
ABSTRACT

The responsible for increase in freshwater demand is due to rapid growth of population, industrialization and modern agriculture practices. The aim of the study tends to carry out a column study for the removal of chloride from raw water. Raw water is natural water found in environment such as rainwater, groundwater and water from bodies like lakes and rivers. Water samples were collected from Valliar River, AVM Canal and Periyakulam Pond from kanyakumari district. Soil used for the study is loam soil. The raw water samples were allowed to pass through the vertical column of soil at different bed depth such as 15cm, 30cm, 45cm, and 60cm depth. The outflow of water is collected which is subjected to analysis the chloride concentration. It was found that when the depth of soil increases, the rate of filtration also increases. Therefore concentration of the chloride content is reducing linearly.

KEYWORDS: Column study, Chloride, Raw water, Loam soil.

INTRODUCTION

Water is one of the most vital natural resources for the survival of all living organisms. One of the greatest challenges is to provide a satisfactory measure of good quality water. Water can be separated into two categories which are surface water, such as rivers and streams, natural lakes, reservoirs, ponds and shallow water such as springs and ground water. The symphony of natural water is firm by a series of physical, chemical and bio-chemical processes which occur during different stages in hydrologic cycle. Raw water is natural water found in environment such as rainwater, groundwater and water from bodies like lakes and rivers. Kanyakumari district is a coastal district situated at the southernmost tip of Tamilnadu near Trivandrum which is the capital of Kerala state. Water pollution remains a major problem in Kanyakumari district due to wastewater flow into the streams, wells, rivers and other water bodies without treatment or improper treatment. Chloride is one of the components in surface as well as subsurface water. Chlorides occur in all natural waters but concentration may change. Normally water flow from mountain has low concentration of chloride but water flow from rivers, streams and irrigation canals have a huge amount due to flow of waste water from industries, small factories etc. This affects the groundwater quality. Rivers are providing major water resources for domestic, agricultural and industrial purposes and outstanding water meets the sea. The quality and quantity of surface water in a water bodies is limited by natural factors such as wind, rainfall, temperature and weathering of rocks etc. Pesticides there in nearby farms and chemical effluents given out by industries largely influence of chloride content in water. Degradation of organic matter in the presence of bacteria leads to changes the quality of raw water. Chloride occurs in all natural waters in widely varying concentrations. Chloride concentration above 250 mg/L could affect the taste of drinking water. The chloride contents normally increases as the mineral content increases. The restrictions of chloride have been laid down mainly from taste considerations. A limit of 250 mg/L chloride has been recommended as desirable limit and 1000 mg/L as the permissible limit for drinking water. There is no adverse health effects on humans have been reported due to intake of waters containing higher content of chloride.

STUDY AREA

The raw water samples were collected from Valliar River, AVM Canal and Periyakulam Pond. Valliar is a small river originates from the Velimalai Hills. Valliar collects drainage from P.P. channel and confluence with the

Arabian Sea near Manavalakurichi. AVM canal was a scheme for connecting Thiruvananthapuram with Kanyakumari and thus extending the water transportation to the extreme south of the country as shown in figure 1. The coastal villages such as Pozhiyur, Kollencode, Neerodi, Marthandamthurai, Vallavilai, Eraviputhanthurai, Thengapattinam, Colachel, Kottipadu and Mondaicadu all depended upon these water resources for most of their needs, including navigation. But today the canal was completely polluted and encroached upon. In Mondaicadu coconut husk retting operation was going on nearer to the canal bank. These affect the water quality. Periyakulam pond has an area of 10 acres which is situated at latitude $8^{\circ}10'26''$ North and longitude $77^{\circ}18'36''$ East near Cheramangalam, Kanyakumari District, Tamil Nadu as shown in figure 2. The water in the pond is mainly used for drinking and irrigation purposes. It is the big water source for all paddy and banana fields in and around Cheramangalam.



Fig. 1. AVM Canal



Fig. 2. Aerial View of Periyakulam Pond

COLUMN STUDY

The column study experiment has been carried out with the help of glass tube equipment as shown in figure 3. The total length of the glass tube is 110cm. The diameter of inlet and outlet tube was 1.25cm. The diameter of the middle tube is 5cm. Proper graduation was provided on the tube starting from 0 to 60cm. A ceramic membrane was provided towards the end of the middle tube to provide a good filtration result. At the end of the outlet tube a tap was provided. A funnel is provided at the top to pour the raw water sample.



Fig. 3. Experimental setup for Column Study at Different Bed Depth

SOIL TEXTURE ANALYSIS

A jar test was carried out to determine the percentage of sand, silt and clay as shown in figure 4. From the test it clearly indicates that soil used for column study contains 40% sand, 40% silt and 20% clay. Percentage of sand, silt and clay are marked in the soil texture triangle. Figure 5 shows the soil texture triangle with various type of soil. These three values intersect at each other in the triangle. The intersection point is loam soil. It indicates the soil used for the study is loam soil.



Fig. 4. Jar Test for Soil Texture

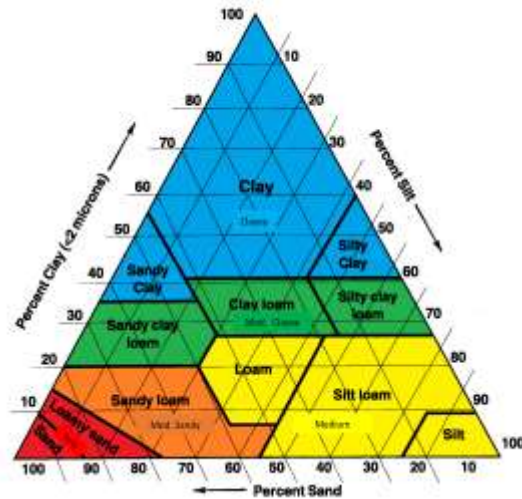


Fig. 5. Soil Texture Triangle

COLUMN STUDY FOR VALLIAR RIVER WATER

A river is a naturally formed watercourse flowing towards sea. Figure 6 shows the column study of chloride content in the Valliar river water sample. The figure clearly differentiates the qualities before and after filtration. Before filtration the Valliar river water sample was tested in which the range of chloride is 400mg/L. Four column tubes were arranged for filtration in which the first column is filled with 15cm depth of soil, second column is filled with 30cm depth of soil then third column is filled with 45cm of soil and the last is filled with 60cm depth of soil. Later the river water sample was allowed to pass through the vertical column which is filled with 15cm, 30cm, 45cm and 60cm depth of soil. For 15cm depth of soil column the chloride content is 320mg/L, then for 30cm depth of soil column the Chloride is 178mg/L, next for the 45cm depth of soil column the range of chloride is 167mg/L and last 60cm depth soil column the chloride content is 160mg/L.

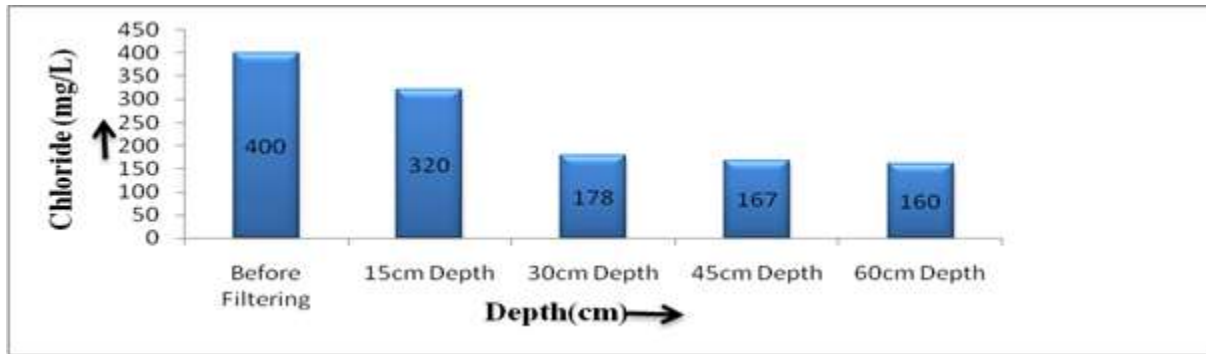


Fig. 6. Chloride Content of River Water at Different Bed Depth

COLUMN STUDY FOR AVM CANAL WATER

A canal is a manmade waterway built for the purpose of carrying water from a source such as dams, rivers and lakes used for farming and also used for water transportation. Figure 7 shows the column study of chloride content in the AVM canal water sample. The figure clearly differentiates the qualities before and after filtration. Before filtration the AVM canal water sample is tested in which the range of chloride is 780mg/L. The AVM canal water sample is allowed to pass through the vertical column which is filled with 15cm, 30cm, 45cm and 60cm depth of soil. For 15cm depth of soil column the chloride content is 727mg/L, then for 30cm depth of soil column the Chloride is

500mg/L, next for the 45cm depth of soil column the range of chloride is 421mg/L and last 60cm depth soil column the chloride content is 400mg/L.

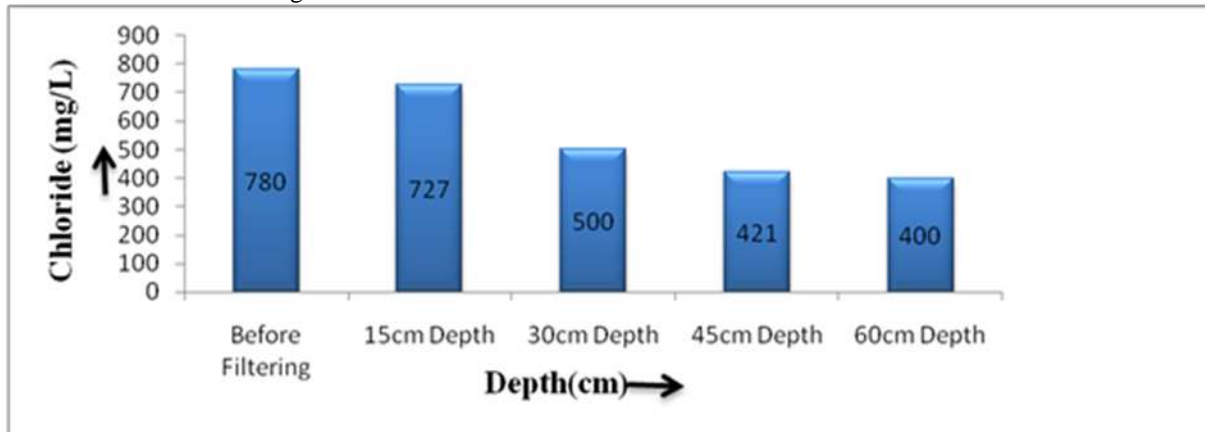


Fig. 7. Chloride Content of Canal Water at Different Bed Depth

COLUMN STUDY FOR PERIYAKULAM POND WATER

Pond is a body of static water formed natural or artificial which is usually smaller than an irrigation tanks. Figure 8 shows the column study of chloride content in the Periyakulam pond water sample. The figure clearly differentiates the qualities before and after filtration. Before filtration the Periyakulam pond water sample is tested in which the range of chloride is 454mg/L. Four column tubes are arranged for filtration in which the first column is filled with 15cm depth of soil, second column is filled with 30cm depth of soil then third column is filled with 45cm of soil and the last is filled with 60cm depth of soil. Later the Periyakulam pond water sample was allowed to pass through the vertical column which is filled with 15cm, 30cm, 45cm and 60cm depth of soil. For 15cm depth of soil column the chloride content is 400mg/L, then for 30cm depth of soil column the Chloride is 360mg/L, next for the 45cm depth of soil column the range of chloride is 290mg/L and last 60cm depth soil column the chloride content is 245mg/L.

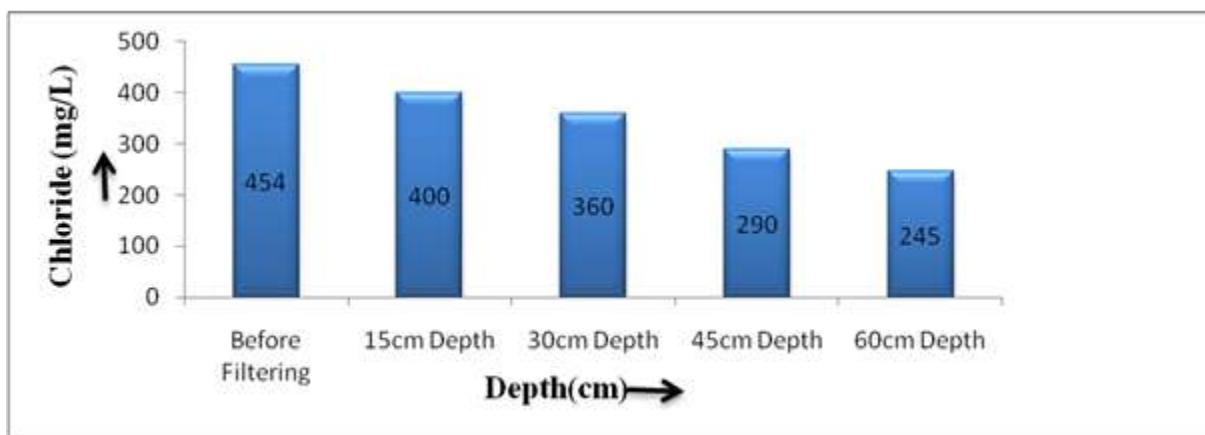


Fig. 8. Chloride Content of Pond Water at Different Bed Depth

ASSESSMENT OF COLUMN STUDY AT DIFFERENT BED DEPTH

Figure 9 shows the total representation of the entire experimental result which has been conducted for chloride test for the raw water. The raw water samples such as river water, canal water and pond water were studied. This comparison gives an idea about the extent of purification taking place at different depth of soil. The chloride concentration of canal water is 780mg/L before filtration which is normally high. This is due to coconut husk retting operation is going on nearer to the canal bank. Chloride content above 250 mg/L could affect the taste of drinking water. There is no adverse health effects on human beings have been reported due to intake of water containing

higher content of chloride. It was found that when the depth of soil increases, the rate of filtration also increases. Therefore concentration for the chloride content is reducing linearly from 15cm to 60cm depth of soil column.

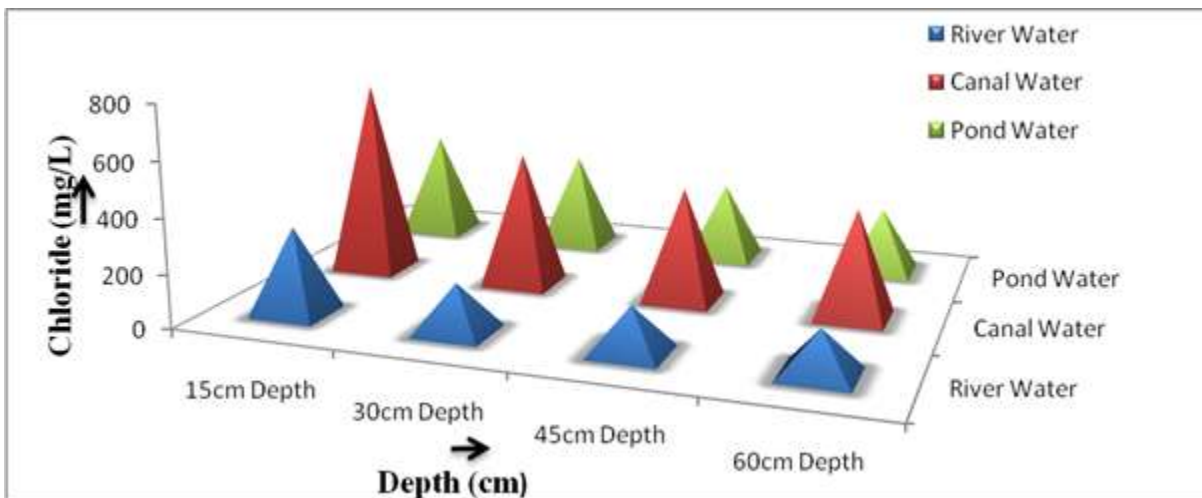


Fig. 9. Comparison of Column Study at Different Bed Depth

CONCLUSION

A study covers the aspect of water quality which is very essential in daily life. The present work is an attempt in this direction. This work focuses mainly on testing the chloride concentration of raw water. This comparison gave an idea about the extent of filtration taking place at different depth of soil. From the above discussion one can conclude that when the depth of soil increases, chloride concentration decreases. Chloride concentration was low for the raw water samples that had passed through soil that was kept at a depth of 60cm. In future research the column study can be done at various types of soil with alternate depth.

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