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Analysis of Viscosity of Orange Fruit Juice to Ensure the Suitability of Processing Applications

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ABSTRACT

Study of viscosity will help in Rheological behavior of orange fruit (Citrus Sinensis) juice,at different compositions which was studied at the KMES Society's ,G M Momin Women's College, Bhiwandi affiliated by Mumbai University, Maharashtra. Viscometer instrument used to determine the flow properties of the products. Viscosity is used to determine the viscosity of the fruit juice. This fruit juice exploited for processing application. The suitability of viscosity was based on the compositions. Results revealed that squash and ready-to-drink juice (Branded Processed juice) of orange had showed significant rheological behavior, however, this study would be a ready reference and helpful communication particularly to those desires for commercial processing of orange products with customary feature.

Key words: *Fresh Natural Orange Juice, Branded Processed Juice, Viscometer, Processing of Jam.*

INTRODUCTION

The increasing social and economic importance of food products, besides the technology complexity of producing, processing, handling and accepting, these highly perishable and fragile food materials like orange fruit, requires a more extensive knowledge of their physical properties because, the rheological properties play an important role in the handling and quality attributes of processed foods. The rheological properties of fruits and vegetables are of interest for food technologist, due to different causes. Firstly, fruits and vegetables are increasing in importance in the contemporary human diet. Secondly, the rheological properties are relevant to several aspects of the study of these materials, including; the causes and extent of damage during harvesting, transport and storage; the human perception of product quality; and the physiological changes that take place in the product during growth, maturation, ripening and storage after harvest[1].

Jam, jelly, juices and squash are usually produced by entrepreneurs and often encounter quality problems and do not meet the standard for these products. It is of utmost importance that a manufacturer must understand the scientific basis for producing a superior product which must meet the fundamental characteristics like, pH, acidity and viscosity to ensure the standard excellence of the product. Studies on the flow behavior of juice, squash and consistency of jam is more important than its manufacturing.

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Information on the viscosity of fruit beverage as influenced by concentration and temperature is of particular importance. With this mixed flow system, the viscosity of the products are needed to determine the heat transfer rates, energy consumption with increase in concentration, and for controlling the temperature and flow rates of heating media to ensure continuous flow and gelling of food products. The flow behavior also influences the pump performance[2].

Besides, for a newly emerging fruit processing system, it is important to document the influence of product flow properties on the systems in overall capacity and energy saving and for reducing handling cost. While reviewing the rheological models of food products, the importance of accurate rheological data for calculation of volumetric flow rates, selection of pumps, determination of pressure drops for pipe sizing and power consumption for pumping systems, and for prediction of heat transfer coefficients for heating, evaporation and sterilization processes. Single strength juices and concentrated clear fruit juices generally exhibit Newtonian flow behavior or close to it, and that sugar content plays a major role in the magnitude of the viscosity and the effect of temperature on viscosity[3].

Rheological properties of fluid fruit and puree products described that fruit and vegetable juices had been assumed to behave as non- Newtonian fluids. If fruit juices contain considerable amounts of pulps, or are very concentrated, they may show an additional resistance to flow represented by a yield stress[4,5].

MATERIALS AND METHODS

Viscometer is cleaned thoroughly with chromic acid and with distilled water, dried by passing hot air through it. Viscometer is clamped in the vertical position on a retort stand.

$10cm^3$ of distilled water pipetted out and transferred in the right hand bulb. The time required for flow of liquids through the capillary tube under its own weight noted down.

Same procedure repeated for the orange fresh fruit juice and Tropicana fruit juice.

Then using following equation viscosity were calculated

$$\eta_1/\eta_2 = t_1*d_1/t_2*d_2$$
$$\eta_2 = \eta_1*t_2*d_2/t_1*d_1$$

pH were determined by using glass electrode. Acidity were determined by volumetric method. Total Suspended Solids and Moisture content were determined by gravimetric method.

RESULT AND DISCUSSION

S.No.	Sample	pH	Acidity	TSS	Moisture	Viscosity in poise
01	Natural orange juice from the orange squashes (5.0%)	4.15	0.001825 Gram/dm^3	35.0ppm	94.0%	0.0124
01	Natural orange juice from the orange squashes (0.5%)	4.15	0.001825 Gram/dm^3	25.0ppm	94.0%	0.0109
01	Natural orange juice from the orange squashes (0.05%)	4.15	0.001825 Gram/dm^3	15.0ppm	94.0%	0.0090
02	Branded Processed juice with added preservatives	5.89	0.003285 gram/dm^3	14.0ppm	93.0%	0.00345
03	Distilled Water	6.79	Neutral	0.00ppm	NA	0.0085

Acidity of all composition of fresh fruit juices are same which indicates that dilution factor does not changes the acidity of fresh fruit juice which is also indicated by pH measurement using combined electrode. Branded Processed juice has little bit high acidity than fresh orange juice which very clearly indicates the addition of preservatives. Therefore the shelf life of the preserved (processed) orange juice is greater than that of fresh orange juice

Viscosity of concentrated orange juice is higher than the diluted orange juice. As dilution increases viscosity decreases. For 5.0 % solution of juice viscosity is 0.0124, for 0.5% solution viscosity is 0.0109 and for 0.05% solution the viscosity is 0.0090 which is slightly greater or nearby equal to distilled water. Branded Processed juice has the viscosity of 0.00345 which is less than all composition of fresh orange juice and less than distilled water also. This again indicates that the preservatives has been added which is responsible for increasing the shelf life.

CONCLUSION

Because of increase in acidity, the viscosity of Branded Processed juice get decreased than fresh fruit juice and distilled water.

The viscosity measurement of food product is much useful behavioral and predictive information to take guidelines in formulation, processing and product development. Hence, this study was partially employed as a quality check during production of jam, squash and juices. Orange juice and squash were found excellent in its quality.

Jam is an effective and tasty way of preserving fruit. Most tropical fruits can be processed and preserved in order to reduce post harvest loss in small scale operations. These fruits are used in the preparation of jam and jelly having high viscosity than distilled water which is also used for preparation of jam and jelly. Concentration of sugar, has the property of forming a viscous semi solid. If this characterisitc of sugar get mixed with the high viscosity of the fruits then there will be fast formation of jam and jelly. This characterstic also increases the stability of solid in liquid colloids.

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