

Experimental study of Sea Water Intrusion level in Poombuhar – Nagai District

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ABSTRACT:Ground water is a natural resource, so we need to preserve as large contribution in our daily lives. Heavy pumping and excessive use of near-coast ground water can increase the intrusion of sea water. Salt water intrusion is a serious menace to the ground water quality of several coastal plains around the world. Sea water intrusion is the movement of saline water into the fresh water, which can lead to the contamination of drinking water sources and other consequences. Hence the attempt was made to analysis the state of ground water salination by sea water intrusion and evaluated the basic parameters such as pH, Na, Ca, K, and DO of coastal aquifers in Poombuhar.

KEYWORDS:Ground water, Salination, pH, Na, Ca, K, and DO.

I. INTRODUCTION

Saltwater intrusion is a potential threat to the quality of ground water for both inland and coastal areas. The coastal aquifers are highly subjected to both sea water intrusion and deterioration of its quality. Saltwater is denser than fresh water and exerts a constant pressure toward freshwater zones. Sea water intrusion is the intrusion of saltwater over fresh water aquifers in the ground. This could affect the human activity and wildlife that depend on the fresh water.

Saltwater intrusion leads to the loss of freshwater vegetation and the spread of saline mudflats into previously vegetated areas. This can lead to the destruction of crocodile breeding grounds and magpie geese habitat and can impact on the ability of the local aboriginal people to hunt and gather food. Saltwater intrusion also affects the high conservation values of coastal freshwater wetlands, as it reduces the diversity of flora and fauna.

1.1 pH:

pH is a numerical scale used to specify the acidity or alkalinity of an aqueous solution. It is precisely the negative of the logarithm to base 10 of activity of the hydrogen ion. Solutions with a pH value less than 7 are acidic and solutions with a pH greater than 7 are basic. Pure water is neutral, at pH 7, being neither an acid nor a base.

1.2 FLAME PHOTOMETER:

A flame photometer is a device used to determine the concentration of certain metal ions, among Sodium, Potassium and Calcium. It is a controlled flame test with intensity of the flame colour. The intensity of colour will depend on the energy that has been absorbed by the atoms that was sufficient to vapourise them. It has the range of metals that could be analysed and the limits of detection are also considered.

1.3 DISSOLVED OXYGEN:

Dissolved Oxygen is known as the amount of oxygen dissolved in a body of water such as a lake, river, or stream. DO is the most important indicator of the health of a water body and its capacity to support a balanced aquatic ecosystem of plants and animals. Wastewater containing organic (oxygen consuming) pollutants depletes the dissolved oxygen and may lead to the death of marine organisms.

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II. STUDY AREA

This study focusses on coastal area of Poombuhar (11°8'33"N9°51'5"E) – a coastal area located along the east coast of TamilNadu in Nagai Dt. Poombuhar also known as KaveriPoompattinam. It is one of the most important and ecologically fragile places along the coastal TamilNadu which lies in the eastern part of Cauvery delta. The soils in this area are very deep, moderately drained, clay to sandy clay loam in texture with deposits of sand in intermittent layers. The soils are somewhat saline in nature due to the influence of tidal waves. The annual temperature of study area ranges from 19.3°C to 40.6°C. The relative humidity is high during the period of October to November, it ranges from 70-77%. The average annual rainfall recorded at Poombuhar is 1500 mm. The major economic activities include fishing, agriculture and aquaculture. Many places of coastal areas of Poombuhar have turned saline due to the presence of swamps and over exploitation of ground water.

III.SAMPLE COLLECTION

For the assessment of ground water state, ground water samples were collected. We gathered the map of Poombuhar and then formulated the grids to divide into ten zones in the map. Then we collected two samples per zone thrice in fifteen days intervals. The details pertaining to sampling locations are given in Table – 1. Zone II and Zone V are dry land, so there we collected only one sample in that zones. All the samples were collected in polyethylene containers and then brought to the laboratory for the further analysis.

Table 1 - Details pertaining to sampling locations

Zone	Sample	Location	Nature Of area	Latitude	Longitude
I	1	Thottalamnankoil	Residential	11.49721	79.86431
	2	Meenavar east	Coastal	11.14398	79.79215
II	3	Mandikulam	Residential	11.17635	79.84761
III	4	Veeramottiruppu	Residential	11.14826	79.35631
	5	Madhavi arch	Coastal	11.53971	79.85718
IV	6	Kundharimedu	Residential	11.18117	79.84762
	7	Karuppannankoil	Residential	11.38641	79.87165
V	8	Anamottukulam	Residential	11.76216	79.85396
VI	9	Dharmakulam	Residential	11.14629	79.84414
	10	Neithavasal	Residential	11.16797	79.84213
VII	11	Pudhukuppam	Residential	11.17061	79.84763
	12	Keezhayurkerkalani	Residential	11.15755	79.83991
VIII	13	VAO office	Residential	11.82615	79.40115
	14	Meenavar west	Coastal	11.14826	79.85142
IX	15	Pazhaiyagaram	Residential	11.17059	79.82541
	16	Vanagiri	Residential	11.38652	79.67281
X	17	Rettaikulam	Residential	11.48736	79.76417
	18	Valavukulam	Residential	11.52892	79.84639

IV.MATERIALS AND METHOD

First of all we selected the Poombuhar as a site which is situated in Sirkazhi Taluk, Nagai district. And we gathered the site map from Poombuharpanjayat at Vandippattarai. For the uniform collection of samples over the entire area, we formulated the grids in the map as ten zones. And we collected two water samples per zone thrice of fifteen days intervals. The samples are collected in the polyethylene bottles. After collection, we analysed the water samples instantly at the site using instant pH meter and also tested those samples in laboratory pH meter to compare the

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Vol. 6, Issue 3, March 2017

results which is shown in Table-2. And also analysed the other parameters such as Na, Ca and K using Flame photometer and DO using DO meter. At last, we suggested the economic preventive measures to avoid further intrusion.

V. RESULTS AND DISCUSSIONS

TABLE 2 - RESULTS FOR pH

Zone	Sample	Location	Instant pH value			Lab test pH value		
			I	II	III	I	II	III
I	1	Thottalamankoil	7.642	7.660	7.665	7.643	7.655	7.661
	2	Meenavar east	7.590	7.598	7.602	7.592	7.599	7.615
II	3	Mandikulam	7.429	7.470	7.486	7.430	7.443	7.449
III	4	Veeramottiruppu	7.830	7.842	7.845	7.829	7.838	7.845
	5	Madhavi arch	7.457	7.469	7.471	7.457	7.466	7.471
IV	6	Kundharimedu	7.030	7.043	7.051	7.031	7.040	7.047
	7	Karuppanankoil	7.765	7.781	7.786	7.767	7.771	7.779
V	8	Anamottukulam	7.308	7.316	7.322	7.310	7.313	7.323
VI	9	Dharmakulam	7.940	7.943	7.947	7.941	7.944	7.949
	10	Neithavasal	7.309	7.311	7.319	7.312	7.316	7.325
VII	11	Pudhukuppam	7.205	7.217	7.233	7.207	7.215	7.222
	12	Keezhayurkerkalani	7.319	7.324	7.330	7.320	7.326	7.331
VIII	13	VAO office	6.877	6.880	6.889	6.879	7.884	7.894
	14	Meenavar west	7.818	7.827	7.831	7.822	7.828	7.834
IX	15	Pazhaiyagaram	7.836	7.840	7.846	7.570	7.577	7.586
	16	Vanagiri	7.569	7.576	7.583	7.839	7.842	7.847
X	17	Rettaikulam	7.481	7.485	7.492	7.482	7.486	7.492
	18	Valavukulam	7.306	7.400	7.409	7.398	7.401	7.411

TABLE 3 - RESULTS FOR DO

Zone	Sample	Location	DO (mg/l)		
			I	II	III
I	1	Thottalamankoil	7.1	6.9	6.7
	2	Meenavar east	7.4	7.1	7.0
II	3	Mandikulam	3.3	3.0	2.8
III	4	Veeramottiruppu	5.2	5.0	4.7
	5	Madhavi arch	3.7	3.4	3.1
IV	6	Kundharimedu	4.0	3.7	3.5
	7	Karuppanankoil	2.4	2.0	1.7
V	8	Anamottukulam	4.3	3.9	3.8
VI	9	Dharmakulam	4.5	4.2	4.1
	10	Neithavasal	4.3	4.0	3.7
VII	11	Pudhukuppam	6.1	5.8	5.6
	12	Keezhayurkerkalani	3.5	3.1	2.9
VIII	13	VAO office	5.4	5.1	4.9
	14	Meenavar west	5.9	5.5	5.4
IX	15	Pazhaiyagaram	7.3	6.9	6.7

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

	16	Vanagiri	6.4	6.1	5.9
X	17	Rettaikulam	4.5	4.0	3.8
	18	Valavukulam	3.7	3.2	2.9

TABLE 4 - RESULTS FOR NA

Zone	Sample	Location	Na(mg/l)		
			I	II	III
I	1	Thottalamankoil	Above 300	Above 300	Above 300
	2	Meenavar east	175	210	246
II	3	Mandikulam	149	161	195
III	4	Veeramottiruppu	156	168	196
	5	Madhavi arch	187	191	239
IV	6	Kundharimedu	Above 300	Above 300	Above 300
	7	Karuppannankoil	198	230	275
V	8	Anamottukulam	Above 300	Above 300	Above 300
VI	9	Dharmakulam	Above300	Above 300	Above 300
	10	Neithavasal	161	171	192
VII	11	Pudhukuppam	Above 300	Above 300	Above 300
	12	Keezhayurkerkalani	Above 300	Above 300	Above 300
VIII	13	VAO office	178	189	197
	14	Meenavar west	185	197	208
IX	15	Pazhaiyagaram	Above300	Above 300	Above 300
	16	Vanagiri	Above 300	Above 300	Above 300
X	17	Rettaikulam	197	219	231
	18	Valavukulam	166	172	181

TABLE 5 - RESULTS FOR CA

Zone	Sample	Location	Ca(mg/l)		
			I	II	III
I	1	Thottalamankoil	Above 300	Above 300	Above 300
	2	Meenavar east	214	256	277
II	3	Mandikulam	Above 300	Above 300	Above 300
III	4	Veeramottiruppu	Above 300	Above 300	Above 300
	5	Madhavi arch	Above 300	Above 300	Above 300
IV	6	Kundharimedu	83	98	110

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

	7	Karuppannankoil	Above 300	Above 300	Above 300
V	8	Anamottukulam	Above 300	Above 300	Above 300
VI	9	Dharmakulam	94	112	136
	10	Neithavasal	Above 300	Above 300	Above 300
VII	11	Pudhukuppam	Above 300	Above 300	Above 300
	12	Keezhayurkerkalani	62	83	96
VIII	13	VAO office	Above 300	Above 300	Above 300
	14	Meenavar west	Above 300	Above 300	Above 300
IX	15	Pazhaiyagaram	Above 300	Above 300	Above 300
	16	Vanagiri	79	93	112
X	17	Rettaikulam	Above 300	Above 300	Above 300
	18	Valavukulam	Above 300	Above 300	Above 300

RESULTS FOR K

Zone	Sample	Location	K(mg/l)		
			I	II	III
I	1	Thottalamankoil	Above 300	Above 300	Above 300
	2	Meenavar east	245	Above 300	Above 300
II	3	Mandikulam	89	124	156
III	4	Veeramottiruppu	115	142	171
	5	Madhavi arch	Above 300	Above 300	Above 300
IV	6	Kundharimedu	76	82	98
	7	Karuppannankoil	Above 300	Above 300	Above 300
V	8	Anamottukulam	131	139	143
VI	9	Dharmakulam	113	117	121
	10	Neithavasal	126	134	139
VII	11	Pudhukuppam	122	131	142
	12	Keezhayurkerkalani	66	73	85
VIII	13	VAO office	103	112	122
	14	Meenavar west	108	119	131
IX	15	Pazhaiyagaram	Above 300	Above300	Above 300
	16	Vanagiri	Above300	Above 300	Above 300
X	17	Rettaikulam	80	97	114
	18	Valavukulam	115	134	156

VI.CONCLUSION

We compared the parameters value of our collected samples thrice in fifteen days intervals. As per our test results, the basic parameters such as pH, Na, Ca, K and DO is slightly increasing day by day. From that, the ground water levels of our site are affected by the encroachment of sea water. Hence, we conclude that by the provision of rainwater

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

harvesting tank, we can recharge the groundwater level which would reduce the further intrusion. It could be proved that this method is economical while compared with other methods. As Red Cloud Lakota says, **“When the last tree is cut down, the last fish is eaten, the last stream is poisoned, you will realized that you cannot eat money”**. So all parties including individual organs even the government should care about this problem and should take early steps to preserve our living place and environment.

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