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Comparison of sodium and potassium content in ORS powders by Flame photometric method

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ABSTRACT

A study was carried out to determine the content of Na and K in two different brands of ORS powder by Flame photometric method. The Na content was found to be higher in Govt. supplied sample and K content was higher in the private sample.

Keywords: ORS powder, Flame photometry, Sodium, Potassium.

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INTRODUCTION

Fluid and electrolyte balance is vital for good health at all ages. In dehydration associated with diarrhoea, gastroenteritis, cholera and dysentery the body is devoid of water and electrolytes. ORT (oral rehydration therapy) is the simple treatment which involves administering a solution of salts and sugars for replenishing electrolyte and water content of the body. Sodium is the major cat-ion found in the extracellular fluid. It regulates the water content of the body and is critical for generation of electrical signals. Similarly, Potassium is the major cat-ion found inside the cells. It is required for regulation of heart beat and function of the muscles. The Sodium and Potassium concentration of ORS must be sufficient to replace their loss and correct hyponatremia/hypokalemia but not so high as to cause or worsen hypernatremia/hyperkalemia which can itself occasionally result in death.

Therefore, it is important to quantify the amount of Sodium and Potassium present in the ORS powder. Flame photometry is a branch of Atomic emission spectroscopy. It is suitable for quantitative and qualitative determination of several cat-ions, [1] especially for metals that are easily excited to higher energy level at a relatively low flame temperature (mainly Na, K, Ca, Rb, Cu, Ba, Cs). A simple Flame photometric method is described in this paper for the determination of Sodium and Potassium content of the ORS powder.

MATERIALS AND METHODS

Instrument- SYSTRONICS Flame Photometer 128

Chemicals- Sodium chloride, Potassium chloride, ORS powder

Two different brands of ORS sachets (WALYTE and Govt. supplied ORS) were purchased and analyzed for their Sodium and Potassium content.

ORS sample 1- WALYTE (Oral Rehydration Salts, I.P): 21 gm

Composition: Sodium chloride- 2.6 gm, Potassium chloride- 1.5 gm, Sodium citrate- 2.8 gm, Dextrose- 13.4 gm, Excipient- q.s

ORS sample 2- ORS: 21 gm

Composition: Sodium chloride- 2.6 gm, Potassium chloride- 1.5 gm, Sodium citrate- 2.9 gm, Anhydrous dextrose- 13.5 gm, Excipient- q.s

Preparation of standard Sodium chloride solution

2.54 gm of Sodium chloride was dissolved and the volume was made up to 1L with double distilled water. 1ml of the solution was diluted up to 10 ml with double distilled water to get a conc. of $10^5 \mu\text{g/L}$ (i.e, 100 ppm).

Preparation of standard Potassium chloride solution

1.907 gm of Potassium chloride was dissolved and the volume was made up to 1L with double distilled water. 1 ml of the solution was diluted up to 10 ml with double distilled water to get a conc. of $10^5 \mu\text{g/L}$ (i.e, 100 ppm).

EXPERIMENTAL

Construction of standard curve for Sodium [2]

Table-1: Flame intensity of Na in standard NaCl solution of different conc.

CONCENTRATION ($\mu\text{g/L}$)	FLAME INTENSITY	FLAME INTENSITY IN PERCENTILE
10^4	10.33	10.65
2×10^4	20.66	21.3
3×10^4	30.52	31.46
4×10^4	40.77	42.02
5×10^4	50.34	51.89
6×10^4	59.43	61.25
7×10^4	69.88	72.03
10^5	97.03	100

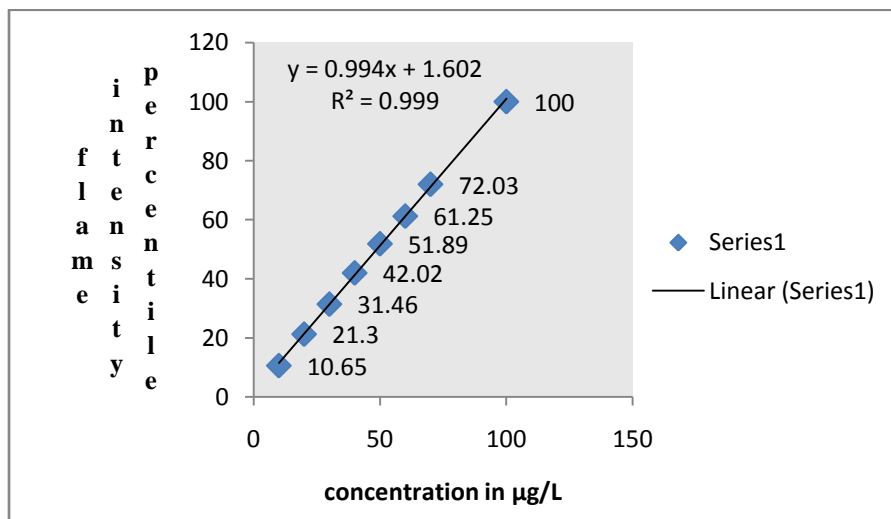


Figure-1: Standard curve for Na

The standard Sodium chloride solution ($10^5 \mu\text{g/L}$) was diluted up to 10^4 , 2×10^4 , 3×10^4 , 4×10^4 , 5×10^4 , 6×10^4 and $7 \times 10^4 \mu\text{g/L}$ concentration. $10^5 \mu\text{g/L}$ was set as highest conc. in flame photometry. Small aliquots of each conc. was taken and their flame intensity was measured (given in **table 1**). A standard curve was plotted taking conc. in abscissa and flame intensity in percentile in the ordinate. A straight line of R^2 value 0.999 was obtained (shown in **figure 1**).

$$\text{Flame intensity in percentile} = \frac{\text{observed flame intensity}}{\text{highest flame intensity}} \times 100$$

Construction of standard curve for potassium

Table-2: Flame intensity of K in standard KCl solution of different conc.

CONCENTRATION (µg/L)	FLAME INTENSITY	FLAME INTENSITY IN PERCENTILE
10 ⁴	9.86	9.86
2x10 ⁴	19.72	19.72
3x10 ⁴	30.77	30.78
4x10 ⁴	41.16	41.17
5x10 ⁴	51.43	51.45
6x10 ⁴	61.54	61.56
7x10 ⁴	70.32	70.32
10 ⁵	99.96	100

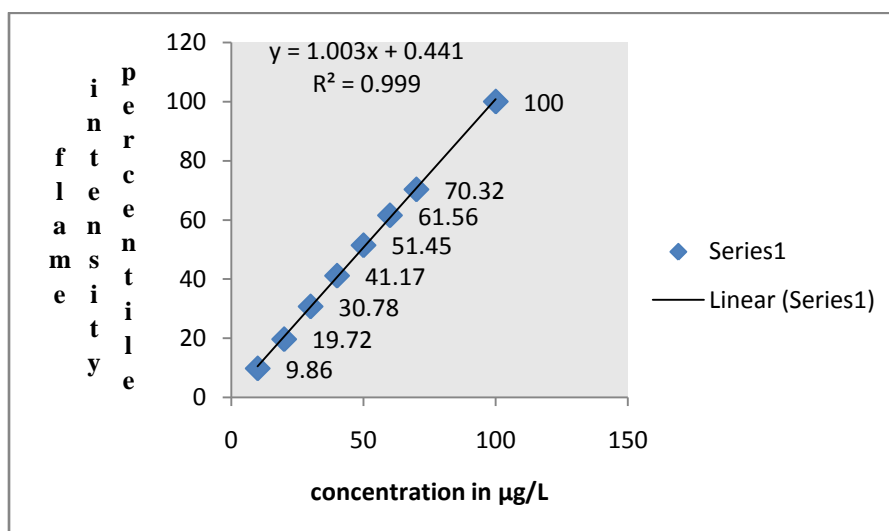


Figure-2: Standard curve for K

The standard Potassium chloride solution (10⁵µg/L) was diluted up to 10⁴, 2x10⁴, 3x10⁴, 4x10⁴, 5x10⁴, 6x10⁴ and 7x10⁴ µg/L concentration. 10⁵µg/L was set as highest conc. in flame photometry. Small aliquots of each conc. was taken and their flame intensity was measured (given in **table 2**). A standard curve was plotted taking conc. in abscissa and flame intensity in percentile in the ordinate. A straight line of R² value 0.999 was obtained (shown in **figure 2**).

$$\text{Flame intensity in percentile} = \frac{\text{observed flame intensity}}{\text{highest flame intensity}} \times 100$$

Preparation of sample ORS solution for analyzing Sodium

0.205 gm of ORS powder was dissolved in 100 ml of double distilled water to prepare a conc. of $10^5 \mu\text{g/L}$ (i.e, 100 ppm) of Sodium.

Preparation of sample ORS solution for analyzing Potassium

0.266 gm of ORS powder was dissolved in 100 ml of double distilled water to prepare a conc. of $10^5 \mu\text{g/L}$ (i.e, 100 ppm) of Potassium.

RESULTS AND DISCUSSION

Table-3: Calculation of Na and K conc. in sample ORS solution

Parameters	WALYTE ORS	Govt. supplied ORS
Flame intensity for Na (y)	115.51	118.67
Flame intensity for K (y')	112.63	110.54
Conc. of Na in $\mu\text{g/L}$ (x)*	114.59×10^3	117.77×10^3
Conc. of K in $\mu\text{g/L}$ (x')**	111.85×10^3	109.76×10^3

$$* y = 0.994x + 1.602$$

$$* y' = 1.003x' + 0.441$$

The concentration of Sodium and Potassium was calculated (given in **Table 3**) from the flame intensity of the sample ORS solutions of both the brands.

Although the content of NaCl and KCl in both the ORS sachets was same, but in comparison it was found that the Govt. sample contained more Sodium ($117.77 \times 10^3 \mu\text{g/L}$) while WALYTE contained $114.59 \times 10^3 \mu\text{g/L}$ of Sodium. Similarly, WALYTE contained more amount of Potassium ($111.85 \times 10^3 \mu\text{g/L}$) while the Govt. sample contained $109.76 \times 10^3 \mu\text{g/L}$ of Potassium.

CONCLUSION

The Flame photometric method is relatively free of interferences from other elements. Therefore it is an accurate and sensitive method which can measure the concentration of Na, K in ppm magnitude also and can be used for routine analysis of ORS powders.

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