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# GROUND WATER QUALITY OF COASTAL AREAS IN ALAPPUZHA DISTRICT OF KERALA

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## ABSTRACT

Analysis of borewell water and open well water of coastal areas of Alappuzha district was carried out to evaluate its potability. The physico-chemical analysis of the sixty four open well waters and seventeen bore well waters was carried out by standard methods. The results show that hardness and alkalinities were in excess in some areas and concentration of fluoride was also found to be high in some of the sampling sites. Excess of these water parameters in potable water is a cause of concern amongst the inhabitants of that area .The aim of the study is to highlight the contamination in the ground water resources of the selected study area

**Key words**: Physico-chemical studies, Bore well water, Open well water, Water quality.

## INTRODUCTION

Ground water is the cheapest and safest source of untreated potable water. Out of 2.5% of fresh water, only 0.5% is available as ground water, rest being surface water[1]. Ground water is liable to contamination through anthropogenic and other sources like use of chemical pesticides, amount of rainfall received and depths of the bore wells. Constant addition of industrial wastes, domestic and agricultural wastes to the water bodies contaminate the ground water. The quantity of ground water depends on annual rainfall, percolation and storage capacity of the ground. The ground water is less contaminated than surface water. Considering the health problems of the residents of coastal areas of Alappuzha district, it is very essential to assign the quality of potable water available in this area. The physico-chemical parameters of water were analysed here and the water is classified on the basis of water quality index. The ground water is tapped out either in the form of open wells, and bore wells which are the most common sources of drinking water of the inhabitants of coastal area of Alappuzha.

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## EXPERIMENTAL

In the present study, a total of eighty one samples were collected from different potable water sources in the coastal areas of Alappuzha. Sixty four samples were collected from open wells and seventeen samples were from bore wells. Samples were collected and stored as per recommended procedures[2]. Standard methods were used for all the analysis[3,4].

All reagents were of analytical grade and solutions were prepared in conductivity water. pH, conductivity, salinity and DO in the water samples were measured at the sampling site using portable water analyser kit.

## RESULTS AND DISCUSSION

The results of physicochemical analysis of different water samples from open wells and bore wells are given in Tables 3 and 4, respectively.

Table 3 (Open well water) shows that pH of water is varying from 6.1 to 8.7, which is within the WHO prescribed range. Electrical conductivity is varying from 110 µS to 1697 µS. 75 % of the samples have high conductivity values, which may be due to presence of high concentration of different ions, high alkalinity and acidity. Total hardness, calcium hardness and magnesium hardness are within permissible limits for drinking water. Only 9.5 % of water samples could be called as hard water.

**Table 1: Some water quality parameters**

| Parameter of water analysis | Method used |
|---|---|
| Total dissolved solids | Evaporation modified (180$^{o}$C) |
| Acidity | Titrimetric |
| Alkalinity | Titrimetric |
| Total hardness, $Ca^{2+}$ and $Mg^{2+}$ | Complexometric titrimetric |
| $F^{-}$ | Ion selective method and spectrophotometric method |
| Fe | Spectrophotometric |
| $Cl^{-}$ | Argentometric |

**Table 2: Standards for drinking water**

| Parameters | WHO Standard (mg/L) |
|---|---|
| pH | 6.5 - 9.5 |
| Specific conductance | - |
| BOD | 6.0 |
| Calcium | 100 |
| Chloride | 500 |
| Iron | 1.0 |
| Magnesium | 150 |
| Nitrate + Nitrite | 45 |
| Total hardness | 500 |
| Total dissolved solids | 500 |
| DO | 6.0 |

Alkalinity values vary from 35 ppm to 470 ppm. 45% of the samples show higher limit of alkalinity than the limiting values of WHO for drinking water sources.

Sodium controls the intercellular and intracellular osmosis, maintains pH and other activities of muscles and nerves. In the present study, sodium has concentration from 0.9 ppm to 36 ppm. Only 6% samples have higher values than suggested limit for public water supply. Concentration of potassium is varying form 0.021 ppm to 15 ppm and only 14% collected samples crosses the suggested limits for drinking water.

DO values vary form 4.1 ppm to 12 ppm. 34% of the analysed samples had lower values of DO, which indicates some extent of pollution.

Chloride and iron in all the samples were found to be within suggested limits of drinking water. Only 3 % of analysed samples were found to have high chloride and iron. Iron imparts bitter taste to water, if present above the prescribed limits.

Fluoride content in open well waters vary from 0.0023 ppm to 1.8 ppm. 6% of water samples had fluoride concentration above 1.5 ppm, which is the prescribed limit for fluoride in drinking water. (Table 2)

**Table 3: Results of the analysis of water sample from open wells**

| Site | Cond. (μS) | F (ppm) | Ca (ppm) | Mg (ppm) | TH (ppm) | pH | Acidity (ppm) | Alkalinity (ppm) | Salinity (ppm) | Na (ppm) | K (ppm) | DO (ppm) | Cl (ppm) | Fe (ppm) | TDS (ppm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TKM-1** | 170 | 1.2 | 40 | 15 | 55 | 768 | 51 | 163 | 0.3 | 1.4 | 0.17 | 5.06 | 21 | 7.1 | 109 |
| **TKM-2** | 240 | 1.5 | 43 | 8 | 51 | 7.6 | 28 | 125 | 0.5 | 3.4 | 0.82 | 6.2 | 56 | 46 | 154 |
| **TKM-3** | 350 | 1 | 35 | 35 | 70 | 7.76 | 42 | 250 | 0.3 | 1.75 | 0.25 | 4.96 | 56 | 3.4 | 224 |
| **TKM-4** | 230 | 1.6 | 35 | 25 | 60 | 7.5 | 37 | 250 | 0.4 | 1.75 | 0.51 | 5.37 | 32 | 4.6 | 147 |
| **TKM-5** | 340 | 1.8 | 43 | 28 | 71 | 7.45 | 37 | 206 | 0.4 | 1.75 | 0.25 | 5.2 | 53 | 6 | 218 |
| **CKD-1** | 600 | 0.8 | 45 | 25 | 70 | 7.8 | 46.3 | 478 | 0.6 | 1.85 | 0.59 | 5.6 | 49 | 4.6 | 384 |
| **CKD-2** | 600 | 1.3 | 30 | 35 | 65 | 7.4 | 56 | 293 | 0.4 | 1.82 | 0.49 | 5.7 | 84 | 4.6 | 384 |
| **CKD-3** | 480 | 1.4 | 45 | - | 45 | 7.7 | 60 | 125 | 0.5 | 3.35 | 0.14 | 4.9 | 81 | 6 | 307 |
| **CKD-4** | 440 | 1.5 | 60 | 5 | 65 | 7.1 | 56 | 250 | 0.3 | 1.32 | 0.03 | 5.4 | 63 | 6 | 282 |
| **CKD-5** | 230 | 0.9 | 40 | 5 | 45 | 7.2 | 28 | 82 | 0.2 | 1.75 | 0.51 | 6.1 | 42 | 15 | 147 |
| **ALY-1** | 330 | 0.7 | 50 | 5 | 55 | 7.2 | 28 | 206 | 0.3 | 1.75 | 0.25 | 6.2 | 46 | 2 | 211 |
| **ALY-2** | 560 | 0.9 | 80 | 75 | 155 | 7.7 | 60 | 393 | 0.2 | 1.85 | 0.59 | 6.3 | 102 | 2 | 358 |
| **ALY-3** | 340 | 0.7 | 35 | 15 | 50 | 7.8 | 60 | 374 | 0.3 | 1.75 | 0.25 | 4.5 | 46 | 2 | 218 |
| **ALY-4** | 340 | 0.8 | 45 | 25 | 70 | 7.8 | 60 | 331 | 0.2 | 1.8 | 0.25 | 5.7 | 42 | 10 | 218 |
| **ALY-5** | 500 | 1 | 45 | 0 | 55 | 7.5 | 69 | 350 | 0.2 | 3.35 | 0.14 | 5.6 | 77 | 12.3 | 320 |
| **CNK-1** | 500 | 0.9 | 45 | 15 | 60 | 7.5 | 69.4 | 206 | 0.4 | 3.2 | 0.14 | 4.2 | 60 | 6 | 320 |
| **CNK-2** | 380 | 0.8 | 55 | - | 55 | 7.4 | 41.6 | 163 | 0.3 | 1.75 | 0.25 | 6.3 | 56 | 3.4 | 243 |
| **CNK-3** | 330 | 0.9 | 40 | 20 | 60 | 8.1 | 83 | 293 | 0.4 | 1.75 | 0.25 | 6.2 | 77 | 6 | 211 |
| **CNK-4** | 530 | 0.9 | 55 | 30 | 85 | 8.3 | 42 | 331 | 0.2 | 3.5 | 0.69 | 5.8 | 74 | 2 | 339 |
| **VZRY-1** | 460 | 1 | 65 | 15 | 80 | 8.2 | 37 | 250 | 0.5 | 3.6 | 0.78 | 6.2 | 60 | 6 | 294 |
| **VZRY-2** | 770 | 0.8 | 65 | 25 | 90 | 8.6 | 56 | 374 | 0.6 | 4.65 | 0.48 | 6.4 | 106 | 3.4 | 493 |

Cont...

| Site | Cond. (μS) | F (ppm) | Ca (ppm) | Mg (ppm) | TH (ppm) | pH | Acidity (ppm) | Alkalinity (ppm) | Salinity (ppm) | Na (ppm) | K (ppm) | DO (ppm) | Cl (ppm) | Fe (ppm) | TDS (ppm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **VZRY-3** | 770 | 1 | 85 | 25 | 110 | 8.5 | 56 | 374 | 0.5 | 4.65 | 0.5 | 9 | 106 | 2 | 493 |
| **VZRY-4** | 820 | 0.8 | 45 | 50 | 95 | 8.4 | 42 | 293 | 0.9 | 5.52 | 0.63 | 6 | 116 | 2 | 525 |
| **VZRY-5** | 860 | 1 | 85 | 25 | 110 | 8.7 | 51 | 418 | 0.9 | 5.52 | 0.63 | 4.9 | 109 | 3.4 | 550 |
| **A-1** | 1000 | 0.47 | 60 | 40 | 100 | 7.6 | 80 | 245 | 1.9 | 7.82 | 1.64 | 10.9 | 795 | 0.206 | 171 |
| **A-2** | 253 | 0.06 | 54 | 8 | 62 | 6.6 | 80 | 145 | 0.2 | 1.32 | 0.032 | 11.6 | 28.4 | 0.294 | 147 |
| **A-3** | 483 | 0.14 | 76 | 10 | 86 | 6.9 | 50 | 215 | 0.4 | 3.35 | 0.135 | 12 | 56.8 | 0.206 | 173.6 |
| **M-1** | 435 | 0.07 | 84 | 26 | 110 | 7.34 | 55 | 195 | 0.3 | 1.32 | 0.027 | 8.1 | 43 | 0.382 | 169 |
| **M-2** | 379 | 0.09 | 86 | 24 | 110 | 7.59 | 25 | 200 | 0.4 | 1.64 | 0.042 | 8.5 | 28.4 | 0.118 | 163.5 |
| **M-3** | 302 | 0.08 | 72 | 62 | 134 | 7.4 | 60 | 170 | 0.3 | 1.82 | 0.27 | 7 | 28.4 | 0.206 | 182 |
| **M-4** | 435 | - | 83 | 7 | 90 | 6.32 | 50 | 180 | 0.3 | 2 | 3 | 8 | 45 | 0.395 | 165 |
| **M-5** | 379 | 0.009 | 74 | 11 | 65 | 7.13 | 25 | 200 | 0.4 | 3 | 4 | 10 | 28.4 | 0.206 | 340 |
| **K-1** | 110 | 0.06 | 20 | 12 | 32 | 6.6 | 58 | 40 | 0.2 | 1.56 | 0.059 | 9.1 | 49.95 | 0.659 | 72.6 |
| **K-2** | 181 | 0.03 | 24 | 4 | 28 | 6.4 | 22 | 60 | 0.2 | 1.85 | 0.022 | 9.5 | 35.7 | 0.471 | 117.7 |
| **K-3** | 194 | 0.06 | 22 | 4 | 26 | 6.14 | 80 | 100 | 0.2 | 3.56 | 0.059 | 4.1 | 35.7 | 0.471 | 126.3 |
| **H-1** | 751 | 0.08 | 90 | 4 | 94 | 6.3 | 35 | 55 | 0.2 | 2.23 | 0.823 | 8.6 | 42.8 | 0.118 | 142 |
| **H-2** | 167 | 0.131 | 30 | 30 | 60 | 7.5 | 75 | 105 | 0.9 | 3.42 | 1.021 | 7.6 | 85.2 | 0.382 | 153 |
| **H-3** | 1697 | 0.09 | 86 | 10 | 96 | 5.87 | 60 | 120 | 1.2 | 2.921 | 1.346 | 6.7 | 85.2 | 0.382 | 148 |
| **H-4** | 1143 | 0.03 | 46 | 34 | 80 | 7 | 70 | 35 | 0.4 | 2.15 | 2.15 | 4.5 | 92.3 | 0.471 | 171 |
| **H-5** | 165 | 0.135 | 31 | 35 | 66 | 6.11 | 70 | 102 | 0.8 | 19 | 5 | 7.6 | 39.1 | 0.329 | 1340 |
| **P-1** | 265 | 0.07 | 38 | 18 | 56 | 6.6 | 80 | 110 | 0.2 | 1.82 | 0.032 | 4.3 | 56.8 | 0.206 | 149 |
| **P-2** | 566 | 0.57 | 88 | 8 | 96 | 6.7 | 75 | 225 | 0.4 | 3.5 | 0.69 | 6.5 | 56.8 | 0.941 | 174.7 |
| **PK-1** | 706 | 0.14 | 72 | 28 | 110 | 6.5 | 90 | 225 | 0.5 | 2.92 | 0.99 | 9 | 113.2 | 0.471 | 172.4 |

Cont...

| Site | Cond. (μS) | F (ppm) | Ca (ppm) | Mg (ppm) | TH (ppm) | pH | Acidity (ppm) | Alkalinity (ppm) | Salinity (ppm) | Na (ppm) | K (ppm) | DO (ppm) | Cl (ppm) | Fe (ppm) | TDS (ppm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PK-2** | 280 | 0.06 | 62 | 24 | 86 | 7.2 | 30 | 40 | 0.4 | 1.85 | 0.52 | 8.3 | 49.9 | 0.206 | 149.4 |
| **PK-3** | 479 | 0.123 | 28 | 26 | 54 | 6.5 | 65 | 140 | 0.5 | 3.6 | 0.785 | 7.5 | 55 | 0.753 | 172.8 |
| **T-1** | 1142 | 0.12 | 100 | 66 | 166 | 7.13 | 28 | 260 | 0.8 | 5.95 | 0.328 | 8.1 | 127.8 | 0.382 | 172 |
| **T-2** | 1643 | 0.12 | 120 | 60 | 180 | 7.43 | 30 | 185 | 1.1 | 6.2 | 0.465 | 9.4 | 42.8 | 0.471 | 169.2 |
| **T-3** | 894 | 0.131 | 106 | 48 | 154 | 7.76 | 22 | 395 | 0.6 | 5.52 | 0.632 | 8.8 | 92.3 | 0.295 | 173 |
| **AMB-1** | 98 | 0.401 | 62 | 18 | 80 | 6.8 | 44 | 120 | 0.2 | 1.35 | 0.175 | 11 | 57 | 0.559 | 128 |
| **AMB-2** | 82 | 0.084 | 14 | 2 | 16 | 6.9 | 28 | 60 | 0.1 | 0.9 | 0.08 | 9.8 | 36 | 0.294 | 53.5 |
| **AMB-3** | 350 | 0.023 | 60 | 12 | 72 | 7.5 | 38 | 155 | 0.3 | 1.75 | 0.25 | 9.3 | 64 | 0.206 | 159 |
| **AMB-4** | 749 | 0.467 | 60 | 10 | 70 | 7.7 | 28 | 290 | 0.6 | 4.65 | 0.485 | 7.6 | 36 | 0.382 | 173 |
| **AMB-5** | 837 | 0.165 | 168 | 56 | 224 | 6.9 | 92 | 355 | 0.6 | 4.65 | 0.54 | 8.8 | 50 | 0.206 | 173 |
| **AMB-6** | 193 | 0.684 | 28 | 2 | 30 | 6.8 | 32 | 80 | 0.3 | 1.75 | 0.51 | 10.3 | 50 | 0.659 | 123 |
| **APZ-1** | 768 | 0.9289 | 52 | 8 | 60 | 7.12 | 54 | 310 | 0.6 | 4.15 | 0.525 | 6.6 | 114 | 0.753 | 174 |
| **APZ-2** | 924 | 0.569 | 72 | 12 | 84 | 6.89 | 88 | 175 | 0.7 | 5.15 | 0.52 | 5.8 | 114 | 0.118 | 173 |
| **APZ-3** | 296 | 0.9022 | 44 | 12 | 56 | 6.6 | 36 | 110 | 0.3 | 3.5 | 0.535 | 7.3 | 43 | 0.118 | 152 |
| **APZ-4** | 278 | 0.1111 | 96 | 32 | 128 | 7.5 | 105 | 115 | 0.3 | 1.8 | 0.29 | 8.6 | 43 | 0.753 | 150 |
| **APZ-5** | 1000 | 0.25 | 160 | 140 | 300 | 7.4 | 110 | 210 | 3.4 | 2.42 | 0.102 | 10.6 | 639 | 0.382 | 170 |
| **AVZHY-1** | 763 | 0.273 | 45 | 15 | 60 | 6.9 | 55 | 128 | 0.6 | 36 | 15 | 6.6 | 73.8 | 0.355 | 211 |
| **AVZHY-2** | 297 | 0.145 | 35 | 10 | 45 | 6.94 | 38 | 140 | 0.3 | 19 | 4 | 6.3 | 19.46 | 0.382 | 240 |
| **AVZHY-3** | 764 | 0.008 | 48 | 12 | 60 | 6.75 | 54 | 128 | 0.7 | 25 | 11 | 6.4 | 42.18 | 0.534 | 215 |
| **AVZHY-4** | 758 | 0.114 | 47 | 13 | 60 | 6.64 | 52 | 135 | 0.7 | 27 | 8 | 7 | 51.12 | 0.515 | 240 |

TKM - Tookukulam
ALY - Alissery
VZRY - Vazhicherry
P - Pathirappally
H - Harippad
APZ - Alapuzha
PK - Purakkad
CKD - Chudukadu
CNK - Chandanakavu
M - Mararikulam
T - Thottappally
AMB - Ambalapuzha
AVZHY - Arattuvazhy
K - Kalavoor
A - Antha Karanazhi

**Table 4: Results of the analysis of water samples from bore wells**

| Site | pH | Cond. (μS) | Salinity (ppm) | DO | Acidity (ppm) | Alkalinity (ppm) | TH | Ca (ppm) | Mg (ppm) | Na (ppm) | K | Fe (ppm) | F | Cl | TDS (ppm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A-1** | 6.8 | 0.505 | 0.4 | 11.8 | 75 | 145 | 70 | 64 | 6 | 1.32 | 0.032 | 0.118 | 0.05 | 121 | 175 |
| **M-1** | 8.4 | 356 | 0.3 | 8.3 | 60 | 185 | 100 | 86 | 14 | 1.75 | 0.032 | 0.118 | 0.07 | 42.8 | 158 |
| **M-2** | 7.8 | 311 | 0.4 | 8.2 | 95 | 215 | 118 | 98 | 20 | 1.64 | 0.042 | 0.559 | 0.08 | 63.9 | 174 |
| **M-3** | 6.6 | 286 | 0.2 | 7.6 | 55 | 160 | 80 | 62 | 18 | 1.32 | 0.027 | 0.559 | 0.06 | 35.7 | 151 |
| **PK-1** | 7.7 | 978 | 3.5 | 9.6 | 70 | 220 | 158 | 96 | 62 | 3.82 | 1.21 | 0.206 | 0.183 | 142 | 172 |
| **PK-2** | 7.9 | 1000 | 1.7 | 8.4 | 75 | 235 | 154 | 78 | 76 | 8.5 | 2.1 | 0.835 | 0.24 | 660 | 170 |
| **T-1** | 7.4 | 1000 | 7.9 | 3.6 | 82 | 255 | 232.2 | 200 | 32.2 | 9.64 | 4.1 | 0.941 | 0.5 | 3486 | 168.3 |
| **T-2** | 7.7 | 1978 | 1.3 | 9.1 | 126 | 620 | 206 | 182 | 24 | 7.4 | 2.1 | 0.471 | 0.354 | 248.5 | 171.4 |
| **H-1** | 7.8 | 1000 | 0.7 | 8.2 | 60 | 125 | 62 | 44 | 18 | 2.15 | 2.15 | 0.559 | 0.02 | 99.4 | 189 |
| **AMB-1** | 6.89 | 751 | 0.4 | 8 | 20 | 50 | 30 | 16 | 14 | 2.75 | 0.5 | 0.206 | 0.08 | 36 | 175 |
| **AMB-2** | 7.58 | 571 | 0.4 | 6.3 | 54 | 195 | 72 | 44 | 28 | 2.75 | 0.5 | 0.294 | 0.06 | 50 | 174 |
| **AMB-3** | 7.72 | 658 | 0.4 | 11.2 | 40 | 95 | 36 | 20 | 16 | 2.65 | 0.5 | 0.206 | 0.06 | 71 | 170 |
| **AMB-4** | 6.7 | 894 | 0.7 | 8.3 | 80 | 294 | 124.4 | 112 | 12.4 | 5.25 | 0.56 | 0.471 | 0.17 | 71 | 172 |
| **APZ-1** | 7.4 | 1191 | 0.8 | 6.7 | 102 | 360 | 40 | 30 | 10 | 5.9 | 2.3 | 0.753 | 0.83 | 163 | 172 |
| **APZ-2** | 7.7 | 1071 | 0.6 | 6.6 | 58 | 150 | 38 | 30 | 8 | 4.15 | 0.53 | 0.941 | 0.96 | 156 | 178 |
| **APZ-3** | 6.8 | 484 | 0.3 | 8.7 | 91 | 120 | 40 | 30 | 10 | 3.5 | 0.54 | 0.382 | 0.71 | 85 | 173 |
| **ALY-1** | 7.15 | 1071 | 0.4 | 5 | 60 | 130 | 35 | 20 | 15 | 14 | 8 | 0.205 | 0.42 | 73.8 | 935 |

H - Harippad ALY - Alissery APZ - Alapuzha PK - Purakkad
AMB - Ambalapuzha M - Mararikulam T - Thottappally
A - Antha Karanazhi

Table 4 gives the results of analysis of water samples from bore wells, which indicate that pH of all the water samples analysed were within the prescribed limits as given by WHO. Conductance of water samples were found to have high values ranging from 484 µS to 1978 µS, which may be due to the presence of dissolved ions.

Alkalinity varies from 50 ppm to 620 ppm and it is high in bore well water than in open wells as they are at a greater depth than from open wells. 42% of water samples have high values of alkalinity than the prescribed limits.

17% of water samples had higher Ca hardness values than the permissible values of drinking water quality given by WHO and these can be classified as hard water .Total hardness and Mg hardness is higher in only one sample collected from the site T-2.(Table 3)

18% of water samples exceed in sodium concentration and 35% in potassium concentration than the limits given by WHO. Excess of these ions may be due to increased concentration of sodium and potassium in subsoils and closeness of sampling sites to the sea.

55% of water samples have high DO content and 11% of water samples have high chloride content. Chloride content is higher in bore well water than in open wells.

Concentration of fluoride in bore well water does not exceed the potable water limits. The open well water and bore well water was classified on the basis of mathematical equation[6,7] .The parameters used were pH, dissolved oxygen, total hardness, chloride and total dissolved solids. The open well waters of Andhakarannazhi (A) belongs to slightly polluted class - C3. Open well waters of Vazhicherry (V) and Alappuzha (APZ) is approaching slightly polluted class and that of Ambalappuzha (AMB), Harippad (HP), Kalavoor (K), Chandanakkavu CNK), Alissery (ALY), Chudukad (CAD) and Thookkukulam (TKM) do not belong to excellent class, where as water from Arattuvazhy (AVZHY) and Purakkad (PK) belong to acceptable class.

Bore well waters of Thottappally (T) belongs to polluted class and that from Purakkad (PK) is of slightly polluted class. Water from Alissery (ALY) is more close to class of slight pollution. Water from bore wells of Andhakarannazhi (A), Mararikkulam (M), Harippad (H), Ambalappuzha (AMB) and Alappuzha (APZ) are not under acceptable classification.

## CONCLUSION

Inhabitants of coastal areas of Alappuzha district, though do not depend upon the water from open wells for drinking, their main drinking source is bore well water and water

from municipal sources but the potability of the water needs evaluation. pH of both; open well and bore well water in all the samples were within the prescribed limits. Open well waters are being used for meeting their house hold needs and for other purposes. It is found that 9.4% open well water of the coastal area is hard water and alkalinities of 45% water samples had higher values. Fluoride concentration exceeded only in 6% of open well water than the desirable values for potability. Open well water of Andhakaranazhi (A) was found to belong to a slightly polluted class and most of the open well waters could be rated to belong to an acceptable class and not to an excellent class. 17% of bore well waters of Thottappallly were found to be hard and belongs to polluted class. Sodium is higher than the permissible limits in 18% of water samples and potassium is higher in 35% of water samples collected from bore wells. Fluoride concentrations are within permissible limits for potable water except in 6% of the open well waters analysed. The water from both bore; wells and open wells needs treatment for hardness. Concentration of fluoride in exceeding areas also needs methods of remedy as these are major sources of fluorosis in the inhabitants of these areas.

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