Use of Rheometeric Instrument for Analysis of Pure Honey and Jaggery Mixture

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Abstract: **The present work refers to an investigation of the rheological behavior of the pure honey mixed with different percentages of Jaggery. Through this rheological study, it is possible to differentiate pure honey and Jaggery adulterated honey. In this work curves such stress induces with shear rate applied, Flow of samples was examined, all samples shows Newtonian fluid behavior. Due to adulteration moisture content increase and shelf life of honey decreases. This rheological study can be helpful in prediction of adulteration in honey and determination its shelf life. The experiments were accomplished in a PAR PHYSICA MCR Rheometer, with geometry, Cone-Plate and Double Gap Cylinder sensor system.**

Keywords: **Honey Adulteration, Rheology, Jaggery, Shelf life, Refractive index of honey.**

I. INTRODUCTION

Honey, a viscous and aromatic natural product appreciated since ancient Vedic times, is prepared by bees mainly from the nectar of flowers or honeydew [1].The characteristic nutritional value, texture, appearance, flavor sweetness and medicinal properties have attracted thousands of customers to use it as food item, alternate medicine [2-4]. Due to its antibacterial activity honey can also be used in skin infections and burns [5]. Honey is premium and expensive due to high demand and shorter supply, since it is natural can be produced only by honey bees not by any industrial process, peoples use to make profit by adulterating it with cheap compositions of sugar and sell it on higher price without concerning about the effect on consumer's health. Previously researchers have made numerous attempts and developed the different techniques to detect adulteration in honey. Near Infra Red spectroscopy (NIR) together with chemometrics [6-8]. In the present work, we used samples of honey and Jaggery solution mixed. The honey producers use this composition to increase production and make more money. We can find even 50% of Jaggery mixed with honey being sold. The following ratios in the tests were used: 5%, 10%, 20% of Jaggery solution added to pure honey (wild flora). Besides, tests were realized with pure honey and, with different % Jaggery solution added to pure honey. In this work, Two tests were carried out 1) Shear test: to examine the rheological behaviour of the mixtures. 2) Measurement of refractive index: to examine effect of adulteration on refractive index of honey.

II. EQUIPMENT

Rheological measurements were realized in a PAAR PHYSICA Rheometer working with a thermocontroller model MC-1 at University Institute of Chemical Engineering & Technology Panjab University Chandigarh, India and Refractive index measurement is done by using the instrument RFM840 of Bellingham & Stanley Ltd. At UCIM Panjab University Chandigarh.

III. MATERIAL AND METHODS

The pure honey was obtained from the Farmer of Himachal Pradesh who uses to sell it in wholesale market. In this work only honey of wild flora was utilized. The Jaggery was obtained from Uttar- Pradesh's producer and solution made has the composition of 4:1 i.e. 320 gms of Jaggery diluted in 80 gms of distilled water. The Jaggery solution was carefully added to honey being obtained rate of 5%, 10%, 15% and 20% of jaggery solution to pure honey. The mixtures were based on weight and in this case the instrument used was a simple digital weighing balance. In present work all the tests were realized at room temperature 27ºC.

IV. SHEAR TEST

In the shear test, we employ a stress to sample or we employ a strain and, we obtain as answer one value of deformation or stress. This test allows us to obtain the viscosity of the sample [9].

V. RESULTS

Figure 1. shows the stress produced in pure honey, with added Jaggery solution. These curves were obtained performing a shear test. We can see in the Figure 1. That, there is a significant difference among stress resulted in samples for the different shear rates applied.

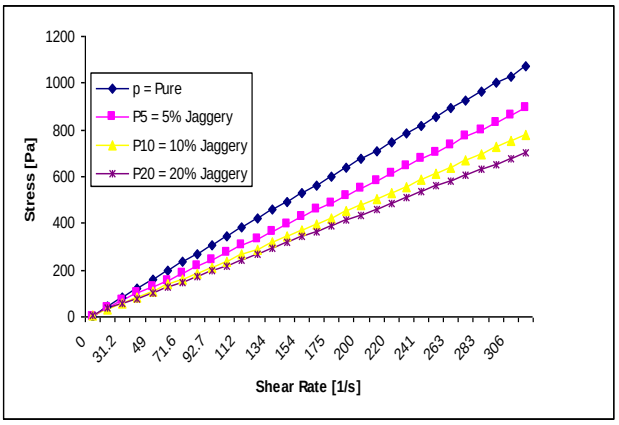

Figure 1: Stress results in samples subjected to different Shear rate

So, the value of stress induced can be a way to known how up to how much extent the Jaggery is there in the honey. This test becomes a good instrument to quality control.

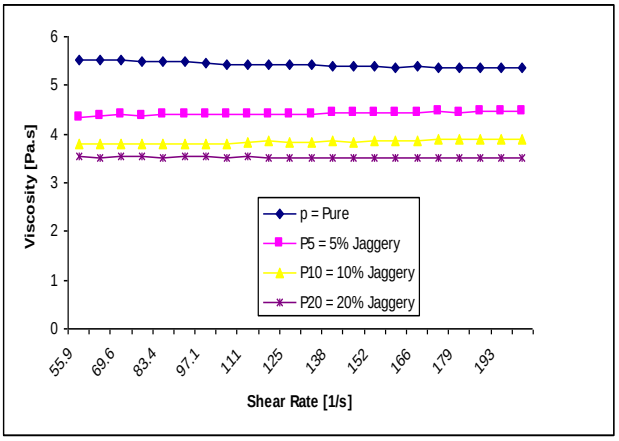

Figure 2: Viscosity Curve: obtained at temperature 27^0 C.

Figure 2. is shear rate v/s viscosity curve for pure honey, and other adulterated samples of Jaggery. We can see that all samples shows Newtonian fluid behavior i.e. viscosity remains constant, also samples were within the linear viscoelastic limit, so that the tests can be performed in this range of stress without alter or broke the structure of the sample.

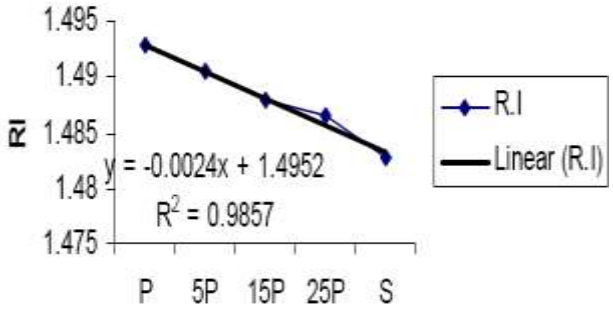

Figure: 3 Refractive index: Obtained for random samples

Figure 3 shows the refractive index measured for samples pure and mixture of Jaggery result shows linear decrease in refractive index of honey with increase in Jaggery Solution mixed in it, graph shows a linear relationship. Refractive index measurement can be helpful in determining the moisture content and hence the shelf life samples can be predicted [10].

VI. CONCLUSIONS

The rheological characterization of honey and Jaggery solution is very important to determinate the quality of the product. Through the knowledgement of the viscosity and refractive index it is possible to determine the quantity of Jaggery contained in an adulterated honey. Besides, the addition of Jaggery to the pure honey decreases the viscosity as well as refractive index of the Sample. This kind of analysis is very helpful in order to test commercial products and in quality control of products in market.

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