B'

C. Collection of Materials

Fig 4:- Actual Photo of Floating Ball

Floating balls which are used in project are made up of HDPE (High density polyethylene). HDPE is non toxic and able to with stand continuous working temperature. The shape of floating balls is sphere and hollow and its diameter is measured about 5 inch (12.7cm) and weight is measured approximately 245 grams. Floating balls which are taken in study has the melting point of 110°C to 180°C

❖ *Calculation:-*

As the surface area of the proposed model is 0.1302m2 , so as per calculation for this area we required 9 balls of diameter 5 inch (12.7cm) and having weight 245 grams.

❖ *Readings and Observations:-*

Week (11April to 6 june)	**Average value of water level in model 'A'**	**Average value of water level in model "B"**	**Difference in value of both the models 'A' and 'B'**	**Total evaporation losses**
11April- 17April	1.41	0.75	0.66	46.80%
18April- 23April	1.97	0.75	1.22	61.90%
24April- 1 May	1.4	0.84	0.57	40.40%
2 May - 8 May	1.41	0.65	0.76	53.90%
9 May - 15May	1.41	0.73	0.74	50%
16May- 22May	1.77	0.96	0.81	45.70%
23May- 29May	2.4	1.11	1.29	53.75%
30 May – 6 Jun	2.6	1.51	1.09	41.90%

Table 1:- Percentage (%) of Evaporation Losses

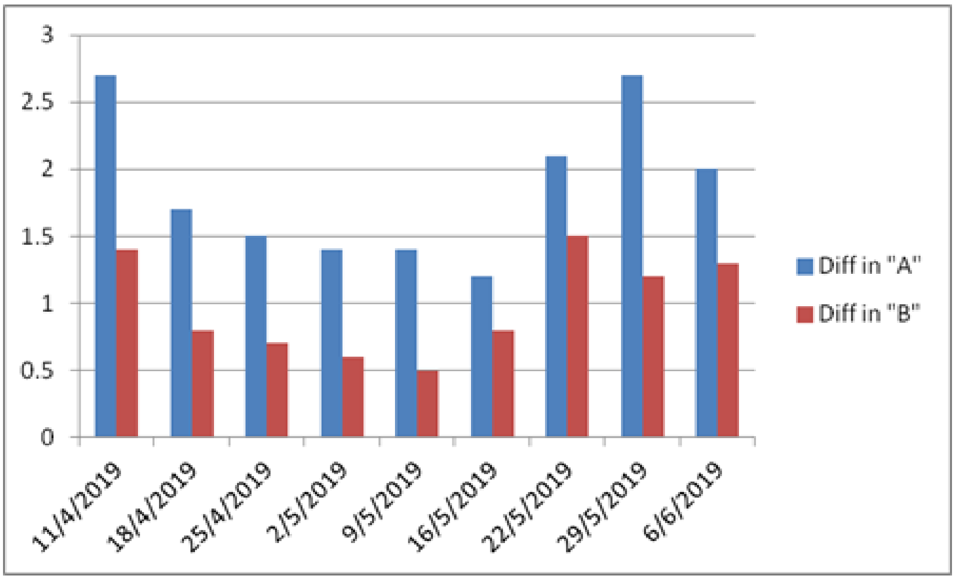

Fig 5:- Comparison of Reading for Model "A" & "B from Pre-Monsoon Season

Week (27 July Upto 18 September)	Average value of water level in model 'A'	Average Value of water level in model 'B'	Difference in value in both the models 'A' and 'B'	Total evaporation losses
27 July-2 Aug	10.74	9.95	0.79	7.35%
3 Aug - 9 Aug	10.38	9.81	0.57	5.49%
10Aug- 16Aug	10.97	9.67	1.3	11.85%
17Aug- 23Aug	9.51	9.64	-0.03	-3%
24Aug- 30Aug	9.47	9.54	-0.17	-17%
31Aug- 6Sept	9.8	9.64	0	0
8sept- 18Sept	8.35	9.8	-0.04	-4%

Table 2:- Increase in Percentage (%) of Water Level

➢ *Testing of Water Parameters :*

The water sample parameter's testing is taken in MIT-Centre for Analytical Research and Studies (MIT-CARS)

Where Sample "A" contain tap water and Sample "B" contain tap Water mixed with rain water.

The important conclusion & recommendation from this paper:-

International Engineering Convention, Domascus, Syria and Medinah, Kingdom of Saudi Arabia, May 11-18, 2009

Sr no	Parameters	Sample"A"	Sample"B"	IS code	Range
1	PH	7.8	8.51	IS 3025part 11:1983	6.5 to 8.5
2	Turbidity	1.1NTU	1.7NTU	IS 3025part 10:1984	Below 5 NTU
3	Conductivity	1422us/cm	672.4us/cm	IS 3025 Part 14:1984	0 to 50000 us/cm
4	Chloride content	11.8ppm	121.1ppm	IS 3025 Part 32:1986	1 to 100 ppm
5	Dissolved oxygen	7.9ml	7.8ml	IS 3025 Part38:1989	Above 6.5 to 8 mg/l

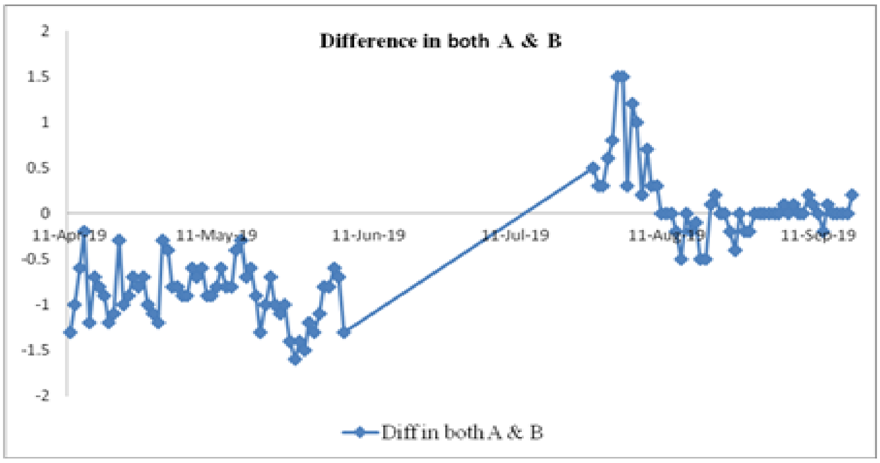

Fig 6:- Water Level Difference in both Modal "A"&"B"

VI. CONCLUSION

- ➢ In pre-monsoon season starting observation 11th April 2019 to 6th June, the evaporation losses from Model 'B' is reduced upto 49% than Model 'A'
- ➢ In monsoon season starting observation from 27th July 2019 to 18th September 2019, shows the increase in the water level in both the models due to rainfall. During this months 9.8% of water level in Model 'A' (without floating balls) increases as compared with Model 'B' (with floating balls).
- ➢ Humidity, Temperature affect the open surface water.
- ➢ Floating balls are more safe than any other chemicals for evaporation control methods.

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