

Objective

Decades ago, homemade fruit syrups prepared of raspberry or red currant were exceedingly popular in Hungary. Customers usually prefer nice thick syrups with a deep colour and a smell of the fruit it is made of. This kind of drinks belong to soft drinks in the concentrated drink category, namely squashes and cordials. While homemade squashes have fruits, sugar, and a small amount of tartaric acid as ingredients, store-bought ones they contain less fruit, and more additives to replace the missing fruit content.

The objective of our work was to evaluate the effect of sugar content and fruit composition in fruit juice content on the physical properties -mainly viscosity and color- of store-bought raspberry and orange flavored squashes.

Materials and Methods

Materials: Raspberry and orange flavoured syrups with different sugar and sweetener contents and with different fruit content composition were purchased from local groceries. The used samples and they properties are summarized in the table below.

The orange squashes contained stabilizers (E414, E445, and E1450) except the O_757_33 sample. Sample O_600_33 contained xanthan gum, while sample O_769_15 had corn oil.

Sample	sugar g/100ml	sweetener content	raspberry in juice, %	Sample	sugar g/100ml	sweetener content	orange in juice, %
Experiment 1 evaluating the effect of sugar and sweetener content							
R_032_1	3.2	YES	1	O_020_33	2	YES	33
R_340_1	34	YES	1	O_330_8	33	YES	8
R_550_3	55	YES	3	O_550_2	55	YES	2
R_600_33	60	NO	33	O_600_33	60	NO	33
R_790_33	79	NO	33	O_790_33	79	NO	33
Experiment 2 evaluating the effect of fruit juice content composition (sugar content 77±2g/100ml)							
R_772_2	77.2	NO	2	O_810_2	81	NO	2
R_810_3	81	NO	3	O_769_15	76.9	NO	15
R_790_33	79	NO	33	O_790_33	79	NO	33
Experiment 3 with evaluating the effect of sugar with pure raspberry/orange content							
R_575_33	57.5	NO	33	O_600_33	60	NO	33
R_600_33	60	NO	33	O_740_33	74	NO	33
R_740_33	74	NO	33	O_757_33	75.7	NO	33
R_790_33	79	NO	33	O_790_33	79	NO	33

Viscosity measurements: MCR302 modular compact rheometer with Couette-geometry (CC27) was applied to describe the rheological characteristics of the samples. The three stages of the test were as follows: upward shear rate ramp from 0.1 to 250 1/s in 120s, high shear phase at 250 1/s for 120s and downward shear rate ramp from 250 to 0.1 1/s in 120s. Apparent viscosity was determined at a shear rate of 50 1/s, and the viscosity of the samples was calculated by the average of the values recorded in the constant speed phase at 250 1/s.

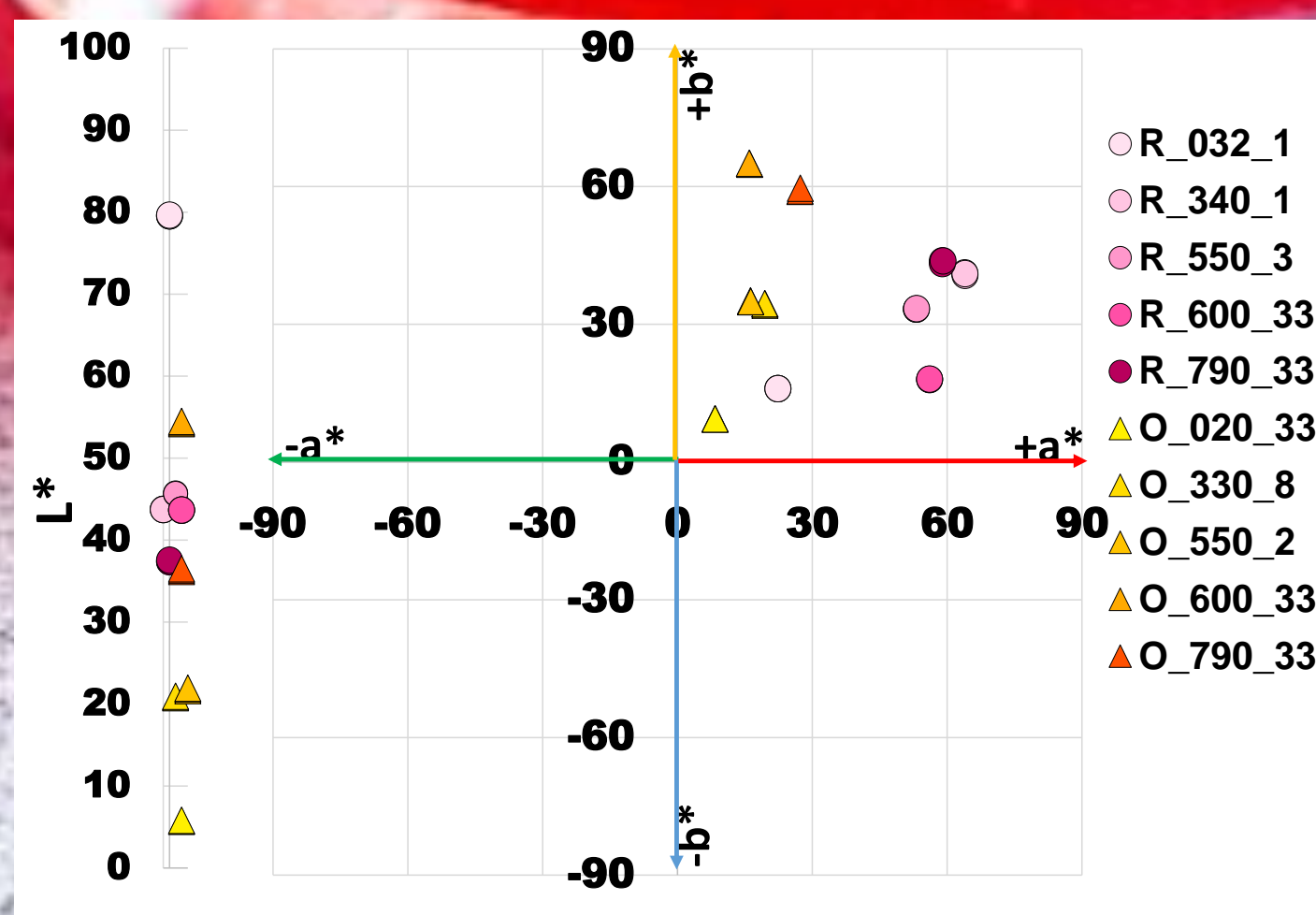
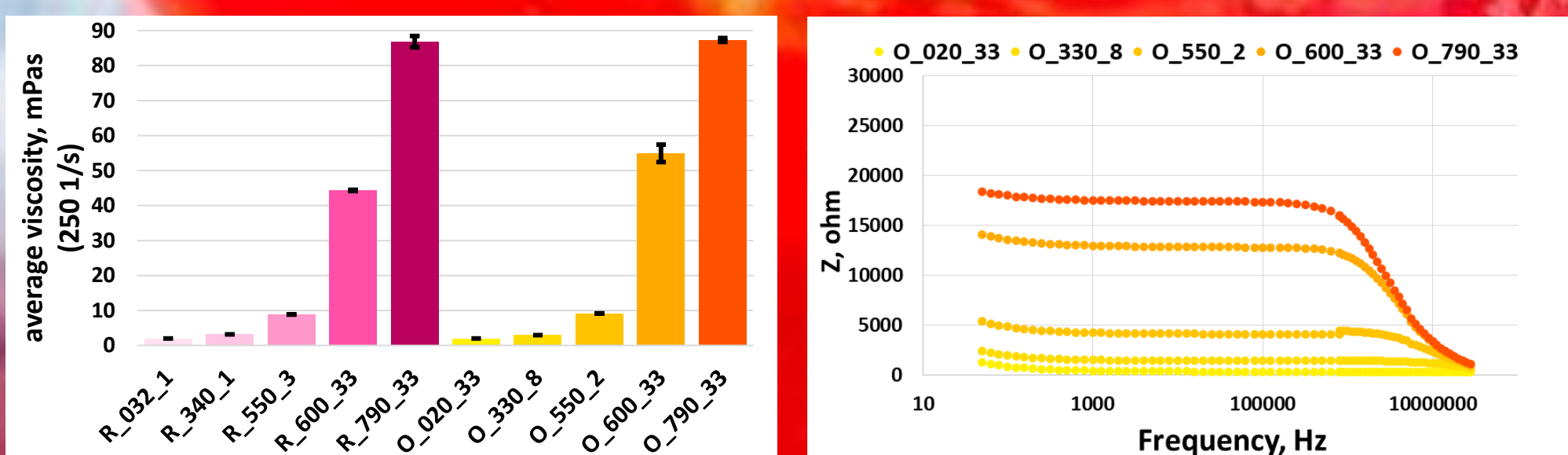
Optical properties: The colour of the samples was evaluated with ColorLite sph850 spectrophotometer, where L*, a*, b* values was measured. Abbe refractometer was applied to determine refractive index and soluble solid content. The flow curve, colour, refractive index and soluble solid content were measured in triplicates at 25±0.1°C.

Dielectric properties: As for the dielectric properties the magnitude (Z) and the phase angle (φ) of electrical impedance in frequency range from 30 Hz up to 1 MHz and from 75 kHz up to 30 MHz were measured with precision LCR meters HP4284A and HP4285A, respectively. Stainless-steel electrodes with 10.5mm distance between them were inserted into the liquid sample of 15ml volume. The measuring voltage was 1V.

Results

Experiment 1. – Effect of sugar and sweeteners

VISCOSITY, IMPEDANCE MAGNITUDES, CIE L*a*b*

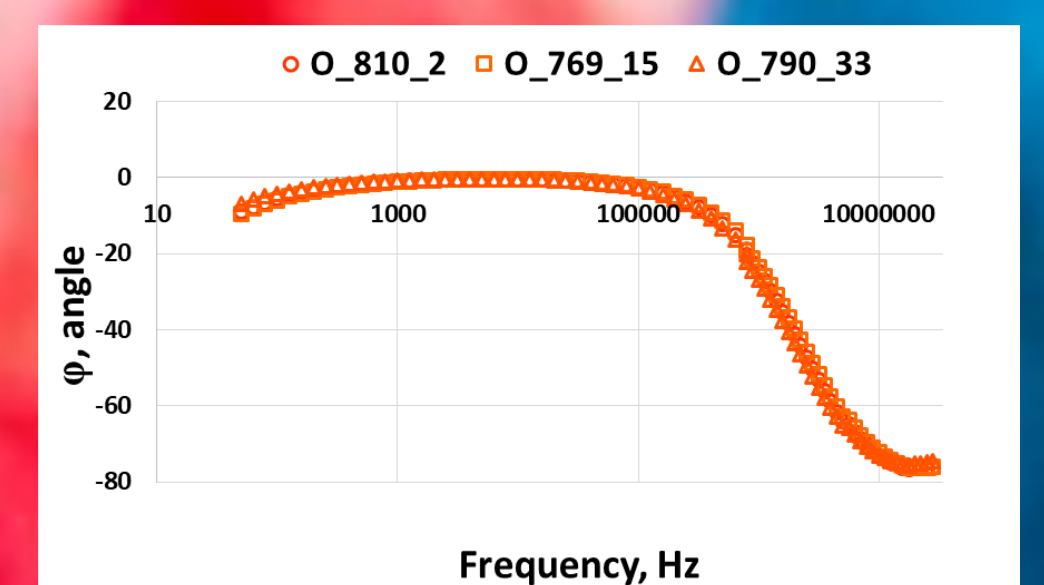
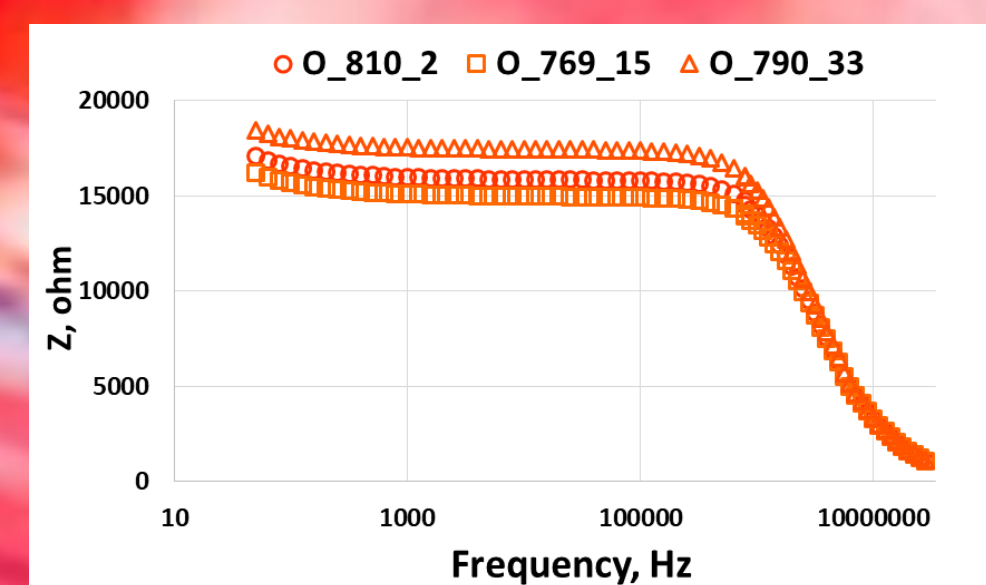
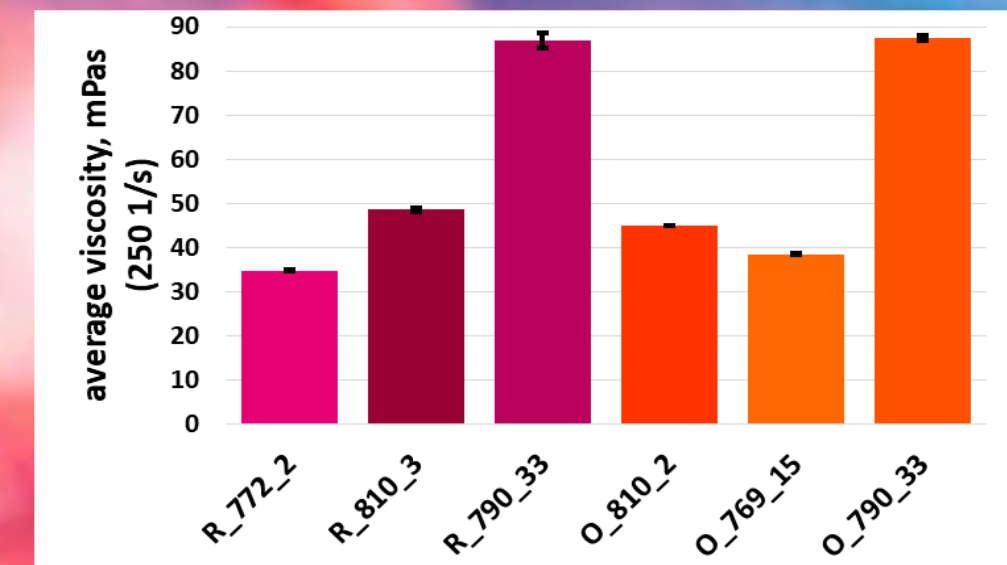


Experiment 2. Effect of flavour specific fruit juice content

VISCOSITY, IMPEDANCE MAGNITUDES, PHASE ANGLE

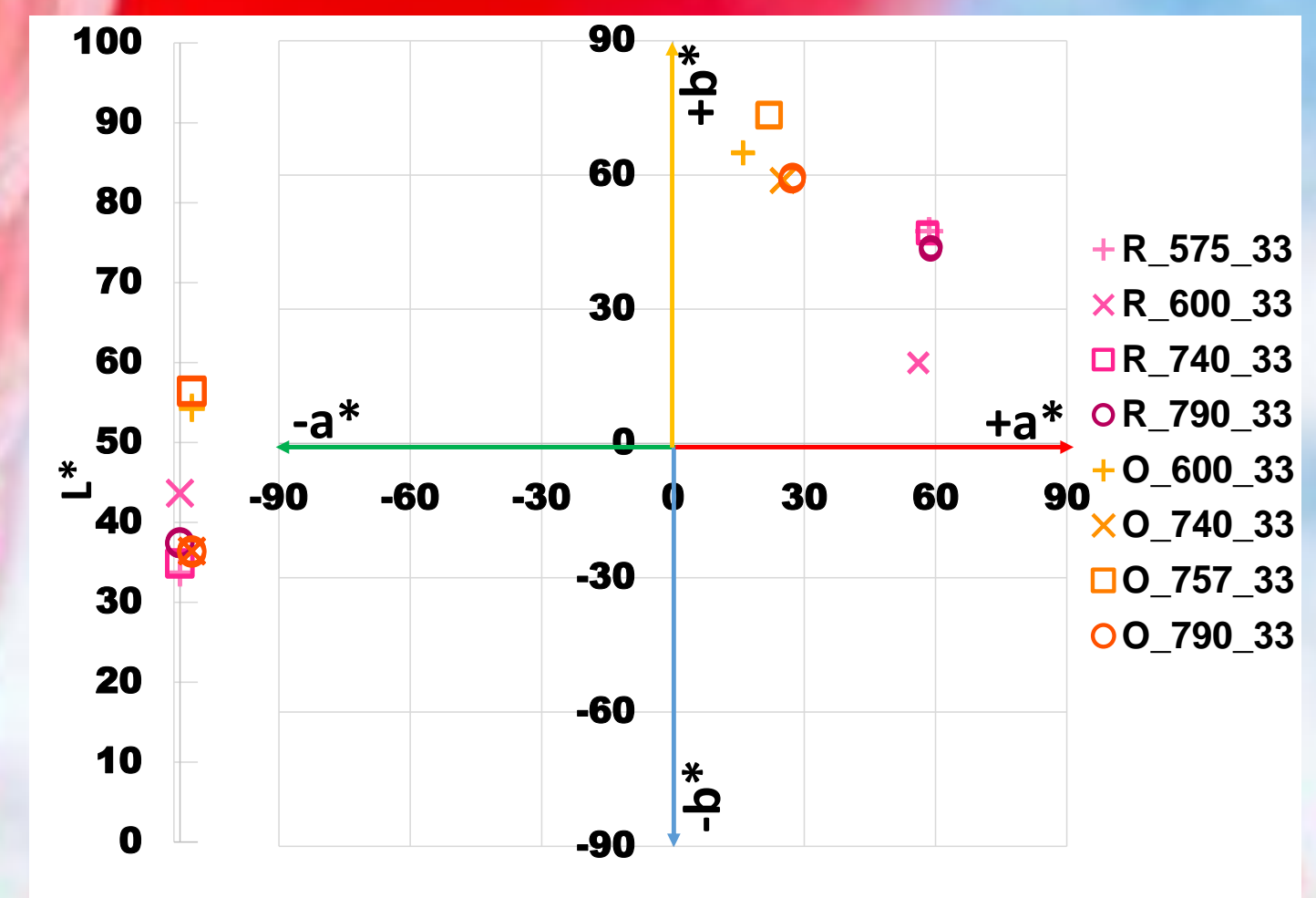
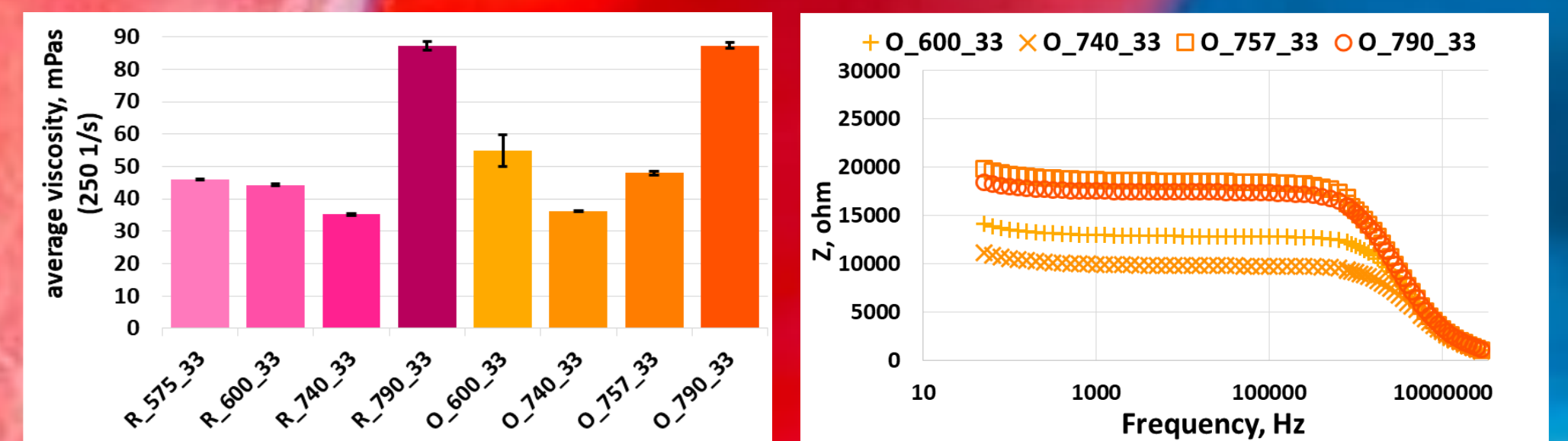
Table 2: Fruit composition of juice content of raspberry and orange squashes (Experiment 2)

Fruit composition	R_810_3	R_772_2	R_790_33	O_810_2	O_769_15	O_790_33
raspberry	3%	2%	33%	-	-	-
orange	-	-	-	2%	15%	33%
apple	24.5%	24.5%	-	24.5%	18%	-
grape	5.5%	6%	-	6.5%	-	-
elderberry	-	0.5%	-	-	-	-



Experiment 3. Effect of sugar content (33% pure fruit juice)

VISCOSITY, IMPEDANCE MAGNITUDES, CIE L*a*b*



Samples overview



Conclusion

Fruit content of used fruit juice and sugar content has a definite effect on the physical properties of squashes. Although color characteristics is defined mostly by the colorant added to the squash, are the other parameters are influenced by the amount of added sugar and used fruit juice. Sweeteners decreased viscosity, refractive index, SSC values and impedance magnitude shows similar tendencies as well. Keeping sugar content on the same level as using different fruit juices in the 33% fruit content caused changes in viscosity, refractive index, and SSC values but the magnitude of impedance showed little changes for all samples. The characteristics of squashes with pure raspberry and orange juice respectively and different sugar content does not follow any trends which emphasizes, that additives have a significant effect on the physical properties.