THE PHYSICOCHEMICAL QUALITY OF COMMERCIAL ICE – A CASE STUDY OF URBAN AND RURAL SETTLEMENT

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ABSTRACT:

The quality of commercial ice has been investigated by examination of physical, chemical characteristics. Target samples were those which were used in food in retail businesses such as Fruit juices, cold drinks, hotels etc for direct human consumption. A total of 10 Samples were collected from the transported vehicles which carry ice from manufacturing plants to the retail businesses and were analyzed for pH, Electrical Conductivity, Total Hardness, Total Dissolved Solids, Calcium, Magnesium, Chloride, Sulphate, and Phosphate. Comparison of the above obtained results with that of the Drinking Water Standards thus provides information to assess the risk of Commercial Ice to people's health. The results revealed that concentration of most of the ions are within the permissible limits making the ice unobjectionable for humans intake, however, unlike groundwater, ice is not consumed in quantities to represent a significant threat to personal or public health.

Keywords: Characterization; commercial ice; Physico-chemical parameters

INTRODUCTION

The frozen dessert market has grown rapidly in recent years and become one of the important consumer products without seasonal restrictions (TING-JANG LU1). 'Ice which comes into contact with food or which may contaminate food is to be made from potable water' and 'It is to be made, handled and stored under conditions that protect it from contamination' (Final Report 07NS1)

The private well providing source water for ice manufacture was contaminated by sewage from the tile drainage field of an adjacent septic tank serving a house where several people with known hepatitis had lived six weeks before the outbreak occurred (Nelson P. Moyer).

Commercial ice should be safe to consume and be of the same quality as drinking water because it is ingested directly then added to juices and soft drinks or indirectly when used to refrigerate foods such as fish and seafood's

(Falcao et al., 2002, Agbaje Lateef et al., 2006). When water freezes, it freezes from its pure portion and from its surface. Because of this, the conductivity of the outside part of an ice cube goes down because impurities migrate away from the surface during freezing. Conversely, the center portion of the cube contains a concentration of the ions and pollutants that were contained in the original tap water, and therefore exhibits higher conductivity (http://www.horiba.com). Source of water is a very important factor for the quality of ice.

The present work has been carried out on the physicochemical quality of commercial ice available in and around Visakhapatnam.

MATERIALS AND METHODS

SAMPLE COLLECTION:

Manufacturing of ice was made in the industry, then stored and transported, the samples were collected from the transporting vehicles from the industry. We have collected one sample of ice (minimum 500ml) from each premises. All samples were brought to the laboratory in a sterile cool box. Samples requiring overnight storage were stored under refrigerated conditions.

The samples were collected from various places in and around Visakhapatnam. Sampling sites and their codes (local places where finally the commercial ice reaches the retailer) were listed below

A - Urvasi: Urvasi, Kancharapalam, Railway Station, Complex Area, Dhondaparti, Ramatakies, Maddilapalam, Dabagarden, Seetammadhara, Akkayapalam Area etc.

B - Industrial Estate: Gopalapatnam, NAD, Simhachalam, Sujatanagar, Vepagunta, Pendurti Area etc.

C - Marikavalasa: Marikavalasa, Yendada, Maduravada, Bhemili, PM Palam, Car Shed, Kommadhi etc.

D - Town kotta road: Townkotta Road Poorna market, Old Post Office, Police Barax, Jagadhamba Some Areas Gnanapuram etc.

E - Autonagar: Old Gajuwaka, New Gajuwaka, Autonagar, Chinna Gantayada, Pedda Gantyada, Kurmannapalam, Steelplant, Sindya, Sriharipuram, Srinagar etc.

F - Anandapuram: Anandapuram, Tagarapuvalasa, Chittivalasa, Thallavalasa, Gudivada, Maddipeta etc.

G - Pedda Waltair: Appugar, Mvp Colony, Sagar Nagar, Rushikonda, GITAM University, Pedda Waltair, Ushodaya etc.

H - Harber: Harbor, Collector Office, Maharanipeta, K.G.H, Beach Road, Chinna Vailtair, Jagadhamba Some Area etc.

I - Vijayanagaram: Vijayanagaram, Railway Station Road, Control Ment, Complex Area, Dassanna Peta, Lanka Vedhi, Gowda Vedhi, Gantastambam etc.

J - Anakapalli: Anakapalli, kasimkota, haripalam, lankalapalam areas, kondakarla, Athikoppaka, Bhayyavaram etc.

CHEMICAL ANALYSIS:

Ice Samples from different sampling area were analyzed for various parameters such as pH, electrical conductivity, Total Solids, Total Suspended Solids, Total Dissolved Solids, Total Hardness, Chlorides, Sulphates, Nitrates, (Dr. B. Kotaiah et al, 1994)

RESULT

Melted ice samples were chemically analyzed to determine the various physicochemical parameters. There was no significant difference in the pH values measured for the ice samples when compared to the drinking water standards (Table: 1).

The pH of water is very important indication of its quality and provides information in many types of geochemical equilibrium or solubility calculations. . The limit of pH is 6.5 to 8.5. The pH of the ice samples are within the permissible limits as they are in the range between 7.02 and 7.84.

The EC measurement provides an indication of ionic concentrations. It depends upon temperature, concentration and types of ions present. The conductivity of ice sample is varying between 0.36 and 1.12 mmhos at 25^{0}C. TDS of the ice sample varies from 100 to 600mg/L. It was observed that 2 of the samples of various areas exceed the permissible limits.

Hardness is an important criterion for determining the usability of water for domestic, drinking and many industrial supplies. The acceptable limit of TH for drinking water is specified as 300 mg/L. TH of the ice sample in the study area varies from 40 to 420mg/L only sample c was found to be above the drinking water standards. Calcium concentration of the ice sample is varying between 10 to 110 mg/L. The limit of Ca for drinking water is specified as 75mg/L. It is observed that nearly 4 ice sample exceeds the permissible limit. Magnesium concentration were varying between 20 to 310mg/L, The limit of Mg^{2+} concentration for drinking water is specified as 30 mg/l. It was observed that 7 samples exceed the permissible limits.

Chloride concentrations are varying from 25 to 200 mg/l. The limit of Cl^{-} concentration for drinking water is specified as 250 mg/l. Sulphates concentration is varying from 25 to 198 mg/l, Nitrates concentration is varying from 1 to 43 mg/l, and the limit for sulphate concentration in drinking water is specified as 150mg/l where as the limit of nitrate concentration in drinking water is specified as 45mg/l.

TABLE: 1, STANDARDS FOR DRINKING WATER

Parameter	ICMR		ISI		WHO	
	P	E	P	E	P	E
pH value	7 – 8.5	6.5 – 9.2	6.5-8.5	6.5-9.2	7 – 8.5	6.5 – 9.2
Total Dissolved Solids	-	-	-	-	500	1500
Total Hardness	300	600	300	600	-	-
Calcium	75	200	75	200	75	200
Magnesium	50	150	30	100	50	150
Chlorides	250	1000	250	1000	200	600
Sulfate	200	400	150	400	200	400
Nitrate	20	50	45	-	-	100

P = Permissible Limit; E = Excessive Limit; UO = Un Objectionable; Note – All Units except pH are in mg/L.

Table: 2, ESTIMATION OF PHYSICOCHEMICAL PARAMETERS OF COMMERCIAL ICE

Sample Code	pH	EC	TS	TDS	TSS	TH	Ca	Mg	CL	NO_3	SO_4
Units	**-**	**mmhos**	**mg/l**								
A	7.84	0.42	700	400	100	120	80	40	25	42	198
B	7.73	0.64	900	100	800	180	70	110	75	29	150
C	7.33	1.12	800	500	200	420	110	310	125	1	100
D	7.02	0.49	1200	400	800	150	100	50	75	3	25
E	7.05	1.11	1000	600	100	300	100	200	150	7	186
F	7.23	0.34	500	200	300	60	10	50	75	7	150
G	7.16	0.17	300	100	200	50	30	20	75	1	175
H	7.25	0.36	500	200	300	40	20	20	75	39	125
I	7.42	0.88	800	600	200	70	10	60	200	43	25
J	7.56	0.76	700	200	500	40	10	30	100	5	75

CONCLUSIONS

The quality of commercial ice on the basis of physicochemical parameters sold in and around greater Visakhapatnam reflects the quality of source water. When compared to drinking water standards the overall quality of ice is unobjectionable. Ice is to be made from potable water and should be taken care of contamination when it is processed and stored.

REFERENCES

1. Agbaje Lateef, Julius K. Oloke etal, (2006). **"***The Microbiological Quality of Ice Used to Cool Drinks and Foods in Ogbomoso Metropolis, Southwest, Nigeria".* Journal of Food Safety, 8, 39-43.
2. Durgesh P. Mahale, Ranjana G. Khade, Varsha K. Vaidya (2008). *"Microbiological Analysis of Street Vended Fruit Juices from Mumbai City, India***"**. Journal of Food Safety, 10, 31-34.
3. De A K, Environmental Chemistry 3rd Edn. Wiley Eastern Ltd., New Delhi**,** 1995.
4. Dr. B. Kotaiah, N. Kumara Swamy (1994). "*Environmental Engineering Laboratory Manual*" Charotar Publishing House.
5. Falcao, J.P., Dias, A.M.G., Correa, E.F. and Falcao, D.P. (2002). Microbiological Quality of Ice Used to Refrigerate Foods. *Food Microbiology* 19:269-276.
6. Food Code, U.S. Public Health Service, U. S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, Public Health Service · Food and Drug Administration, Washington, DC 20204(2001).
7. ISI; Indian standards specifications for drinking water. Indian Standard Institute, New Delhi (1983)
8. Microbiological Quality of Ice for Cooling Drinks, Final Report 07NS1, 1st National Microbiological Survey 2007 (07NS1), Food Safety Authority of Ireland, 1.
9. Moyer NP, Breuer GM, Hall NH etal, (1993). "*Quality of packaged ice purchased at retail establishments in Iowa".* Journal of food protection 56 (5), 426-431.
10. Nichols G, Gillespie I, de Louvois J (2000).*'The microbiological quality of ice used to cool drinks and ready-to-eat food from retail and catering premises in the United Kingdom''* Journal of food protection, 63(1), 78-82.
11. Nelson P. Moyer, Ph. D., etal "Evaluation of Packaged Ice Sold in Iowa" www.uhl.uiowa.edu/publications/archive/research/ice.pdf
12. Ting-jang lu, chin-wen chuang etal, (2002). "Sensory *and Physicochemical Analyses on Commercial Taro Ice Products***". Journal of Food and Drug Analysis, 10(1), 55-6.**
13. V Saritha[1] K. Swapna Vahini[1], B.Padmavathi[1] and V. Rohini Kumari[2] (2009). *"CHARACTERIZATION OF GROUNDWATER OF DIFFERENT ACTIVITY REGIONS OF AN URBAN SETTLEMENT"*, Rasayan J of Chemistry 2, 539-542.
14. http://www.horiba.com/application/material-property-characterization/water-analysis/water-quality electrochemistry-instrumentation/ph-knowhow/the-story-of-conductivity/story-of-water-in-our-daily-lives/hard-water-soft-water