EXPERIMENTAL ANALYSIS OF DEW DRAIN WATER

SASIDHARAN R
Department of Civil Engineering
Bannari Amman Institute of Technology, Sathyamangalam
Erode, India

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Abstract - *Without water, there is no life on our Earth. We strongly implore you to conserve our natural resources, all of the, but especially our water. Wasting water is a lethal mistake. Water scarcity is already a life threatening problem, in near future we can expect it will raise to the peak. For future use this idea will be a favor for use of water. We had built a dew trap to collect water and determine how the surface area of the trap contributes to the amount of water it had collected. In this case, the trap will not strictly harvest dew, but the water that condenses on the inside of the cool trap covering. To build the dew trap, we dug holes 1 ft deep in the ground, placed a collector at the bottom of the hole, and then covered the hole with clear plastic. The collected water is analyzed for various lab testing.*

***Key Words*: Dew drain water, Potability tests, IS: 10500 Requirements**

1. INTRODUCTION

Without water, there is no life on our Earth. We strongly implore you to conserve our natural resources, all of them, but especially our water. Wasting water is a lethal mistake. Water is important to the mechanics of the human body. The body cannot work without it, just as a car cannot run without gas and oil. In fact, all the cell and organ functions that make up our entire anatomy and physiology depend on water for their functioning.

Deserts are defined as landscapes that receive on average less than 10 inches (about 250 millimeters) of **precipitation** (either rain or snow) per year. For people who live in the desert or in **semi-arid** regions, which receive between 10 inches and 20 inches of precipitation on average per year, finding water can mean the difference between life and death. You may not see water in the form of a lake or stream in a desert, but that doesn't mean that water isn't present in the environment. **Water vapor** in the air, also known as **humidity**, comes from water **evaporating** (changing from liquid to gas) from oceans, lakes, and other bodies of water, and water vapor excreted by the leaves of plants through a process called **transpiration**. Water also exists in the form of **dew**, small droplets of water that form on surfaces during the night. As the nighttime air cools to a point where it can't hold any more water vapor, the vapor **condenses** from a gas into a liquid on exposed objects like grass, leaves, flowers, and manmade objects like cars and fences. (If it's cold enough, the water droplets can turn into ice, forming **frost**.) Dew occurs when the water vapor condenses faster than it evaporates. As the air cools, and at a certain **barometric pressure**, it will eventually reach a temperature where the water vapor condenses into dew. This temperature is called the **dew point**. When the temperature increases during daylight hours, the dew evaporates.

In this environmental engineering project, we will build a dew trap to collect water and determine how the surface area of the trap contributes to the amount of water it collects. In this case, the trap will not strictly harvest dew, but the water that condenses on the inside of the cool trap covering. To build the dew trap, we will dig holes 1 foot (ft.) deep (of two opening sizes) in the ground, place a collector at the bottom of the hole, and then cover the hole with clear plastic.

2. LITERATURE REVIEW

The extensive literature survey has been done and papers were collected from various journals. The contents of the paper related to water and soil have been discussed below.

Mehlo, et al (2013) in their international conference carried out a project on Monitoring and Modeling of Water Quality Characteristics. Potable water quality can deteriorate immensely from a point of treatment to point of usage. This change in quality along a bulk distribution main may be attributable to numerous factors for example, ingress of storm water. Furthermore, water utilities experience challenges in terms of microbiological organisms that are not attributed to operational practices.

Satish Gupta, et al (2004) carried out an investigation on Moisture Retention Characteristics of Base and Sub- base Materials. Soil water retention refers to the relationship between the amount of soil water and the energy with which it is held. This relationship is important for characterizing water movement through granular materials.

ManojYadav and Dharmendra (2014) investigated A Critical Review on Performance of Wastewater Reuse Systems. Interest in wastewater reuse is increasing all over the world. India, as a developing country also faces water crisis. Hence, reuse of wastewater is an emerging field which is attracting new researches to develop new technologies to curb this rapidly growing problem of water crisis. Implementation of wastewater reuse leads to sustainable development thereby helps in reducing the water demand and the overall sewage production.

IntizarHussain, et al (2002) a working paper on Wastewater Use in Agriculture. The objective of this paper is to provide a review of the characteristics of wastewater used for irrigation, and the reasoning behind the international guidelines presently used in regulating wastewater reuse for agriculture.

Marco Bittelli (2008) researched corrections in Measuring Soil Water Content. Soil water content (SWC) is a soil property that plays a crucial role in a large variety of biophysical processes, such as seed germination, plant growth, and plant nutrition. SWC affects water infiltration, redistribution, percolation, evaporation, and plant transpiration. Indeed, the quantification of SWC is necessary for a variety of important applications in horticultural systems, such as optimization of irrigation volumes, fertilization, and soil-water-budget computations.

Jeff Lewis and BirgittaLiljedahl (2010) carried out a research on Groundwater Surveys in Developing Regions. This paper discusses the interpretation of surface features that can assist in the evaluation of groundwater resources in semi-arid and arid developing regions. The lack of infrastructure in these areas places serious constraints on borehole drilling, which these conditions, surface indicators may be used to infer useful information about the subsurface, which includes shallow aquifers. This article summarizes those surface indicators which provide useful data in arid and semi-arid regions and provides a review of the literature to assist in their interpretation.

3. MATERIAL AND EXPERIMENTAL APPROACH

3.1 Selection of Area

The area for collection of dew drain water is selected in which it is capable of holding up to 20 holes. Each hole is digged up to 1 feet (ft) deep (of two opening sizes) on the ground with a diameter of 1 feet (ft).We will place a tray underneath or at the bottom of hole to collect the condensed dew drain water. The top of the hole is covered with transparent plastic sheet which holds the droplet of cooled dew water on the bottom side of sheet.

Fig -1 Selection Area

Fig 1.2 Caption of Dew

3.2 Collection of water

The condensed dew drain water collected in the tray is transferred to storage bottle once in every 7 days. The water collected at the end of every 7 days is approximately about 2 liters. The collected water is checked and tested on site for basic tests like temperature and colour. The temperature of the collected water and atmospheric surroundings are found using normal thermometer.

Fig -3 Removal of Transparent Sheet

Fig -4 Collection of Dew

Fig -5 Transfer to Storage bottle

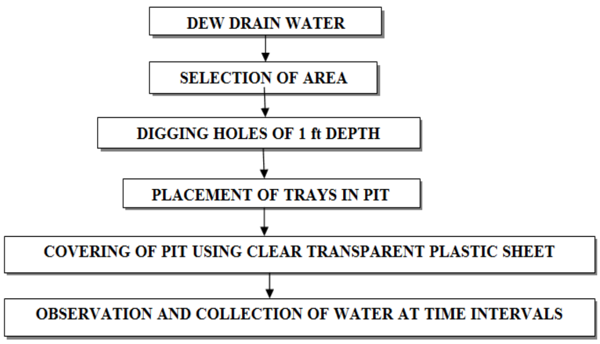

Fig -6 Flow chart deputing dew drain analysis

4. LABORATORY ANALYSIS

4.1 Determination of pH.

A pH meter is an electronic device used for measuring the pH (acidity or alkalinity) of a liquid (though special probes are sometimes used to measure the pH of semi-solid substances). A typical pH meter consists of a special measuring probe (a glass electrode which generates a potential varying linearly with the pH of the solution in which it is immersed.) connected to an electronic meter that measures and displays the pH reading.

- The pH value of given sample is **6.6.**
- pH below 6.5 starts corrosion in pipes. According to BIS water for domestic consumption should have a pH value between **6.5 to 8.5**

Fig -7 pH setup

4.2 Estimation of Hardness

In alkaline condition, EDTA reacts with Ca and Mg to form a soluble chelated complex, Ca and Mg ions develop wine-red color with Erichrome black T. When EDTA is added as a titrant, Ca and Mg divalent ions get complexed resulting in sharp color change from wine-red to blue, which indicates end point of the reaction.

The amount of Total Hardness present in the given sample = **2.5 mg/l**

4.3 Determination of Turbidity

The method presented below is based on a comparison of the intensity of light scattered by the sample in specific conditions with the intensity of light scattered by standard reference suspension under the same condition. The higher the intensity of scattered lights, higher the turbidity. Formazine polymer, which has gained acceptance as the turbidity standard reference suspension is used as a reference turbidity standard suspension for water. It is easy to prepare and is more reproducible in its lights scattering properties than the clay or turbid natural water standards previously used. The turbidity of a given concentration of formazine has an approximate turbidity of 100 NTU, when measured on candle turbidity meter. Nephelometric turbidity units based on formazine preparation will have approximate units derived from Jackson candle turbidimeter but will not be identical to them.

Turbidity of the given sample = **0.7 NTU.**

Fig -8 Turbidity Meter

4.4 Determination of Total solids, Suspended solids and Dissolved solids

Total solids are determined as the residue left after evaporation and drying of the unfiltered sample.

Fig -9.a Filtering of Water

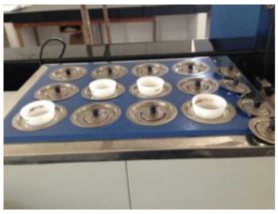

Fig -9.b Evaporating apparatus

Amount of Total solids present in the sample = **100mg/l**

Amount of Dissolved solids present in the sample= **50mg/l**

Amount of Suspended solids present in the sample =**50mg/l.**

4.5 Determination of Acidity

The mineral acids present in the sample which are contributing to mineral acidity can be calculated by titrating or neutralizing samples with strong base NaOH to pH 4.3.The CO_2 and bi-Carbonate that are present and contribute to CO_2 acidity in the sample can be neutralized completely, by contributing the titration to pH 8.2.

1. Methyl Orange Acidity = **0 mg/l.**
2. Phenolphthalein Acidity = **55 mg/l.**
3. Total Acidity = **55 mg/l.**

Fig -10.a Methyl orange Acidity

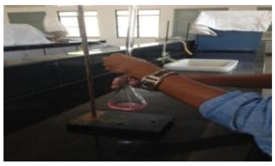

Fig -10.b Phenolphthalein Acidity

4.6 Estimation of Alkalinity

Alkalinity can be obtained by neutralizing OH^-, CO_3^{2-}, and HCO_3^- with standard H_2SO_4. Titration to pH 8.3 or decolourization of phenolphthalein indicator will show complete neutralization of OH^- and of $CO3^{2-}$ while to pH 4.4 or sharp change from yellow to pink of methyl orange indicator will indicate total alkalinity i.e. OH^-, CO_3^{2-}, and HCO_3^-.

Total alkalinity present in the given sample **= 40 mg/l.**

4.7 Determination of Chlorides

The water sample is titrated with standard Silver Nitrate in which Silver Chloride is precipitated at first. Potassium Chromate is used an indicator. The end of titration is indicated by formation of red Silver Chromate from excess Silver Nitrate.

Amount of Chlorides present in the given sample = **19.338 mg/l.**

4.8 Estimation of Sulphates

Sulphate ions are precipitated with HCl and Barium Chloride. The precipitated Barium Sulphate is filtered and dried, ignited and weighed as $BaSO_4$.

Sulphate present in the given sample = **309.09 mg/l.**

4.9 Estimation of Dissolved Oxygen (Winkler's Method)

Manganese Sulphate reacts with the alkali to form a white precipitate of Manganese Hydroxide which in presence of Oxygen gets oxidized to a brown color compound. In the strong medium, Manganese ions are reduced by Oxide ions which gets converted into Iodine, equivalent to original concentration of oxygen in sample.

Amount of Dissolved Oxygen present in the given sample = **7.244 mg/l.**

4.10 Determination of Bio Chemical Oxygen Demand (Titration Method)

The dissolved oxygen content of the sample is determined before and after 5 days incubation at 20° C. The amount of oxygen depleted is calculated as BOD. Sample devoid of oxygen or containing less amount of oxygen are diluted several times with a special type of oxygen dilution water saturated with oxygen, in order to provide sufficient amount for oxidation.

The BOD of the given waste water sample = **0 mg/l**

5. COMPARISION OF RESULTS WITH IS SPECIFICATION

S.No	Parameter	Test Values	IS: 10500 Requirement (Desirable limit)
Essential Characteristics			
1.	pH	6.6	6.5 – 8.5
2.	Turbidity, NTU, Max	0.7	5
Following Results are expressed in mg/l :			
3.	Total hardness as CaCO3, Max	25	300
4.	Chlorides as Cl, Max	19.32	250
Desirable Characteristics			
5.	Dissolved solids, Max	50	500
6.	Sulphate as SO4 Max	309.09	200
7.	Alkalinity, Max	40	200
8.	Dissolved Oxygen	7.244	9

Collection of Dew drain water is an effective way in overcoming the environmental issues related to Water. Hence this water is within all tolerance limits recommended for drinking water, it may be used for drinking after certain purifying treatments.

Water scarcity is already has been a huge problem, in near future we can expect it will raise to the peak. So utilize water in a conserved manner.

6. REFERENCES

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