

Effect of Excess Chlorides & Microbiological Presence on Water Quality Standards in Periyar River Near Puthenvelikara Panchayath

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Abstract: *The requirement of water for our daily activities is always on the rise. Ironically, the world's fresh water reserves are dwindling due to climate change, uncontrollable pollution and unprecedented distribution of rainfall. Proper analysis of the area pertaining to the ground water reserve would in fact provide an insight in to the quality of water present in the reserves. This journal presents a comparison of treatment units to be provided based upon the water sample analysis of various parameters at Puthenvelikara Panchayath when compared to certain similar locations pertaining to the same parameter analysis.*

Keywords: Water Treatment, Chlorides, MPN Index, Treatment Units, Samples, River, Panchayath, Periyar

I. Introduction

A water treatment plant is always commissioned to meet the requirements of the present population as well as the future population for a certain number of years generally referred to as the Design Period. Choosing a design period greater than the life of the components in the treatment plant would invite further investments. Altering the different components of the plant in size or even resorting to replacement would incur heavy capital investment. Choosing a suitable design period is the first step towards a successful water treatment plant. A design period of 30 years is found to be apt for a water treatment plant. The different components of the water treatment plant are chosen depending upon the analysis of the water sample taken from the source. The water sample being analysed for various parameters gives a clear-cut idea on the various components to be used.

II. Scheme Area

The scheme area is Puthenvelikkara panchayath which lies between North latitudes 9°15' 50"- 10°32'53" and East longitudes 76°07'38" - 77°24'32" and lies along the northern boundary of Ernakulum district in the State of Kerala. It comprises of 17 wards and has an area of 19.87 sq.km. 32213 is the population as per 2011 census with a population density of 1522 per square kilometre. The main source of income for people comes from agriculture. Chalakkudy River flows through this panchayath and the entire area gets divided into two halves. The confluence of Chalakkudy River and Periyar River takes place at Elanthikkara situated in this panchayath and the combined flow continues towards Arabian Sea along the southern boundary. The western side of this panchayath is surrounded by back waters. The Rural Water Supply Scheme was commissioned in 1985 and rehabilitated in 2005 with a 3.60 MLD water treatment plant.

Certain areas of this panchayath are abundant with fresh water, while many other places have petite supply of fresh water and are infested with brackish water and some low-lying area are flooded with high tide water. In addition, quite a few areas face water shortage owing to its high elevation which elevates into a critical situation during the summer season.

III. Methodology

The very first stage of planning a water treatment plant requires the adoption of a design period. Design period refers to the number of years for which the different components in the treatment plant are expected to serve its purpose. The water treatment plant located at Puthenvelikara is over a decade old and it was found essential to carry out an analysis of several parameters to determine the adequacy and deficiency of the treatment plant. The design period was chosen as 30 years which is found to be apt for a place like Puthenvelikara based upon its population, topography and availability of water at all regions. The design of the treatment plant is often carried out by analysing the population at the end of the design period. This population will play the most important role in determining the capacity of each treatment unit. The population data of the Puthenvelikara Panchayath is available from the Census data obtained by carrying out census every 10 year. The past three population for the year 2011, 2001 and 1991 are given in the following table:

Table	Population
2011	32213
2001	29082
1991	26579

Table 1: Population Data

Based upon the above data and by considering the design period as 30 years, the population after 30 years is determined. Geometric Increase Method is found to be the simplest realistic population model based on past information. It accurately describes the continuous and cumulative nature of population growth (Dinesh W Gawatre, et. al 2016).

Presentation of Water Analysis Data:

Water samples were collected from three different locations at Puthenvelikara Panchayath during the month of October 2016 and February 2017. The description of the three locations are:
Location 1: Upstream end lying in the Chalakkudy River
Location 2: Downstream end lying in the Periyar River
Location 3: Source of water at the present treatment which is the downstream end of Chalakkudy River

The above said locations lie at an approximate distance of 1 km from each other. The water samples were collected in plastic bottles of 1 litre capacity and before filling with water sample, each bottle was rinsed with distilled water once and thrice with the sample water. Entrapment of air in the bottle was avoided by completely immersing the bottle in the water sample as per the recommendations of sampling by Bureau of Indian Standards.

The water samples were analysed a single parameter; Chloride Content. The table below gives the data regarding analysis of water sample from the source for the above-mentioned parameter.

Parameters	October, 16	February, 17
Chloride	50ppm	1300ppm
MPN	240	>1100

Table 2: Water Quality Analysis

Discussion of Chloride Content:

The acceptable limit for Chloride in a potable sample has been established at 250 mg/l and the maximum limit is maintained at 1000 mg/l. The analysis of the water sample during the month of October in 2016 gave a value of 50 mg/l and the analysis during the month of February 2017 gave an alarming value of 1300 mg/l.

One needs to ascertain beforehand the extent of contamination of the area, possible intrusion of sea water and their potential risk towards the ground water quality.

A study conducted by Joseph et al (1984) proved the existence of zero salinity up to the regions of Alupuram and areas of FACT Industry. Intrusion of sea water into the river water occurs during the pre-monsoon months. According to a study conducted by Joy (1989), the construction of earthen bunds helped in reducing the intrusion of salt water into the river water. The mining activity carried out at river basins for collection of river sand creates pockets in the river which helps to hold sea water during its intrusion.

Therefore, the drastic increase in the chloride content can be attributed the occurrence of high tide during the months of January and February which allows the entry of sea water into river water reserves and thereby increasing the chloride content. The presence of chloride content in the water sample can impart undesirable taste and can also corrode the distribution pipes.

Another reason which could be attributed to the increase in chloride content is the contamination of the area. The region lying from Angamaly to Kochi comes under a zone consisting of several industries situated along the Periyar river basin. The region consists of large scale and small scale industries exceeding 50 in number and around 2500 small scale industries. The industries located in the Eloor region consumes about 2 lakh cumecs of water per day and 75% of this water is let into the river with large quantities of effluents and pollutants. The industries contributing to this catastrophe are fertilizers, pesticides, chemicals and allied industries, petroleum refining and heavy metal processing, radioactive mineral processing, rubber processing units, animal bone processing

units, battery manufacturers, acid manufacturers, pigment and latex producers etc. The range of pollutants that drastically affects the water quality of the river water consist of toxic and hazardous materials which includes toxic and hazardous materials such as heavy metals, hydrocarbons, pesticides, radionuclides, ammonia, domestic and untreated waste water.

Likewise, the high content of chloride in the region can be attributed to the presence of contaminants in the region. The heavy waste from industries in the Ernakulam district are often deposited in the Periyar River and at several disposal places in the Puthenvelikara Panchayath. The waste contaminants from these contaminants often percolate into the soil and contaminate the ground water increasing its chloride content.

As per a study conducted by Kelly in the state of Illinois (2012), several reasons can be accounted for the increase in chloride content and they are:

- 1) The potential feeding of animals on a large scale at a relatively small area can lead to the contamination of shallow ground water, rivers, etc.
- 2) The runoff of road salt can result in higher concentration of chloride in the ground water.
- 3) Landfills often contain large amount of chloride from food scraps and pet wastes which leach into the soil and result in the contamination of ground water. The concentration of chlorides in a landfill decrease with age of the landfill
- 4) Human Wastes accounts for a small percentage of chlorine percolating into the soil

The above-mentioned reasons as per the study could be the possible reasons to the increase in chloride content in the water sample collected from the source.

The presence of contaminants in the region requires the treatment of soil and the remedial measures can be of the following where in the treatment method chosen depends upon the characteristics of the contaminant.

1. Physical methods: excavation, soil washing, soil vapor extraction, etc.
2. Thermal methods: incineration, desorption, vitrification, etc.
3. Chemical treatment: chemical stabilization.
4. Bioremediation: in-situ biotreatment, ex-situ biotreatment, ex-situ slurry biodegradation, root zone treatment, etc.

The best possible method to eliminate the chloride content in the water is the commission of a Desalination Plant. But in a country like India where investments are scarce, the construction of a Desalination Plant would be practically impossible for a Panchayath. Therefore, one would have to resort to an alternative technique.

Discussion of MPN Index:

As per the Indian Standard of Drinking Water, MPN Index should not be detectable in a sample of 100ml, A value of 240 was obtained from the analysis of the sample during the month of October in 2016 and likewise a value greater than 1100 during the month of February in 2017. Both the obtained values are highly unacceptable when compared with the Indian Standards.

As per the study conducted by R.K. Thakur et al, the high value of COD can be attributed to the disposal of sewage in the

regions with the Panchayath. Another study conducted by Deepesh Kumar et al, found a value of 180 for MPN Index for a water sample collected from municipal water reserve and this value was termed as very high.

The remedial measures to be adopted for the high value of MPN Index can be summarised as:

1) Proper sanitary survey, design and implementation of water and sanitation projects; regular disinfections for drinking should be planned and conducted

2) To ensure potable water supply, water should pass through three stages – storage, filtration and disinfection, method of storage removes 90-95% of the physical impurities by mechanism of suspension. It permits the penetration of light which results in oxidation of organic matter by aerobic bacteria.

3) Filtration comes as the second stage of water purification resulting in 98-99% drop in bacterial count apart from other impurities.

4) Disinfection should be the final stage of purification which destroys all pathogenic organisms left after storage and filtration.

IV. Conclusion

The water samples which were collected from the Periyar near the Panchayath was high in Chlorides and MPN Index. The high value of Chloride and MPN Index is due to the ingress of sea water during high tide and due to deposition of waste in the nearby areas respectively.

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