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A STUDY ON THE ESTIMATION OF CHLORIDE ION CONCENTRATION IN GROUND WATER SAMPLES

P.Ramya*[1], A.Jagadeesh Babu[2], E.Tirupathi Reddy[3], L.Venkateswara Rao[4]

1. *Assistant Professor, Dept. of Veterinary Public Health & Epidemiology, College of Veterinary Science, Proddatur.
2. Associate Professor, Dept. of Veterinary Public Health & Epidemiology, College of Veterinary Science, Tirupathi.
3. Assistant Professor, Dept. of Poultry Science, College of Veterinary Science, Proddatur.
4. Professor & Head, Dept. of Veterinary Public Health & Epidemiology, College of Veterinary Science, Proddatur.

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For Correspondence:

Dr. P. Ramya

Assistant Professor, Dept. of Veterinary Public Health & Epidemiology, College of Veterinary Science, Proddatur.

E-mail:

puttururamya@gmail.com

ABSTRACT

Chloride ion, a negatively charged ion, major electrolyte, play different roles in the body like osmoregulation, maintenance of extra cellular fluid volume, transportation of nerve impulses and etc. Keeping inview of its important role in the body, the present study was designed to estimate the concentration of chloride content in ground water samples of one town (40) and two villages (40 each). All the water samples have been collected into screw capped sterile glass bottles and chloride content was estimated by Mohr method. Out of 120 samples analysed 52.5% of the samples have shown chloride content of more than its desirable limit (250mg/lit) set by BIS. The samples of villages have shown more chloride concentration compared to that of town which was may be due to pollution of ground water by agricultural runoff. Water with Chloride content of more than 250 mg/lit, tastes salty, but if it exceeds its permissible level it will show hazardous effect.

INTRODUCTION

Chlorides are the inorganic compound resulting from the combination of the chlorine gas with metal. Some common chlorides include sodium chloride (NaCl) and magnesium chloride ($MgCl_2$). Chlorine alone as (Cl_2) highly toxic, and it is often used a disinfectant. In combination with a metal such as sodium, it becomes essential for life. Small amounts of chlorides are required for normal cell functions in plant and animal life [(1)]. Chloride is a major mineral nutrient that occurs primarily in body fluids and it is most essential mineral for humans. It is a prominent negatively charged ion of the blood which represents 70% of the body's total negative ion content. On an average an adult human body contains approximately 115 gms of chloride for making up about 0.15% of total body weight [(2)]. Chlorides constitute approximately 0.05% of the earth's crust. Chloride concentration of between 1 - 100 ppm are normal in fresh water. Chloride ions come into solution in water in underground aquifers, geological formations that contain ground water. Chlorides are present in both fresh and salt water and are essential elements of life [(3)].

Chloride, a negatively charged ion play a pivotal roles in the body and serves as one of the main electrolytes of the body. In addition to its functions as an electrolyte chloride combines with hydrogen in the stomach to make Hydrochloric acid, a powerful digestive enzyme that is responsible for the breakdown of proteins, absorption of other metallic minerals and activation of intrinsic factor which inturn absorbs Vit-B_{12}. Chloride ion also play a role in the maintenance of extra cellular fluid volume [(4)]. A constant exchange of chloride and bicarbonate between red blood cells and the plasma helps to govern the p^H balance and transport of carbon di oxide, a waste product of respiration from the body. With sodium and potassium, chloride works in the nervous system to aid in the transport of electrical impulses throughout the body, as movement of negatively charged chloride into the cell propagates the nervous electrical potential [(5)].

High chloride concentration in fresh water can harm aquatic organisms by interfering with osmoregulation, the biological process by which they maintain the proper concentration of salt and other solutions in their body fluids. Difficulty with osmoregulation can hinder survival, growth and reproduction. Department of environmental management has set a maximum contaminant level of 250 ppm chlorine for drinking water which is the point at which water starts to taste salty [(3)].

Excess intakes of dietary chloride only occur with the ingestion of large amounts of salt and potassium chloride. The toxic effects of such diets, such as fluid retention and high blood

pressure, are attributed to the high sodium and potassium levels [6]. Chloride toxicity has not been observed in humans except in the special case of impaired sodium chloride metabolism ex: in congestive heart failure [2]. Healthy individuals can tolerate the intake of large quantities of chloride provided that there is a concomitant intake of fresh water. Other situations in which increased blood levels of chloride are seen include diseases of improper waste elimination that occur in kidney diseases. Excess chloride is normally excreted in the urine sweat, and bowels. In fact, excess urinary excretion of chloride occurs in high salt diets. Excess intakes of chloride can occur in a person with compromised health in addition to an unhealthy diet. However those that follow a healthy diet and lead an active life style may need to consider supplementing their diet with this important mineral. Environmental impact of chlorides are not usually harmful to human health; however, the sodium part of the table salt has been linked to heart and kidney diseases. Sodium chloride may impact a salty taste at 250 mg/l [7]; however, calcium or magnesium chloride is usually detected by taste until levels of 1000 mg/l are reached. Public drinking water standards require chloride level not to exceed 250 mg/l [1] . By considering the pivotal role of chloride ion in our body the present study was designed to estimate the concentration of chloride ion in ground water samples.

MATERIALS AND METHODS

One hundred and Twenty samples of ground water were collected from one town and two different villages while attending Mega Animal Health Camp organized by College of Veterinary Science, Proddatur, Y.S.R. Kadapa District, Andhrapradesh, India. All the water samples were collected aseptically in to a sterilized screw capped glass bottles and brought to the laboratory. Chloride content of all the water samples was tested by using Mohr method [8,9], by taking 100 ml of water sample into a conical flask which will be added with 2 ml of Potassium chromate indicator followed by titration with 0.02N Silver nitrate solution present in a burette. End point was noted down when the contents of conical flask turned to reddish brown colour. Amount of chloride content in water was calculated by using the following formula

Chloride content in mg/lit. = ml. of silver nitrate used for titration x N. of silver nitrate x 1000 x 35.5 / Vol. of water sample taken

RESULTS AND DISCUSSION

Out of One hundred and twenty samples of ground water collected from one town and two villages 52.5% of the samples have shown Chloride content of more than 250mg/lit, which was set as maximum permissible limit (MPL) for drinking water by BIS.

S.No.	Place of collection	No.of samples collected	No.of samples with >250mg/lit of chloride content	Percentage of samples with >250mg/lit of chloride content
1.	Proddatur town	40	18	45
2.	Sannapalli village	40	24	60
3.	Chinnakuravaluru village	40	21	52.5
		Total	63	52.5

The chloride content in water samples collected from villages are having more chloride content when compared to that of samples collected from town, which was may be due to the contamination of ground water samples by agricultural runoff. Out of forty samples collected from Proddatur town 18 samples (45%) have shown chloride content of more than its MPL value. In case of water samples collected from Sannapalli village and Chinnakuravaluru village out of 40 samples collected 24(60%) and 21(52.5%) were shown chloride content of more than its MPL values. Altogether out of 120 samples collected 63 (52.5%) samples have shown chloride content of more than its MPL values.

Gaur et. al. [(10)] had analysed several water samples from Uttarakhand region, India, for chloride content in water by Mohrs method and identified that all most all the water samples have shown the chloride content within desirable levels i.e 250mg/lit. Chlorides may get into surface water from several sources including: rocks contain chlorides, agricultural run-off, waste water from industries, oil well wastes, and effluent waste water from waste water treatment plants. Chlorides can corrode metals and affect the taste of food products. Chlorides can contaminate fresh water streams and lakes. Fish and aquatic communities cannot survive in high level of chlorides. Therefore, water that is used in industry or proceeds for any use has a recommended maximum chloride level [(1)].

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