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Research Study on Evaporation Control in Reservoir

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ABSTRACT: We the human creatures of the world are living because we are having a set of sustainable elements on the earth such as the water, the air, the land, etc. These all natural elements are useful for our survival on the planet earth. Out of these basic elements, the most common liquid which is widely available on our planet is the water. The water is the most vital, primary, elementary and basic requirement of the human. Contribution of the water in the development of India is very much crucial and key role is always played by the water in socio-economic development of India. As our country is agrarian country and the water is the prime need to increase the yield of agriculture product. This project revealed that the physical methods can reduce evaporation effectively without environmental consequences methods of Evaporation Control.

KEYWORD: Evaporation, *Reservoir*, Evaporation Control, temperatures, vapour pressure

1. INTRODUCTION

Water is one of the nature's precious gifts, which sustains life on earth. Civilizations over the world have prospered or perished depending upon the availability of this vital resource. Water has been worshiped for life nourishing properties in all the scriptures. Vedas have unequivocally eulogized water in all its virtuous properties. We the human creatures of the world are living because we are having a set of sustainable elements on the earth such as the water, the air, the land, etc. These all natural elements are useful for our survival on the planet earth. Out of these basic elements, the most common liquid which is widely available on our planet is the water. The water is the most vital, primary, elementary and basic requirement of the human. Contribution of the water in the development of India is very much crucial and key role is always played by the water in socio-economic development of India. As our country is agrarian country and the water is the prime need to increase the yield of agriculture product. Our gross domestic production, all over demands, the bullishness of each and every sector, very much depends on the availability of the water and the Gross Domestic production is higher in the year in which availability of the water is sufficient. It is also found that for the efficient development, the optimum use of the water is very much important.

Nowadays, the water has become a part of non-profit to profit organization, which engages various countries across the world with-holding sewage data for nearly all the countries and provides a better way of the water use and its management which can be useful for various routine activities. But due to a huge wastage of the water, the water is becoming one of the scarce resource day-by-day in the world and also in our country, India. The corporation and the farmers draw ground water which is less costly and easily available. Moreover, as and when they need the water, it can be drawn from the ground and thus groundwater levels have reduced, as the ground water level reduces, relatively the sea water level becomes higher so there is land ward hydraulic gradient which results into the flow of the seawater or the salty water stars approaching towards the ground which is called as the sea water intrusion into the ground and the amount of pollutants in the water is increasing rapidly, as per the report by the World Resource Institute. The report states that with more than half of India's total areas are facing high to extremely high stress; almost 60 core people are at very high risk of the surface-water supply disruptions.

A. Evaporation Loss

When the molecules of the water situated at the surface are changed its state from liquid into vapour and escaped from the water body. Hence the quantity of the water is decreased, called as the loss of the evaporation. This process occurs even below boiling temperature of the water. During this process, the heat energy is absorbed by molecules of the water and it converts into the kinetic energy, as the cohesive forces prevailing between the water molecules are not so high

and the water molecules now possess the kinetic energy, the result of which the molecules of the water eject themselves from the surface and start upward motion towards the atmosphere. The amount of the energy used by the unit of mass of water to convert its state from liquid into vapour at a constant temperature is called the latent heat or the evaporation and it is about 585 calories per gram. Whenever the energy from the outside is not obtainable, the heat energy which is obtained from the water bodies itself is used for the evaporation and because of this the temperature of the water is reduced.

II. FACTORS AFFECTING EVAPORATION

Evaporation is a process by which a liquid changes into vapour form. Water molecules are in constant motion and some have the energy to break through water surface and escape into air as vapour. Evaporation in general is a beneficial phenomenon in regulating global water balance through the hydrological cycle and it is the same phenomenon contributing to massive losses from water bodies. Control of evaporation from land based water bodies, has thus remained one of the main planks of water conservation strategies. This assumes greater significance in arid regions, where water scarcities are already a common problem.

(I) Temperature

The rate of the evaporation is directly proportional to the temperature means as the temperature is greater the loss of evaporation also large.

(II) Atmospheric pressure

The pressure due to the atmospheric temperature is known as atmospheric pressure. If there is a decrease in the atmospheric pressure, it results into the increase of the rate of evaporation.

(III) Wind and wind velocity

The wind can remove the water vapour molecules and the fresh air flows over the surface which is capable of holding more water vapors. Hence, the rate of the evaporation increases with increase in the speed of air circulation occurred over and just above the surface.

(IV) Shape and size of the water surface

The loss of the evaporation also depends on the geometry of the water surface and water body.

(V) Nature of the surface

The rate of the evaporation also depends on the nature of the surface. The rate of the evaporation from a snow surface is less as compared to that from a water surface.

(VI) Depth of the water

Whenever the depth of the water decreases the loss of the evaporation increases and the depth of the water increases the loss of the evaporation decreases but it is observed that not only the depth but the ratio of the depth to the surface area also plays a vital role and the greater the ratio.

(VII) Impurities in the water

When the rain water falls down towards the surface of the earth, it passes through the atmosphere which absorbs its impurities such as gases and dust.

(VIII) Humidity

The evaporation losses are inversely proportional to the humidity of the atmosphere. If the humidity of the atmosphere increases, the evaporation loss decreases or the loss due to the evaporation is less if humidity is more.

III. METHODS TO REDUCE EVAPORATION

Although evaporation losses in the country are quite substantial, the evaporation retardant methods perhaps cannot be employed to all open surface water bodies, irrespective of their size and shape. In view of this, water conservation management by control of evaporation has so far been limited generally to drought prone and scarcity areas under specified wind speed and temperature conditions of the water bodies.

The methods of evaporation control can be grouped under two broad categories:

- i) Short term measures and
- ii) Long term measures.

A number of approaches have either been applied or considered by Engineers and Scientists in their attempt to reduce evaporation losses from surface of water bodies. Since the basic meteorological factors affecting evaporation cannot be controlled under normal conditions, efforts have so far been restricted to managing the suppression or inhibition of evaporation from water surfaces by physical or chemical means. The methods generally used or being tried are broadly listed below:

1) Wind Breakers

Wind is one of the most important factors which affect rate of evaporation loss from water surface. The greater the movement of air over the water surface, greater is the evaporation loss. Planting of trees normal to windward direction is found to be an effective measure for checking of evaporation loss. Plants (trees, shrubs or grass) should be grown around the rim of tanks in a row or rows to act as wind breaker. These wind breakers are found to influence the temperature, atmospheric humidity, soil moisture, evaporation and transpiration of the area protected

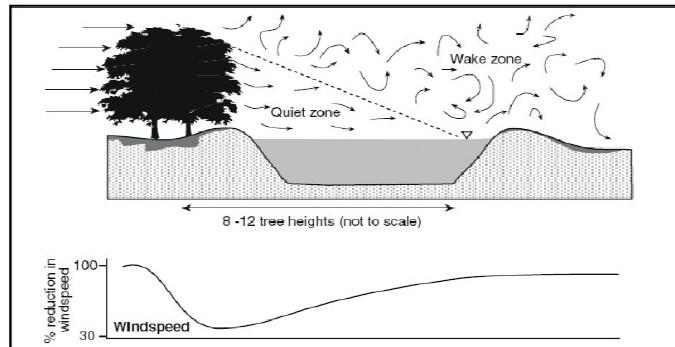


Fig 1 Wind Breakers

In general, the following spacing's are recommended:

- Shrubs 0.60 to 1.00 m
- Medium height broad leaved trees 1.50 to 2.00 m
- Medium to tall evergreen trees 2.10 to 2.40 m
- Tall broad leaved trees with conical crown 2.40 to 3.00 m

Spacing of plants at 3 m is found to have little effect in reduction of wind velocity over the protected area

2) Self-Spreading Mechanism of Watersavr

Chemical mono-layers are single molecular layers (~2 millionths of a mm thick) of insoluble or sparingly soluble compounds. When applied to water these compounds form an invisible film that can be used to cover a reservoir and block evaporation. Chemical monolayers reduce evaporation by creating an insoluble film of a single layer of packed fatty alcohol molecules that acts as a physical barrier to water molecules escaping the surface (pores smaller than H₂O) and a possible shield from air movements interacting with water surface molecules. In addition, the polar charged hydrophobic and hydrophylic molecular ends reduce the surface tension of water thus lowering the surface area available for evaporation.

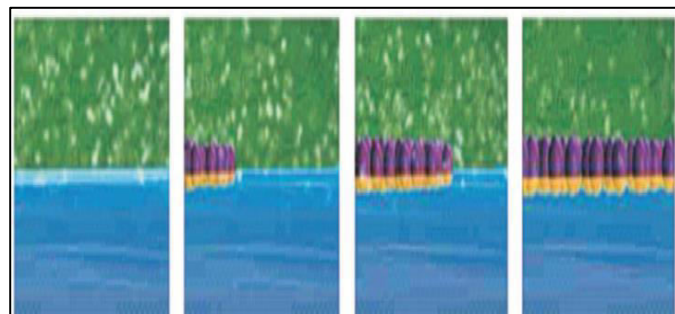


Fig 2 Self-spreading mechanism of WaterSavr

3) Bubble Plume

To destratify a reservoir a bubble plume diffuser could be used. Bubbles released via the diffuser will rise through to the surface. The bubbles entrain cold and dense water in the cold hypolimnion layer and form a plume. This plume will rise through the layers until the mixture of air-water reaches its natural buoyancy where its density is equal to the density of the surrounding water.

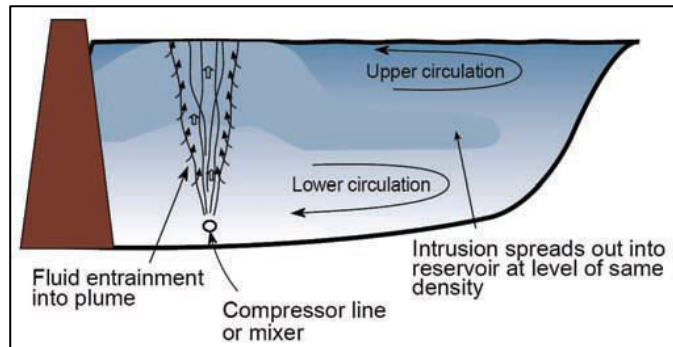


Fig 3 Typical circulation pattern set-up by artificial desertification.

4) Solar Panels

Photovoltaic technology uses semiconductors to produce power based on the photoelectric effect. If photons of light (either natural or artificial) with enough energy penetrate a photovoltaic cell, they can excite electrons to a higher energy state. In fact, the electrons of a semiconductor that are not normally free, will become free and act just like they're in a conducting material. These free electrons can then be captured, resulting in an electric current that can be used to produce electricity. The more light gets absorbed, the more electricity will be produced by photovoltaics. So by using the photovoltaic phenomenon, we can easily convert solar energy into electricity and use it as an alternative to traditional means of energy generation



Fig 4. Solar panels above the Narmanda irrigation canal

IV. CONCLUSION

There are always various types of water losses in the water supply system of any city. The evaporation losses are taken into account in this research work among all the water losses, as the rate of the evaporation losses is considerably high. The problem of evaporation losses is more critical when there is a shortage of water in a region. From the analysis study, we had studied different types of method used for evaporation control and it's advantage and disadvantage and for the reservoir that are easy, cost-beneficial, and easily available, and as per the analysis five economical methods for the Lower Wardha Major Irrigation Project are suggested are as follow

- 1) **Wind Breakers-** wind breakers are found to influence the temperature, atmospheric humidity, soil moisture, evaporation and transpiration of the area protected. Spacing of plants at 3 m is found to have little effect in reduction of wind velocity over the protected area
- 2) **Self-Spreading Mechanism of Watersavr-** Chemical methods of evaporation reduction save a small percentage of water (between 20-40%), their capital costs are not large, but their maintenance costs are significant.
- 3) **Bubble Plume-** The method of injection of air bubbles into the water is the most effective method of reducing evaporation in deep water bodies (for depth greater than +18 m).
- 4) **Solar Panels-** Natural cooling of SPVS is an additional advantage of using solar panels over irrigation canals, leading to increase the efficiency of the solar panels by 7%, compared to ground SPVS.

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