

Analysis of Food Salts, Their Benefits In Health)

[Ajitha Priya Jammala, Azza Salim Al-Maawali, Jawaher Nasser Al-Khamisi and Nahla Mohammed Al-Salmi]

Abstract— Humans cannot live without salt as it brings out the flavor in foods. It is also a fact that salt is present almost everywhere inside our body, where it is both a requirement and a nourishment for certain cellular activities. This paper focuses two areas of studies: the analysis of different food salts and their benefits in health. The samples salts are collected from different regions. The analysis part included solubility of food salts in water at various temperature, pH of food salts, conductivity of food salts, determination of the amount of Na⁺ ion, I⁻ ion and Cl⁻ ion, the moisture content of food salts. The results obtained from the antimicrobial properties, vitamin C content, fermentation of yeast, rehydration solution experiments confirmed the benefits of various food salts in human health.

Keywords— Different food salts, properties, benefits.

I. Introduction

For thousands of years, salt (sodium chloride) has been in use for several purposes by humans. History reminds us it's not just used with food but also in economic, mythological and religious realms. Today salt plays an important role as a nutrient which enhances flavor as well as texture of foods. Besides these, salt is used as a preservative. The fact that the types of salts, the regions from where they are obtained also has an effect on its use. Although excess of salt causes high blood pressure which leads to other health problems, but sodium chloride helps muscles and nerves work properly by assisting in muscle contraction and transmission of nerve signals. Also helps to regulate blood pressure and volume. Maintains the body fluids, sustains blood pH.

II. Methods and Materials

Materials

Four different sample salts, namely, Bioenergy Himalayan crystal salt, which is an unbleached, uniodized and unrefined salt (A). Hotace salt that is an iodized salt (B), Sea salt (C) and low sodium salt (D). All purchased from the local supermarket.

Azza Salim Al-Maawali
Higher College of Technology
Sultanate of Oman

Jawaher Nasser Al-Khamisi
Higher College of Technology
Sultanate of Oman

Nahla Mohammed Al-Salmi
Higher College of Technology
Sultanate of Oman

Methods

Some physical properties like the solubility, conductivity, pH are measured using the instruments and also the moisture content is calculated. Further, the amount of each individual ions like sodium, chloride, and iodide are determined through volumetric analysis.

The benefits of salts are verified by measuring vitamin C. It's anti-microbial activities, the importance of adding salt in baking procedures and finally, the effectiveness of salts as a rehydrating agent are also tested to add to the list of benefits in improving the proper usage of salts.

The determination of sodium: Flame photometer

A stock solution of NaCl is prepared by weighing the suitable amount needed to prepare 1000 ppm Na⁺ ion. The standards calibrations are prepared by appropriate dilution of stock solution. Concentration of calibration standards depend on the limit of detection of the instrument in use. Deionized water is used as blank. A 50 ml solution of each is prepared. The standard solution was aspirated starting from the lowest to highest concentration, the emission readings were noted down. A calibration graph of concentration (x-axis) plotted versus the emission (y-axis) is plotted and the unknown samples are calculated using the equation of a straight line obtained from the calibration graph.

The determination of chloride and iodide ions: Titration method

Amounts of chloride and iodide ions are determined by conventional methods of titration. Further the ratios of sodium and potassium chlorides are compared in various salt types.

The determination of Vitamin C: The procedure is described by the University of Canterbury [19]

Anti-microbial activity

Salt is the little power element that could. Sodium chloride is a powerful antibacterial substance. An antibacterial agent is one that inhibits the growth and multiplication of bacteria. Sodium chloride in butter used as a microbial inhibitor which means that it is prevents the growth of bacteria since it reduces the amount of water present.[20,21].

Part I:

15 g of salt samples are weighed and dissolved in 50ml of distilled water. One spoon of sodium bicarbonate was added and stirred till it completely dissolved.

Part II:

The plates of agar were put on oven at low temperature to remove impurities. The tools and the work table were sterilized. The bacteria are cultured on nutrient agar plates. Two holes are made in each agar plates by cork barer. 5-6 drops of salt solution are dropped on the holes. The plates are labeled and left for 24 hours to grow. The results are checked and recorded in the table.

Respiration of yeast

Yeast are microscopic one-celled organisms belonging to the group of organisms called fungi. Yeasts are found in the soil, in water, on the surface of plants, and on the skin of humans and other animals. Yeasts are eukaryotic single celled fungi, which reproduce by budding or fission. To obtain the energy they need for their life activities, yeast carry out several processes, one of which is fermentation where they convert sugars to alcohol and carbon dioxide [28, 29]. 500 ml beaker is taken and filled with distilled water and heated to 59 °C. 50 ml of the hot water was poured in three conical flasks labeled as flask NO.1 (no salt), flask NO.2 (3 spoons of salt) and flask NO.3 (6 spoons of salt). 5g sugar and 0.84 g yeast were added in each conical flask. 3 spoons of salt were added in conical flask NO.2 and 6 spoons of salt were added in conical flask NO.3. The balloons were placed on each conical flask and timer is started simultaneously. The same steps are repeated for each salt and results are recorded.

Salt solution and dry vegetables

The effect of the rehydration solution using all salt samples on dates were studied. (Helmenstein, 2017). Hands were washed with soap and water before preparing solution. 200 ml of distilled water is poured in a beaker. Added 2.6 g of sodium chloride, 1.5 g of Glucose, anhydrous, 2.9 g of potassium chloride, and 5 g of Trisodium Citrate and dissolved completely in the beaker containing distilled water. Dates are weighed and added in the beaker. The same is repeated for other samples. The final weights of dates are measured after 3 days.

III. Results and Discussion

TABLE I. THE RESULTS OF PHYSICAL PROPERTIES AND MUCH MORE

Parameters	Samples			
	A	B	C	D
Solubility(g)	1.2531	3.3365	1.31705	3.7544
pH	7.30	6.85	7.80	10.50
Conductivity (ms/cm)	22.85	23.41	23.13	23.3
Amount of Na ⁺ (ppm)	13.6	18.4	9.6	4.815

Amount of I ⁻ (M)	0	0.00063	0	0.00184
Amount of Cl ⁻ (M)	0.00883	0.0094	0.0086	0.0095
% of moisture	0.1836	0.286	19.482	18.668
Vitamin C Boiling	0.48433	0.22015	0.17612	0.79254
Without boiling (mg/l)	0.26418	0.48433	0.3524	0.52836
Killing bacteria (mm)	27	21	14	24
Yeast breathing duration (minutes)	9	2	14	14

The solubility of food salts dependent on the temperature. As the temperature of water increased the solubility also increased, however the solubility of each salt is at different temperatures. The pH of all the three samples, A, B and C remained between 6.8-7.8 but surprisingly for the low sodium salt the pH is more than 10 converting it to alkaline solution. From the data table the conductivity of all the samples remain the same. From the results it is found that the moisture content of sea salt is higher than the rest therefore, this salt is more hygroscopic, followed by the low sodium salt. It is particularly noticed that the unrefined salt and the iodized salt have less moisture content. The concentrations of Na⁺, I⁻ and Cl⁻: From the data it is seen that Iodized salt has high concentration of sodium, i.e. 18.4 ppm, along with added iodine, 2.538×10⁻⁵ mg/kg of salt as well as 9.4×10⁻³ M of chloride ions present. Studies related to the effect of different ions present in the salt with their solubility. Vitamin C: It is first observed that there is elevation in boiling point of water when salts are added to water and boiled. Secondly, the color of the beans remained green in the boiled water containing salt. Therefore, addition of salts to water preserve the natural green color of the vegetables when boiled in water. The minimum loss of vitamin C from the boiled vegetables is seen when sea salt and iodized salts are used. It is also found that maximum vitamin C is lost from the vegetables upon boiling when low sodium salt and uniodized salts are used. Further studies will identify and explain the reason for the same. Anti-microbial activity: It has long been in use to use 10-20% salt solutions and found to be effective in cleaning open wounds, ears and eye rinse solutions. 30% salt solutions have been used to check for anti-microbial growth and found to have inhibited the growth of bacteria. Thus salts are very effective in killing bacteria. Yeast fermentation: Yeast reacts with sugar releasing alcohol and carbondioxide. This is the principle employed in baking of bread. However the use of salt has hampered the amount of release of carbondioxide. The results show the effect of various salts and the time required for the release of CO₂. These results are highly welcomed as in cases where bread is made with little or no yeast for people who suffer from diabetes and also obesity. It's also been mentioned that apart from flavoring the texture of bread, use of salt in dough has made the bread much stronger. Rehydration salt solutions: In this experiment, we have found that rehydration salt has a benefit in dry dates

because their weights change. However, the percentage of change in weight of date which was inside sample D solution increases more than other samples. However, as the figures above shown, the color of dates which were inside the rehydration salt solution change and became fresher, but there is no change in date which was inside the water.

iv. Conclusion

Although some conventional methods of analysis of solubility, conductivity, pH and the presence of certain ions gave results, more research is encouraged in this area. The solubility or absorptive capacity of different salts on people (having active and sedentary lifestyles) in different regions of the world and races and cultures to fully understand the long term effects of these ions in the body. Further studies on the properties like anti-microbial, antioxidant, anti-inflammatory as well as the preserving Vitamin C in preserved fruits and vegetables will become more beneficial. The studies on the decarboxylation in yeast fermentation and dealing with the extent taste and nutrition in baked goods. Last but not the least, the rehydration methods in improving the shelf life of vegetables and fruits which helps preserve the fruits and vegetable all across the globe without polluting-which is the leading cause of cancers in humankind.

References

- 1) Wood, F. O., & Ralston, R. H. (2017, May 04). Salt (NaCl). Retrieved June 09, 2017, from <https://global.britannica.com/science/salt>
- 2) Physical Properties. (n.d.). Retrieved June 09, 2017, from <http://www.saltinstitute.org/salt-101/chemical-physical-properties>
- 3) (n.d.). Retrieved June 09, 2017, from <https://www.seasalt.com/>
- 4) Helmenstine, P. A. (n.d.). Here's How Salt Preserves Food. Retrieved June 09, 2017, from <https://www.thoughtco.com/why-does-salt-work-as-preservative-607428>
- 5) Six Surprising Functions Salt Plays in Food. (n.d.). Retrieved June 09, 2017, from <https://www.thespruce.com/functions-of-salt-in-food-1328615>
- 6) Callahan, M. (2017, March 09). 6 Types of Salt and How to Use Them. Retrieved June 09, 2017, from <https://www.realsimple.com/food-recipes/cooking-tips-techniques/cooking/six-types-salt>
- 7) Galvin, A. A. (2013, November 30). The Advantages & Disadvantages Of Sodium. Retrieved June 09, 2017, from http://www.apgfitness.com/index.php?route=ac_cms%2Farticle&b_id=8
- 8) Rix, G. (2015, December 05). The Disadvantages of Salting Food. Retrieved June 09, 2017, from <http://www.livestrong.com/article/549657-the-disadvantages-of-salting-food/>
- 9) The Disadvantages of Sodium. (n.d.). Retrieved June 09, 2017, from <http://healthyeating.sfgate.com/disadvantages-sodium-2948.html>
- 10) (n.d.). Retrieved June 09, 2017, from <http://galileo.phys.virginia.edu/education/outreach/8thgradesol/TempSolubility.htm>
- 11) Why Does Water Dissolve Salt? (n.d.). Retrieved June 09, 2017, from <http://www.middleschoolchemistry.com/lessonplans/chapter5/lesson3>
- 12) HCT college Handout Fundamental of Environmental Science
- 13) L. (2016, July 21). Aqueous Solutions of Salts. Retrieved June 09, 2017, from https://chem.libretexts.org/Core/Physical_and_Theoretical_Chemistry/Acids_and_Bases/Acids_and_Bases_in_Aqueous_Solutions/Aqueous_Solutions_Of_Salts
- 14) HCT college Handout Chem Laboratory Techniques I (Part A) Chapter 2 , Experiment 2
- 15) R. Chang,(2000) Physical Chemistry For The Chemical And Biological Sciences, University
- 16) Science Books, Sausalito, California.
- 17) HCT college Handout Analytical Chemistry 1 Laboratory Manual Subject Code: CHEM2201 P Experiment 5, Page 19.
- 18) The University of Canterbury. (2019). Chemistry. [online] Available at: <https://www.canterbury.ac.nz/science/outreach/chemistry/> [Accessed 10 Jul. 2019].
- 19) HCT college Handout Chemistry Laboratory Techniques 1 (Part A) Chapter 1. Experiment 1
- 20) Rsc.org. (2019). Kitchen Chemistry: Use of salt in cooking, part 2- Learn Chemistry. [online] Available at: <http://www.rsc.org/learn-chemistry/resource/res00000806/use-of-salt-in-cooking-part-2> [Accessed 10 Jul. 2019].
- 21) HCT college Handout Fundamental lab Tech Biology Chapter 2 .Experiment 2
- 22) Helmenstine, P. A. (n.d.). Learn How To Make Saline Solution at Home. Retrieved June 09, 2017, from <https://www.thoughtco.com/how-to-make-saline-solution-608142> BBCBitesize.(2015).Respiration.Retrieved from:
- 23) KS3 Biology - Respiration - Revision 1. (n.d.). Retrieved June 09, 2017, from <http://www.bbc.co.uk/education/guides/zq349j6/revision/1>
- 24) Effect of salt on the rate of respiration of yeast. (n.d.). <http://www.youngscientist.com.au/wp-content/uploads/2016/01/175->
- 25) Moenginah, P. A., S., Soenarto, J., Bachtin, M., Sutrisno, D., S., & Rohde, J. E. (1978). Sucrose Electrolyte Solution for Oral Rehydration in Diarrhea. Journal of Tropical Pediatrics,24(3), 127-130. doi:10.1093/tropej/24.3.127
- 26) <http://www.bbc.co.uk/education/guides/zq349j6/revision/1>