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LINEAR CORELATIONS BETWEEN PHYSICOCHEMICAL PARAMETERS IN CASE OF SOME EXOTIC FRUIT COMPOTES

Antoanela COZMA[1], Ariana VELCIOV[1], Dacian LALESCU[1], Casiana MIHUT[1], Anisoara DUMA COPCEA[1], Daniela SCEDEI[1], Adalbert OKROS[1], Mihaela PETCU[1], Maria RADA[2]

[1] *University of Life Sciences "King Michael I of Romania", 300645, Timişoara,Romania*

[2] *University of Medicine and Pharmacy "Victor Babes" Eftimie Murgu, 300041, Timisoara, Romania*

Abstract:*The physicochemical properties of processed fruit products are important indicators of their quality, stability and nutritional value. Understanding the relationships between these properties can contribute to improved characterization and control of fruit-derived foods. The aim of this study was to investigate the statistical relationships between selected physicochemical parameters of exotic fruit compotes prepared from pineapple (Ananas comosus) and mango (Mangifera indica). Experimental samples were produced in three formulations: without additives, with brown sugar and with non-caloric sweetener. The analyzed parameters included pH, total soluble solids (TSS), electrical conductivity (G) and dynamic viscosity (η). Physicochemical measurements were performed using standard analytical methods, while statistical analysis was carried out using linear regression models and analysis of variance (ANOVA) in STATISTICA 10 software. The results revealed statistically significant correlations between several physicochemical parameters. A strong negative correlation was observed between pH and electrical conductivity (r = −0.81, p < 0.05) indicating that increased ionic concentration is associated with decreased pH values. Additionally, a strong positive correlation was identified between refractive index and dynamic viscosity (r = 0.86, p < 0.05), suggesting that sugar concentration plays a major role in determining the rheological behavior of fruit compotes. These findings demonstrate that physicochemical parameters can serve as reliable indicators for quality characterization of exotic fruit compotes.*

Introduction

- The consumption of fruit and fruit-based products has increased considerably due to their recognized nutritional and functional benefits. Fresh fruits are products of great importance in a rational diet, having numerous health benefits, due to their nutritional properties. Rich in carbohydrates, cellulose, minerals and antioxidant compounds, being sources of vitamins: A, B1, B5, C, enzymes and fiber, they should not be missing from a rational daily nutrition. Fruits can be consumed fresh or can also be prepared in various food products, such as juices, nectars, soft drinks or fermented fruit drinks, syrups, jams or fruit compotes.

- Among tropical fruits, pineapple (*Ananas comosus* L.) and mango (*Mangifera indica* L.) are widely appreciated due to their nutritional value and sensory characteristics. Pineapple contains significant quantities of vitamin C, B-complex vitamins and minerals such as potassium and magnesium, while mango is rich in carotenoids, vitamin A and vitamin C. Pineapple is a perennial herbaceous plant of the *Bromeliaceae* family with the botanical name *Ananas Sativus* or *Bromelia* pineapple. It originates in the tropical regions of America and the Far East. It is cultivated for its large fruit with a weight of 700 -2500 g. The pulp of this fruit is hard, sweet-sour taste (CHAUDHARY et AL., 2019).

Material and method

- Fresh pineapple and mango fruit purchased from a hypermarket, were used for the compote's preparation. Three experimental variants were made: compote without added sweetener (control), compote with brown sugar and compote with non-caloric sweetener. The fruits were washed, peeled, cut into pieces and thermally processed according to conventional compote preparation procedures.

- The objectives of our study was to evaluate the physicochemical characteristics: viscosity (η), electrical conductivity (G), pH and total soluble solids content (TSS) for mango and pineapple fruit compotes and examine the existence of linear correlations among selected physicochemical parameters.

- The determination of the physicochemical parameters was performed according to the AOAC Official Methods of Analysis, 2000.The pH was measured using a pH meter OP-211/2 equipped with a combined electrode OP-0808P. The total soluble solids (TSS) and the refractive index were measured using the refractometry method, with the Abbe refractometer corrected to the equivalent reading at 20°C. Electrical conductivity was measured using a conductometer OK-112. Dynamic viscosity was determined using the Ostwald-type viscometer using standard formula.
- Experimental data were analyzed using STATISTICA 10 software. Linear regression analysis was applied to evaluate relationships between physicochemical parameters using the model: $y = ax + b$, where: a = slope of the regression line; b = intercept.

- The statistical significance of regression coefficients was tested using analysis of variance (ANOVA), and correlation strength was assessed using Pearson correlation coefficients. The purpose of the statistical analysis was to identify correlations between the analyzed parameters, by modeling them as linear functional relationships (ŻYWICA, BANACH, 2015).

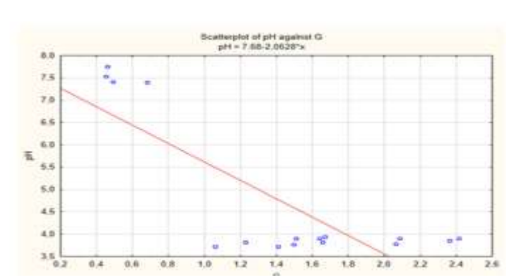
Results and discussions

- Determining the physicochemical parameters of fruit compote, namely pH, total soluble solids (TSS) content, refractive index, dynamic viscosity and electrical conductivity, allows a complex assessment of the quality, composition and stability of the analyzed product.

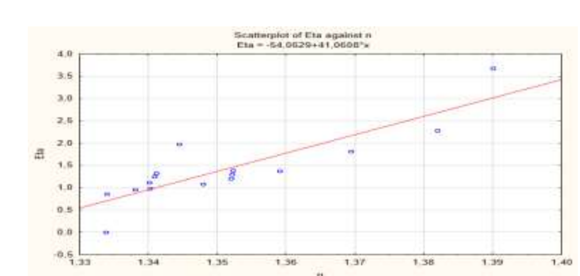
- The purpose of this paper is to test that there exist functional dependencies between some physicochemical characteristics (pH, total soluble solids, electric conductivity and dynamic viscosity) in case of various types of exotic fruit compotes. In our statistical analysis, pH, total soluble solids, electric conductivity and dynamic viscosity were noted by pH, n, G and η.

•Relationship between pH and electrical conductivity

The regression analysis performed between pH and electrical conductivity revealed statistically significant results. pH provides information on the degree of acidity, influencing both the microbiological safety and the sensory characteristics of the product. The obtained data provide similar pH values, the lowest pH value was obtained for pineapple fruit compote with sweetener (3.77) and the highest value for mango with brown sugar (3.91). The lowest values of pH were obtained in case of the mango fruit compote without sugar (3.85) and the highest value of pH was for mango with brown sugar (3.94) (COZMA et AL., 2015).



Regression line of pH as a function of electrical conductivity (G)



Regression line of dynamic viscosity (η) as a function of refractive index n

Electrical conductivity is influenced by dissolved ionic compounds, including organic acids and mineral salts, which explains the relationship between conductivity and pH. The regression line $y=b_0+b_1x$ is the linear equation used to fit the best straight line to the data (Figure 1). The dependent variable pH was expressed as the equation: pH = 7.68 - 2.0628·G

•Relationship between dynamic viscosity and refractive index

The dependent variable η was expressed as the equation: η = -54.0629+41.0608·n

The 95% confidence interval for the slope +41,0608 was (+27.21, +54.90) and the 95% confidence interval for the intercept -54.0629 was (-72.76, -35.35) which provides the lower and upper bounds for the unstandardized regression coefficients. We noted that the 95% confidence interval does not include 0 suggesting that the slope is significantly different than 0 which means there is a strong linear relationship between η and n. In fact, the strong positive linear correlation was reported by the Pearson linear correlation coefficient r= -0.86 and determination coefficient r^2= 0.74.

The correlation coefficient (r = 0.86) indicates a strong positive relationship between viscosity and refractive index. The coefficient of determination (r^2 = 0.74) suggests that approximately 74% of viscosity variation is explained by changes in refractive index. High concentration of sugar in fruit samples gives high value of refractive index (KUMAR, KIRAD, 2013).

The sugar concentration modifies the viscosity too. Dynamic viscosity reflects the consistency and texture of the product, influencing its sensory perception and technological behavior. This can explain the strong positive linear correlation between the viscosity and the index of refraction (MOMIN, THAKRE, 2015; COZMA et AL., 2017).This relationship can be attributed to the influence of soluble solids concentration, particularly sugars, which increase both refractive index and solution viscosity.

•Conclusions

•The results of this study demonstrate the existence of significant relationships between several physicochemical parameters of pineapple and mango compotes.
•A strong negative correlation was observed between pH and electrical conductivity, indicating the influence of ionic composition on acidity. In addition, a strong positive correlation was identified between refractive index and dynamic viscosity, reflecting the role of soluble solids concentration in determining rheological properties. The results correspond to those described in the literature.
•The results highlight the importance of physicochemical parameters as useful indicators for characterizing the quality of fruit compotes. Also, the use of alternative sweeteners did not significantly modify the fundamental relationships between the analyzed variables. Overall, these parameters provide an integrated picture of the quality of the compote, being essential for controlling the technological process and ensuring the conformity of the finished product.
•Future research should include larger data sets and a greater diversity of fruit types, to better understand the complex physicochemical interactions that occur in processed fruit products.