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PHYSICO-CHEMICAL ANALYSIS OF DRINKING WATER PROVIDED IN HIGHER COLLEGE OF TECHNOLOGY, MUSCAT, OMAN.

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ABSTRACT

Water is very essential part of all living organism. Water becomes polluted with various impurities it includes hardness causing substances, some physical and chemicals impurities, heavy and toxic metals. Increased human population, industrialization, use of fertilizers and man-made activity are main cause of water pollution with different harmful contaminants. The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life. It is necessary to know details about different physico-chemical parameters such as color, temperature, acidity, hardness, pH, sulphate, chloride, DO, BOD, COD, alkalinity used for testing of water quality. In present study we have analysed quality of drinking water used in Higher College of Technology at various different places and validating with guidelines of drinking water standards of Sultanat of Oman.

Keywords: Water, Physico - chemical, Parameters, Hardness, BOD, Heavy metals.

I. INTRODUCTION

Water becomes polluted with various impurities it includes hardness causing substances, some physical and chemical impurities, heavy and toxic metals. It is necessary that the quality of drinking water should be checked at regular time interval, because due to use of contaminated drinking water, human population suffers from varied of water borne diseases [1]. There are trends in developing countries to use sewage effluent as fertilizer has gained much importance as it is considered a source of organic matter and plant nutrients and serves as good fertilizer [2]. It is very essential and important to test the water before it is used for drinking, domestic, agricultural or industrial purpose. Water must be tested with different physic-chemical parameters [1]. The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life. Drinking water is the mean source of disease spreading to the human being [3]. So It is necessary to know details about different physico-chemical parameters such as color, temperature, acidity, hardness, pH, sulphate, chloride, DO, BOD, COD, alkalinity used for testing of water quality.

Increasing population and its necessities have leaded to the deterioration of surface and sub-surface water [4]. The increasing human populations are use of water for municipal, industrial and irrigation needs, and man-made activity [5] and discharge heavy and varied influences substances in natural water resources such as river, lake, sea etc.

Higher college of Technology, Muscat is located at the east coast of Oman. Muscat is the very clean and capital largest city on Oman. HCT is running under the Ministry of Manpower. Government has providing hygiene drinking water facility to the students with large dispensers. It is necessary to know the quality of water present in water dispensers. Students of Applied Sciences department selected three different places for collection of water samples in different dispensers. We did various common physic-chemical properties study. No other published work found for testing of water in HCT.

Present study includes testing of various physic-chemical parameters such as hardness, pH, conductivity, alkalinity, acidity, chloride, calcium, magnesium etc. with the help of routine analytical techniques.

II. MATERIAL AND METHOD

Three samples were selected, one from CARVAN area, other is from Applied Sciences Department and third is from Engineering Department. Water sample was collected in one litre polythene bottles and first analysed for its temp and pH and then was kept in the freezer at 8^0C temp for the further analysis.

Various water quality parameters were tested by using various standard procedures given in published papers and standard book [6]. All parameters were tested three times with the same procedure and result were compared and validated with Omani Drinking Water Standard [7].

pH and conductivity of water sample was determined by routine laboratory instruments. Analysis of hardness, alkalinity, acidity, chloride, calcium and magnesium determined with routine volumetric methods of analysis.

2.1 pH –

pH is most important in determining the corrosive nature of water. Lower the pH value higher is the corrosive nature of water. pH was positively correlated with electrical conductance and total alkalinity. pH was measured three replicates with each sample[10].

2.2 Electrical conductivity –

Measurement of Conductivity is very important it shows significant correlation with ten parameters such as temperature, pH value , alkalinity , total hardness , calcium , total solids, total dissolved solids , chemical oxygen demand , chloride and iron concentration of water.

2.3 Alkalinity-

It is primarily made of carbonate (CO_3^{2-}) and bicarbonate (HCO^{3-}), alkalinity acts as a stabilizer for pH. Alkalinity, pH and hardness affect the toxicity of many substances in the water. It is determined by simple dil HCl titration in presence of phenolphthalein and methyl orange indicators.

2.4 Hardness –

Hardness of water is very important to know the presence of hardness causing ions. It reflects the quality of water. Hardness containing water does not useful for any purpose. Hardness was determined by using complexometric titration with standard EDTA and Eriochrome black-T as an indicator.

2.5 TDS -

Total dissolved solids are composed of various dissolved inorganic and organic cations and anions such as, Ca^{++}, Mg^{++}, Na^{+}, K^{+}, Cl^{-}, $SO_4^{--}CO_3^{--}$, PO_4^{3-} etc. [7,8]

2.6 Calcium -

It is measured by complexometric titration with standard solution of ETDA using Patton's and Reeder's indicator under the pH conditions of 12.0. These conditions are achieved by adding a fixed volume of 4.0 M Sodium Hydroxide. It represents the hardness of water.

2.7 Chloride -

It is measured by titrating a known volume of sample with standardized silver nitrate solution using potassium chromate solution in water as an indicator. Indicator forms a red colored compound with silver as soon as the chlorides are precipitated from solution.

2.8 Sodium -

It is measured with the help of flame photometer. The standard solution of sodium ion (100 ppm) is prepared by using NaCl salt. The instrument is standardized with the known concentration of sodium ion (100 mg/litre). Calibration graph was prepared at five different concentration level and calibration equation was formed (y = mx + b), with the help of this calibration equation concentration of sodium in water sample were calculated.

III. RESULT AND DISCUSSION

Water sample was analysed for various physic-chemical parameters at 3 replicate readings. Results found were calculated by using various calculations and standard deviation calculated. The SD values are tabulated along with all results. All parameters detected were within the limit prescribed by Oman Drinking Water standard [9].

pH of all the water samples was almost nearly same. It was ranges between 6.27 to 6.57 with standard deviation falling +/- . Electrical conductance was little varied, Carvan sample contains 441.3 *us/cm* while old building sample having highest 508.3 *us/cm*. Total dissolved solid (TDS) present in sample lies between 470 and 500 mg/L. Engineering college water sample contains highest TDS level.

Alkalinity (total) was varies between 20 to 60 mg/L. Carvan water sample contains lowest while Engineering college sample showed highest one. Acidity of all water sample was lies very low and all samples were shoed same value of 11 mg/L. Total hardness were lies between 52 and 56 mg/L, while hardness due to Calcium present in the range of 37 to 43 mg/L range. Carvan sample shows high 56 and Engineering college sample shows 43 mg/L both total hardness and calcium hardness respectively.

Chloride present in the sample was lies in 136.5 – 150.6 mg/L, old building Sample having highest chloride content. Sodium contains was in 70.8 and 76.99 mg/L, Engineering college sample contains highest amount of sodium. Nitrate nitrogen was detected was very low range between 0.283 to 0.239 mg/L. Iron was totally absent in all samples.

TDS level present in all three drinking water sample was near about the same range. Carvan water contains average of 370 mg/L, Old building water sample contains 440 mg/L while Engineering water sample contains

about 500 mg/L TDS level. This level is calculated on the average of three readings with low value of Standard deviation.

Total hardness and chloride hardness values of all water sample are within the range provided by Omani drinking water standard. These values are total hardness 56 mg/L, 52 mg/L and 52 mg/L respectively for carvan, old building and engineering college water sample stations. While Calcium hardness are 39 mg/L, 37 mg/L and 43 mg/L respectively. Dissolved oxygen is ranges between 7 to 8 mg/L in all three drinking water sample.

Sodium content was in the range of 70 to 80 mg/L for all three samples. We did not find any Iron in any of the water sample. While Nitrate Nitrogen present was find out variable amount in the sample. Nitrogen content in three water samples respectively 0.283 mg/L, 0.508 mg/L and 0.239 mg/L for Carvan, Old building and Engineering water sample stations.

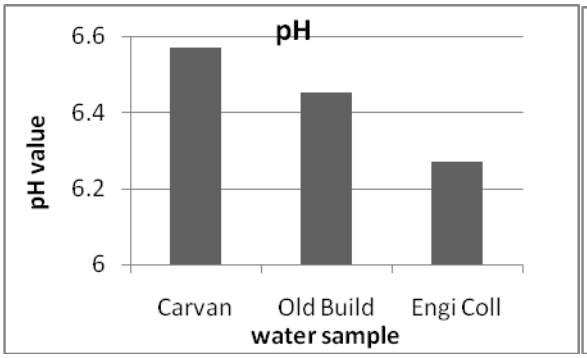

Fig. 1 Determination of pH

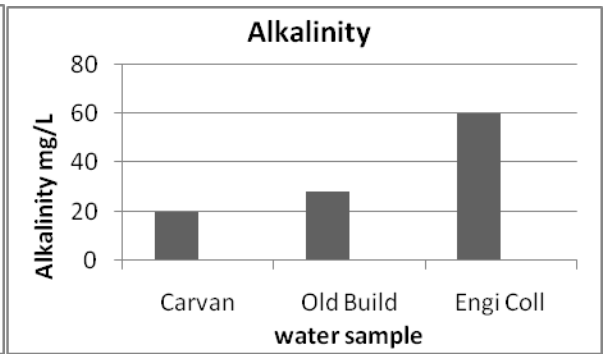

Fig. 2 Determination of Alkalinity

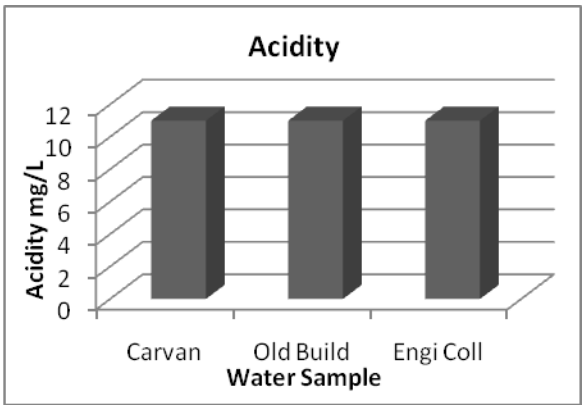

Fig. 3 Determination of Acidity

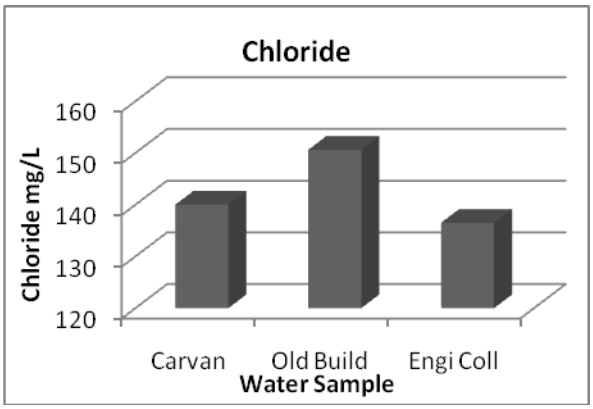

Fig. 4 Determination of Chloride

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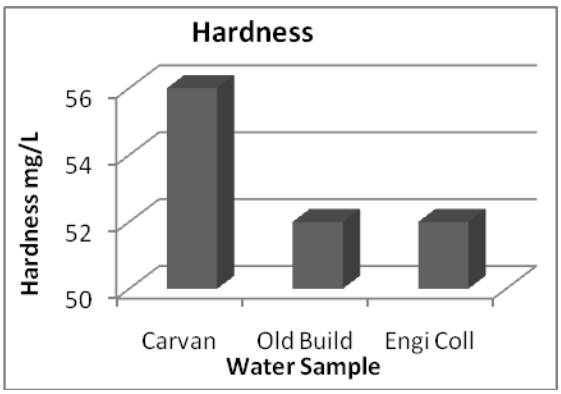


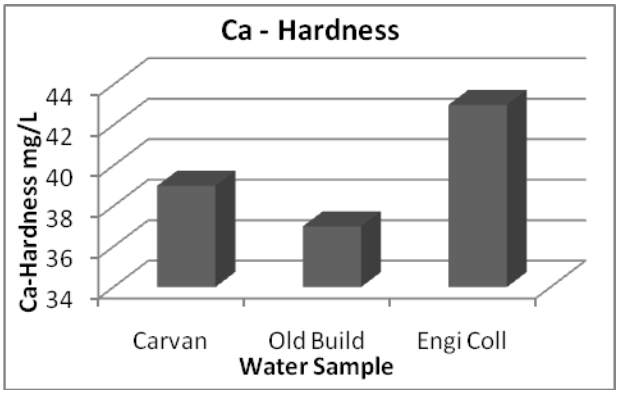
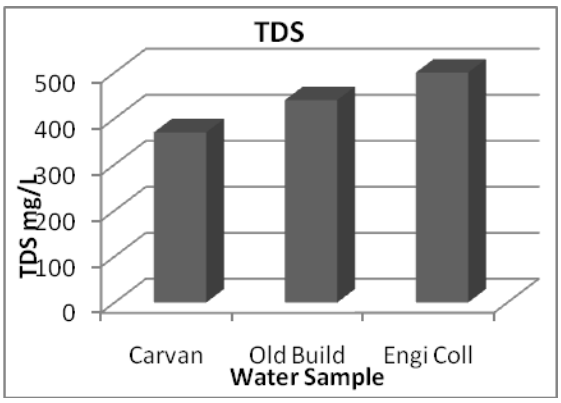


Fig. 5 Determination of Hardness

Fig. 6 Determination of Ca-Hardness



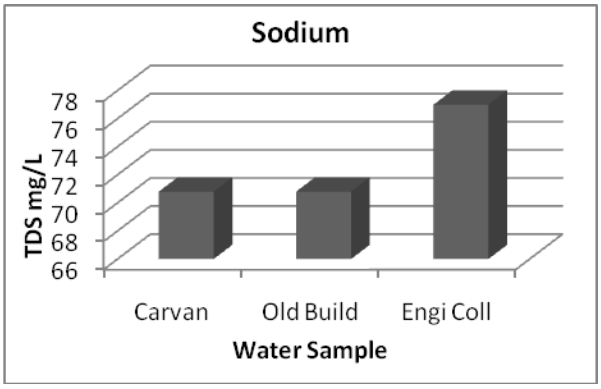


Fig. 7 Determination of TDS

Fig. 8 Determination of Sodium

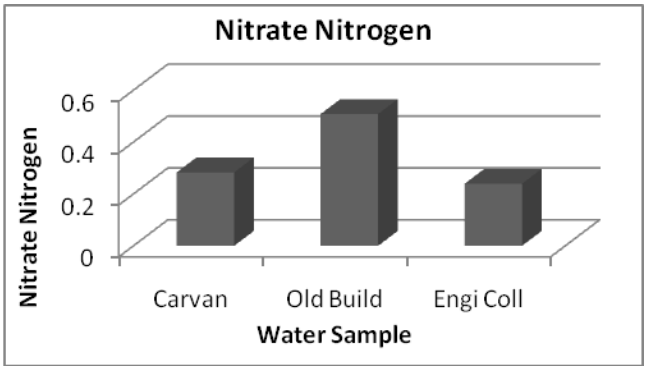


Fig. 9 Determination of Nitrate Nitrogen

Table 1- Physic-chemical parameters with Omani Drinking Water Standard.

Parameter	Carvan	Old Building	Engg. College	Omani Quality Standard	Omani Standard Max.
pH	6.57	6.45	6.27	6.5 -8	9
Temp ^{0}C	25	25.4	26.2	-	-
Conductance (*us/cm*)	441.3	508.3	498	-	-
TDS (mg/L)	370	440	500	120 -600	1000

Alkalinity (mg/L)	20	28	60	-	-
Acidity (mg/L)	11	11	11	-	-
Hardness (mg/L)	56	52	52	<200	500
Diss. Oxygen (mg/L)	7.5	8	7.9		
Ca-Hardness (mg/L)	39	37	43	-	-
Chloride (mg/L)	140	150.6	136.5	< 250	600
Sodium (mg/L)	70.8	70.8	76.99	<200	400
Nitrate N (mg/L)	0.283	0.508	0.239	<50	-
Iron (mg/L)	0.0	0.0	0.0	0.0	<1

IV. CONCLUSION

In this present study it was found that all physic-chemical parameters tested with three different drinking water stations in Higher College of Technology were well within the Omani Standard as well as International Standard limits. The quality of water provided is very good and all precaution taken during the purification process of water.

V. ACKNOWLEDGMENT

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