

Effect of temperature, starch and plasticizer concentrations on color parameters of ulluco (*Ullucus tuberosus* Caldas) edible films

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Abstract. The growing concern about limited natural sources and pollution has aroused the interest of developing bio-packaging based on agricultural polymers. The Andean tuber ulluco (*Ullucus tuberosus* Caldas) is a promising source of starch that can be used in the production of edible films or coatings for preserving the quality of food products. Color is an important feature for edible films production due to can alter the visual perception of the coated product. In this study, the effect of drying temperature (T) (40 to 60°C), starch concentration (SC) (2.0 to 3.0% w/v) and glycerol concentration (GC) (1.0 to 3.0% v/v) on the color parameters (L^* , a^* and b^*) of ulluco edible films was evaluated. A composite central design was used to combine five levels of the three factors (T , SC and GC). Artificial neural network (ANN) were applied to establish mathematical models that could represent the dependence of the factors on the color parameters. The edible films showed luminosity values between 87.4 and 90.3. Results indicated that the higher T , the lower a^* and b^* parameters and the higher luminosity of the films. Likewise, the lower G , the higher luminosity of edible films. Sensibility analysis shows that SC has an important influence on L^* , a^* , b^* parameters. Statistical results indicated that the ANN approach provided an accurate estimation ($R^2_{adj} = 0.885$ and $MSE = 0.054$) of the color parameters. ANN use a feed-forward architecture with five neurons in the hidden layer, hyperbolic-tangent transfer function, and Bayesian regularization backpropagation as training algorithm. ANN could be an alternative tool for modelling the complex relationship between the color parameters and the temperature, starch and plasticizer concentrations on ulluco edible films.

1. Introduction

Over the last twenty years has been growing the global concern about pollution generated by the indiscriminate use of non-renewable products. As result, many researches are focused on the development of products that can use as food packaging and replace petroleum based materials. Bioplastics are an alternative solution for this issue, they are obtained from natural polymers and their demand has been increased, by 2019 their production is expected to be around 5.5 million metric tons [1].

