

## STUDIES ON SURFACE TENSION OF SELECTED MOUTHWASH FORMULATION BY DROP NUMBER METHOD USING TRAUBE'S STALAGMOMETER TECHNIQUE

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Received on: 11/12/2010 Revised on: 09/01/2011 Accepted on: 12/02/2011

### ABSTRACT

The selected marketed mouthwash formulations was carried out using Traube's stalagmometer technique by drop number method to determine their individual surface tension for further identification, structure elucidation and chemical constituents. The formulation I (Potassium nitrate & sodium fluoride), formulation II (Chlorhexidine gluconate), formulation III (Thymol, eucalyptol and menthol) were selected for the case study. These formulations were also evaluated to their same quantity mixture ratio with distilled water combination for estimation of different percent composition. The main aim and rationale of the study was to evaluate the surface tension of three selected formulations with distilled water. In individual surface tension study, it was noted that formulation II (48.29 dyne/cm) showed highest value and formulation III (40.81 dyne/cm) showed lowest value comparison between the three formulations under laboratory conditions. The 50% formulation mixture with distilled water showed minimum surface tension (49.20 dyne/cm) and 90% formulation mixture with distilled water showed maximum surface tension (54.30 dyne/cm) amongst other composition. In our present study, all the percent composition values were less than standard surface tension value. The 20% (50.31 dyne/cm), 70% (50.64 dyne/cm), 80% (50.26 dyne/cm) and 30% (49.30 dyne/cm), 50% (49.20 dyne/cm) and also 40% (51.73 dyne/cm), 60% (51.26 dyne/cm) formulation mixture with distilled water showed approximately same surface tension values.

**KEYWORDS:** Surface tension, mouthwash formulations, Drop number method, Traube's stalagmometer.

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### INTRODUCTION

A mouthwash is an aqueous solution which is most often used for it is deodorant, refreshing or antiseptic effect in the oral cavity. Water is the simplest mouthwash and aqueous saline is a complex type of mouthwash. A mouthwash may also contain alcohol, glycerine, synthetic sweetners and surface active, flavouring, coloring agents. These mouthwashes frequently contain therapeutic or antibacterial ingredients and are used as therapeutic aids in the treatment of gingival or mucosal diseases or for the prevention of dental carries.<sup>1-3</sup> Surface tension is the force per unit length that must be applied parallel to the surface so as to counter balance the net inward pull. Surface tension has the units if dyne/cm in the CGS system and Newton/m in the SI system. Traube's stalagmometer is an instrument for measuring surface tension by determining the exact number for drops in a given quantity of a liquid. The drop number method is based on the principle that a fixed volume of a

liquid is delivered is free falling from a capillary tube held vertically approximately proportional to the surface tension of liquid. Surface tension is the result of the difference between attractions of molecule of the substance on the other side of the interface. The surface tension of water is created by Vander wall forces. (an electric force between the molecules in order to increase the surface tension). One would have to find a way increasing the range of force or strength of these electric forces<sup>4-7</sup>. The formulation I (potassium nitrate and sodium fluoride), formulation II (Chlorhexidine gluconate), formulation III (thymol eucalyptol and methol) were selected for case studies. The significance of the study was to determine individual surface tension for each marketed formulations and also evaluated to their quantity mixture ratio with distilled water combination for estimation of various percent composition.

## MATERIALS AND METHOD

The three formulations were purchased from local market. The nitric acid and acetone were purchased from loba chemie (Mumbai). All the chemicals used were of analytical grade.

### Experimental Methodology

Step I. The specific gravity bottle is cleaned thoroughly with nitric acid, rinsed the bottle with distilled water and dried it rinsing with acetone. Accurately weigh the specific gravity bottle and data was noted. Bottle was filled with water and weight was noted. Then bottle was cleaned and dried. The bottle is then filled with formulation I, II, III and weight was noted respectively. The specific gravity of three formulation was estimated using following:

Mass of liquid

$$\text{Specific Gravity} = \frac{\text{Mass of liquid}}{\text{Mass of equal volume of distilled water}}$$

Step II. Traube's stalagmometer was cleaned and dried and mounted in the vertical plane by using burette stand. The number of drops falling down between two points of instrument was counted serially for all the liquids i.e. distilled water, formulation I, II, III. The process was repeated three times and means value was calculated.

Step III. The surface tension of three selected formulation was estimated from the following:

$$\text{Surface tension of liquid} = \eta_1$$

$$\text{specific gravity of liquid X} \text{-----} \text{X Surface tension}$$

$$\eta_2 \text{ of water}$$

Step IV. The marketed formulation mixture were prepared at the ratio of 1:1:1 and prepare the different composition formulation quantity mixture with distilled water such as 10-90, 20-80, 30-70, 40-60, 50-50, 60-40, 70-30, 80-20, 90-10. The mixtures were weighed accurately and their specific gravity were calculated

Step V. Each formulation were taken into traube's stalagmometer and the no. of drops were counted and their surface tension was calculated using the same formula.

## RESULTS AND DISCUSSION

From **table 1**, it was found that the formulation II (48.29 dyne/cm) showed highest value and the formulation III (40.81 dyne/cm) showed lowest value amongst the other

formulations in individual surface tension studies under laboratory conditions (at 20°C approx). It was also observed that the three formulations surface tension values showed lower values than the standard.

From **table 2**, it was found that the 50% formulation mixture (1:1:1) with distilled water (49.20 dyne/cm) showed minimum surface tension and the 90% formulation mixture (1:1:1) with distilled water (54.30 dyne/cm) showed maximum surface tension amongst the other compositions. The 20%, 70%, 80% formulation mixtures (1:1:1) with distilled water showed approximately same values i.e. 50.31 dyne/cm, 50.64 dyne/cm, 50.26 dyne/cm; 30%, 50% formulations mixtures (1:1:1) with distilled water showed approximately same value i.e. 49.30 dyne/cm, 49.20 dyne/cm and 40%, 60% formulation mixture (1:1:1) with distilled water also showed approximately same value i.e. 51.73 dyne/cm, 51.26 dyne/cm. It was also observed that all composition of formulation mixtures (1:1:1) with distilled water surface tension value showed lower value than the standard.

The results indicated that the difference between attraction molecule of the substance have for each other and their attraction for the molecule of the substance of the other side of the interface.

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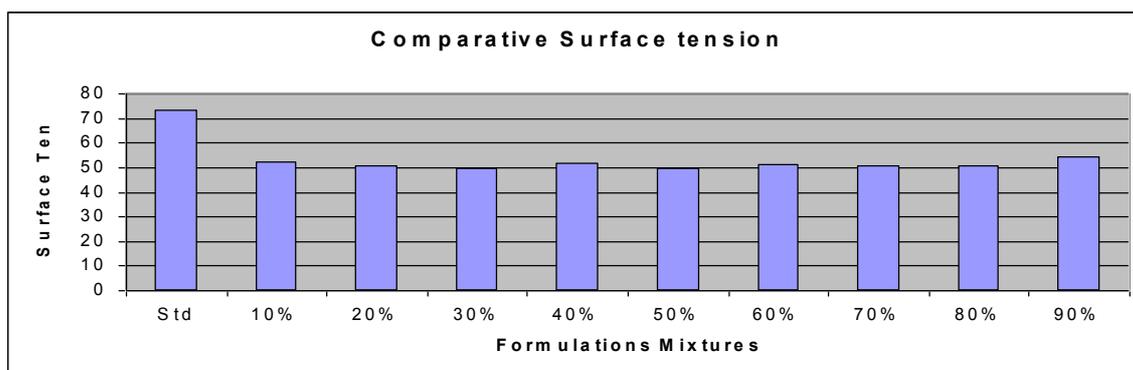
**Table 1: Specific gravity and surface tension of individual formulation**

S.No.	Standard / formulations	Number of drops			Mean no. of drops	Specific gravity	Surface Tension (dyne/cm)
		I	II	III			
1.	Standard: Distilled water	83	85	84	84	1	72.80
2.	Formulation I	142	144	143	143	1.057	45.20
3.	Formulation II	133	137	138	136	1.074	48.29
4.	Formulation III	152	156	157	155	1.034	40.81

Temp. Room temperature

**Table 2: Specific gravity and Surface tension of different composition of formulation quantity mixture with distilled water**

S. No.	Composition of formulation mix (1:1:1) with distilled water (%)	Number of drops			Mean no. of drops	Specific gravity	Surface Tension (dyne/cm)
		I	II	III			
1.	Standard : Distilled water	83	85	84	84	1 approx	72.80
2.	10%	116	118	120	118	1.004	52.03
3.	20%	121	123	125	123	1.012	50.31
4.	30%	126	127	128	127	1.024	49.30
5.	40%	123	122	121	122	1.032	51.73
6.	50%	125	133	132	130	1.046	49.20
7.	60%	129	124	122	125	1.048	51.26
8.	70%	130	126	128	128	1.060	50.64
9.	80%	133	129	134	132	1.085	50.26
10.	90%	126	121	125	124	1.101	54.30



**Fig 1: Comparative surface tension**

Source of support: Nil, Conflict of interest: None Declared