A Technique Developed To Determine The Extent Of Standardization Of Locally Prepared Salt-Sugar Solution At Certain Temperatures

Dikko A. B., Ahmed A. D., Alkasim A., Pascal T

ABSTRACT: Oral rehydration therapy (ORT) is a type of fluid replacement used as a treatment for dehydration. It involves drinking water mixed with sugar and salt, while continuing to eat. In this paper, density and viscosity of salt sugar solution at 308.15 K, 313.13 K, 318.15 K, 323.15K, 328.15 K and 333.15 K have been determined using Ostwalds viscometer. The results showed that density and viscosity decreased with increased in temperature. The density-temperature and viscosity-temperature curves obtained can be used to determine the extent of the accuracy of any locally prepared oral rehydration therapy.

Keywords: salt, sugar, water, solution, density, viscosity, temperature, ORT.

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1. INTRODUTION

Oral Rehydration Therapy (ORT) is the taking in of fluid through the mouth to prevent and/or correct the dehydration that is a result of diarrhoea. As soon as diarrhoea begins, treatment using home remedies to prevent dehydration must be started. If a patient has not been given extra drinks, or if in spite of this dehydration does occur, they must be treated with a special drink made with oral rehydration salts (ORS). The formula for ORS recommended by WHO and UNICEF contains:[1]

Reduced osmolarity ORS	grams/litre
Sodium chloride	2.6
Glucose, anhydrous	13.5
Potassium chloride	1.5
Trisodium citrate, dihydrate	2.9

Home made sugar and salt solution (SSS) is not quite as good as commercial oral rehydration solution as it does not contain potassium. However, it is immediately achievable and often life saving. The commonest recipe for a sugar and salt solution is: 1 litre of clean water, 8 level teaspoons of sugar and ½ of a level teaspoon of table salt. One litre of water can be measured with a measuring jug or a one litre cool drink bottle. The sugar and salt must be added to the litre of clean water and mixed well. It is very important not to add too much salt. If possible, the sugar and salt solution should be given by cup or by spoon as this avoids using dirty bottles. It is dangerous to add a sachet of rehydration powder to the sugar and salt solution as this will make the solution too concentrated.

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The discovery that sodium transport and glucose transport are coupled in the small intestine so that glucose accelerates absorption of solute and water is potentially the most important medical advance this century.[2] The thermo physical properties of liquid systems like density and viscosity are strictly related to the molecular interactions taking place in the system[3].These interactions decides the drug reaching to the blood stream its extent of distribution, its binding to receptors and producing physiological actions[4]. The interactions are of different types such as ionic or covalent, charge transfer, hydrogen bonding, ion-dipole and hydrophobic interactions. Therefore we decided to study the density and viscosity of sugar- salt solution as a function of temperature in order to find a technique that can be used to determine the accuracy of the locally prepared oral rehydration therapy.

2. MATERIALS AND METTHOD

The solutes selected for the study were dry salt and sugar. Commercial distilled water was used for preparation of solution mixture. One litre of clean water, Eight level teaspoons of sugar and Half of a level teaspoon of table salt were mixed and stirred very well to give a homogenous solution. The density and viscosity of final solution were measured at 308.15 K, 313.13 K, 318.15 K, 323.15 K, 328 K and333 K by using specific gravity bottle of 10 cm^3 capacity. A precision balance with a precision of 0.05 gm was used for weighing purpose. The weighing was repeated three times to ensure the accuracy in weights. The reproducibility of the result was close to hundred percent. Viscosity measurements were carried out using Ostwald's viscometer. The viscometer was clamped vertically in a thermostatically controlled water-bath,[5] whose temperature was maintained constant at the various temperatures (± 0.1K). A fixed volume of the solution was delivered into the viscometer. The viscometer was kept for 10 to 20 minutes in the thermostatically controlled water-bath to achieve constant temperature. The experimental measurements of flow time of the solution between two points on the viscometer were performed at least three times for each solution and the average results were recorded.

3. RESULTS AND DICUSSION

Using the Ostwald's viscometer, the viscosities of the salt sugar solution (u_2) at various temperatures were calculated using the equation,[5]

$$\mu_2 = \frac{\mu_1 \rho_2 t_2}{\rho_1 t_1} \qquad (1)$$

Where μ_1 is the viscosity of reference liquid (water), ρ_1 is the density of the reference liquid, t_1 is the time of flow of the reference liquid, ρ_2 is the density of the sugar salt solution, and t_2 is the time of flow of the salt sugar solution. Generally, (Fig 1 & 2) show that density (ρ) and viscosity coefficient (μ) of salt sugar solution, decrease with increase in temperature. This could be due to the energy obtained to overcome the resistance to flow. Fig (2) shows that the reduction of the viscosity is greater at the initial stage of the temperature increment, and subsequent increases in the temperature during the latter part had less influence on reducing the viscosity.

Table 1 Variation of Density and Viscosity Sugar Salt Solution with Temperature

T (K) ±0.01	Densit (g/cm³) ±0.05	Viscosity, μ (10^{-4} Pa.sec) ±0.001
308.15	1.65	7.802
313.15	1.43	7.012
318.15	1.22	6.272
323.15	1.00	6.012
328.15	0.78	5.852
333.15	0.56	5.712

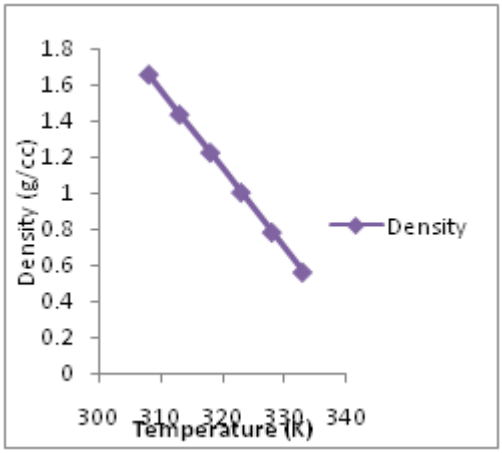

Fig. 1 Variation of salt sugar solution (sss) density with temperature

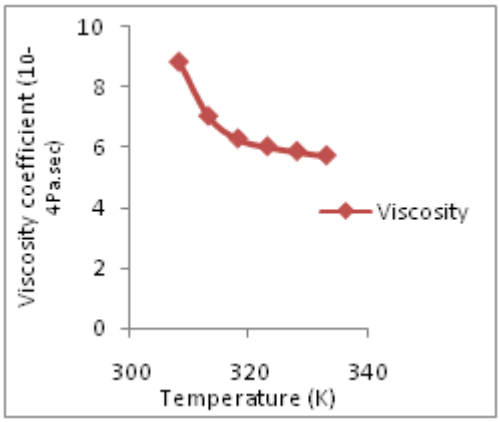

Fig. 2 Variation of salt sugar solution (sss) viscosity with temperature

The curves in Fig 1 & 2 can be used to find whether the prepared sugar salt solution has achieved an acceptable level by noting temperature and density or viscosity of the solution at the same time and comparing it with the corresponding calibrated curves.

4. CONCLUSION

A capillary viscometer was used to determine the density and viscosity of local oral rehydration therapy. An innovative technique to determine the accuracy of any locally prepared salt sugar solution within the temperature range studied has been developed.

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