ChemClass Journal, 2004 (6-8)

Determination of pH, Ca^{2+} and Cl^- in packaged pure water consumed in Plateau State

*I.Y. Longdet, A.C. Chukwu, M. A. Okooboh, and E. D. Mwanse
Chemistry Department, Federal College of Education, Pankshin, Plateau State
[islongdet@yahoo.com]

ABSTRACT

This work was designed to check the NAFDAC status, pH values, Chloride and Calcium ions concentrations of the samples. Ten specimen samples of the commonly consumed *pure water* were randomly selected and bought from the market for the analyses. The results show that only 40% were registered with NAFDAC and only10% had the batch product checked by NAFDAC; Chloride ion concentration was generally low ranging between 1.54mg/l and 18.23 mg/l; Calcium ion concentration was also low ranging between 5.6 mg/l and 40.21 mg/l. 50% of the samples had PH less than 6.5 while non-had PH above 8.5. The water samples were found not to meet set standard. This implies that the consumers are at risk. Therefore the Supervisory Agencies are called upon to insist upon checking every product no matter the location while producers should be quality conscious.

* Author for correspondence

INTRODUCTION

Water is the most common, most widely distributed and most useful liquid on earth. Two third of human body weight is made up of water attaining forty five litres in the average adult. The brain is eighty five percent water; muscles contain seventy seven percent and bones thirty three (33%) percent [1]. As a result of the significance of water in physiological systems, it is difficult to survive for long without water. A normal average weight adult in the savannah region consumes 4-6 litres daily, although weather condition, health status, physical activity etc may influence the intake greatly.

Following this large intake and the fact that very many substances dissolve readily in water, it has been found to serve as a medium of introducing some of the required substances into the physiological systems of both plants and animals. Since some of these substances may or may not be deliberately added, regulatory bodies like Standard Organisation of Nigeria (SON), National Agency for Food and Drug Administration and Control (NAFDAC), World Health Organisation (WHO), etc have set standards or limits of concentration on the substances to be found commonly in water meant for human use. The substances are numerous, but of most importance to us in this work are the calcium and chloride ions concentrations, as well as pH values and NAFDAC status in the selected samples. Why calcium, chloride and pH?

pH, the negative logarithm of hydrogen ion concentration, measures the acidity or alkalinity of a system. The pH of a physiological system is determined by the ions or kinds of solutions introduced into it. The maintenance of the composition of the internal environment (homeostasis) of an organism is very necessary for both function and effectiveness. The body metabolism depends largely on enzyme activity. And the enzymes are highly pH sensitive. Therefore, the desire is a step in the right direction for the well being of the consumers.

Chloride ion, according to Okoye [2] and Mayes [3] and is significant fluid and electrolyte balance for health and so deficiency leads to muscle cramps, vomiting and renal disease. Although substantial quantity is taken in food prepared with sodium chloride, a recommended amount is desired through drinking water. The WHO recommended concentration of Cl^- ion in potable water is a maximum of 200mg/l.

Calcium ions have been known to regulate a number of important physiological and biochemical processes. These include neuromuscular excitability, blood coagulation, secretory processes, membrane integrity and plasma membrane transport, enzyme reactions, the release of hormones and neuro-transmitters and the intracellular action of a number of hormones [4]. In addition, the correct extra cellular fluid and periosteal concentration of Ca^{2+} is required for bone mineralisation. For these to be achieved, therefore, the required level of Ca^{2+} ion must be present in the system. Nature, in providing resources for life, created Ca^{2+} as part of the earth crust from where plants and animals may enjoy supplies. For man, common sources of Ca^{2+} are dairy products, beans and leafy vegetables.

Base on the need of this ion in the system, National Food and Nutrition Board (1989) gave a recommended daily allowance (RDA) for different categories of people:

Infants 0 to 0.5 years (400mg); 0.5 to 1 year (600mg). Children 1-10 years (800mg)

Males/Females 11-24 years (1200mg); 25-51 years (800mg). Pregnant /lactating 1200mg

Obtaining these quantities per day may not be a reality in a community where neither dairy products, beans nor leafy vegetables are commonly consumed. This is the case in a large part of the State. The next option may be the water source. However, potable water availability has continued to be a problem in many parts of Nigeria, Plateau State inclusive. This work was, therefore designed to check the following in the samples:

1. Compliance of Producers the call to register with NAFDA
2. pH values
3. Level of Ca^{2+} ion
4. Level of Cl^- ion.

MATERIALS AND METHODS

Samples and sampling Technique

Ten, commonly consumed, packaged water (*pure water*) brands were purchased from shops in Jos and some other towns in Plateau State. The basis for the choice of the samples was their availability in the area under study. The samples were as in Table 1

Table 1 Names and locations of samples. The NAFDAC status of each sample was noted

Apparatus and Reagents

The apparatus used were pH meter; burette, pipette and retort stand with clamp. The reagents used included murexide indicator, 0.01M EDTA, standard calcium solution, sodium hydroxide solution, Mercuric nitrate and diphenylcarbazone .

Estimation of Cl^- concentration

10ml of the water samples was pipetted into an Erlenmeyer flask and diphenylcarbazone was added as indicator. This sample was titrated against 0.014M mercuric nitrate solution to a purple end point.

Estimation of Ca^{2+} concentration

50ml of the water sample was pipetted into a 100ml conical flask; then 2ml of NaOH solution and 0.1g of murexide indicator were added and mixed well. This mixture was titrated immediately against 0.01M EDTA onto a pink to purple end point. The burette reading was recorded.

Determination of pH

Using a Philips Harris pH and redox meter, the pH of each sample of water was determined.

RESULTS AND DISCUSSION

The findings of the work were summarized and presented on Table 2. The factories producing the samples analysed were not all registered with NAFDAC. 40% were registered while 60% were not and so they carry no Registration Numbers. Only 10% had the NAFDAC batch number while 90% had none. The only product with batch number had no registration number. This observation sends a serious signal to consumers. That 60% of the so-called *pure* water are

Table 1: Names and locations of samples collected

Sample code	Name	Address
A	LY-Noble	Lydon Nig. Entrp, Dogon Dutse, Jos
B	Eden	No 3 Rikkos Rd., Opp. Maguns Hospital. Jos
C	Elim	Opp. Film Corporation, Jos
D	Newlife	No 30 Tafawa Balewa Street, Jos
E	Favour	II Liberty Boule Yard, Jos
F	Omega	Victoria Street, Jos
G	Capital	Victoria Street, Jos
H	Rita King	Bauchi Rd. Opp. University of Jos, Jos
I	Kiwon Lafiya	No G22 New Layout, Pankshin
J	Tin City	No 102 Katako Road. , Jos

Table 2: Summary of findings

Sample	NAFDAC STATUS		pH	ion concentration.(mg/l)	
	REG. NO.	Batch No.		Cl^-	Ca^{2+}
A	-	-	6.3	10.22	19.42
B	-	C0001	6.3	5.82	13.69
C	01-02252	-	6.2	11.24	8.90
D	-	-	7.0	2.91	32.50
E	-	-	7.5	18.23	40.21
F	01-07691	-	6.8	1.54	5.61
G	-	-	6.3	18.23	48.32
H	01-2371	-	6.7	9.41	24.83
I	01-02-481	-	6.6	7.99	10.74
J	-	-	6.3	8.44	38.47

operating illegally, worst still is the fact that even the registered factories do not have their products checked by the appropriate quality control agencies [5]. This was evident by the fact that they had no NAFDAC batch numbers.

The recommended pH range for portable water is between 6.5 and 8.5. However, 50% of the samples had pH values outside this range - below 6.5. This implies that what is taken in form of water is a dilute acid. This has a serious negative implication for the health of the consumers. We are at risk of having the pH of our physiological systems reduced below the levels required for optimum activity of some enzymes.

The chloride ion concentration of between 1.54mg/l and 18.23mg/l is relatively low compared to the maximum of 200mg/l recommended by WHO. If there will be any health implication it may be in the aspect of physiological electrolyte balance.

The Ca^{2+} ion concentration in the samples is generally low compared to the 70mg/l recommended value by WHO. 30% of the samples had values above 35.00mg/l while 70% had values below 35.00 mg/l. This low level may be permitted in a community with large intake of dairy products, beans and leafy vegetables. But in communities with very low, if not, no dairy products as part of their meals and/or low intake of beans and leafy vegetables, this low-level of Ca^{2+} ion in water poses some risk. The risk is in having less than the RDA. For adults, this may not be of much concern since some travel around the world and may enjoy higher intake of this ion in foods served in such communities. The problem and so concern is for the children since their movement is restricted. They are at a high risk of suffering from rickets and/or osteoporosis (Okoye, 1992; Mayes, 1996). These results tend to confirm the complaints of Olabisi (1998) over pure water that is being marketed.

CONCLUSION

Most of the samples were not conforming to NAFDAC conditions for registration. Most of the samples were more of dilute acids than water for human consumption. The Cl^- and Ca^{2+} concentrations in the samples were both generally low.

It is suggested that:
Producers of pure water should be quality conscious
NAFDAC should insist on checking everything produced, no matter the locality
The populace should be empowered to be able to eat what they should.

REFERENCE

1. B.E. Akpan (1998). *A context Based investigative Approach of Teaching of water Pollination*. Ibadan: STAN Environmental Education Series. Number 2.
2. Z.S.C. Okoye (1992). *Biochemical Aspects of Nutrition.* India: Prentice Hall Ltd. Pp 192.
3. P.A. Mayes (1996). Nutrition In. R.K. Murray, D.K. Granner, P.A. Mayes, W. Rodwell (Eds.). *Harpers Biochemistry*. 24th Ed. UK: Prentice hall internal ltd. p625-634.
4. D.K. Granner, (1996). Hormone Action. In: R.K. Murray, D.K. Granner, P.A. Mayes, W. Rodwell (Eds.). *Harpers Biochemistry*. 24th Ed. UK: Prentice hall internal ltd. p509 521.
5. K. Olabisi (1998). Pure water threatens Public Health. *Daily Times*. August 4th, 1998. p 15.