Generalized model for the characterization of fortified pasta with high nutritional value

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Abstract

The aim of this paper was to elaborate a generalized input – output model that shows the different steps to produce and characterize fortified pasta. The authors identified all the influence factors on the pasta production process and the analyses that must be done to characterize the final products. In this way, further researchers and pasta producers will have a generalized model for the production technology and characterization of this type of pasta.

Keywords: pasta, nutritional value

1. Introduction

To produce functional food with high nutritional, an important role plays the active components of the composition. Cereals are an important source of elements and chemical compounds with potential biological activity, such as phenolic compounds. The phenols in cereals can be divided into acids derived from either benzoic acid or cinnamic acid (CA). The main cinnamic acids are ferulic acid, p-coumaric, caffeic and synapses. From these, the ferulic acid is one of the mostly abundant cinnamic acids in the cereals. Cinnamic acids have biological significance through their antioxidant, anticancer and antiinflammatory properties [1, 2, 4, 5, 8, 9].

The purpose of fortifying foods is to increase the nutritional value by adding nutrients or biological active compounds. Pasta with fruit fortification is relatively unusual. An example to obtain new dietary foods with high nutritional potential is to add rice flour with banana flour and in these way to obtain gluten-free pasta [3, 6, 7, 8].

To design a generalized input - output model for a given operation has to go out from be three groups of variables [10]:

I. Group of input variables, which are that initial variables due to which the whole operation / entire process can be controlled and ordered;

II. Group of output variables representing the results from the variation of the initial parameters (input variables);

III. Group of control variables whose variation controls and orders either the input or output variables

IV. 2. The input - output model

V. To develop a generalized input - output model assume an experimental study, mainly focused on [8]:

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VI. a) Obtaining pasta from certain raw material – rice flour, added with different proportions of dried fruit (example banana)

VII.b) Characterization of the obtained products in terms of polyphenols, cinnamic acid, contents of macro- and microelements.

VIII. We identified groups of variables and made the generalized input - output model shown in figure 1, as follow:

IX. I. GROUP OF INPUT VARIABLES, split into three subgroups:

X. 1. **Microelements determination** – flame atomic absorption spectroscopy method (AAS) with graphite furnace (sample quantity, burning time, burning temperature; ash dissolution).

XI. 2. **Total phenolic content (TP) determination** – Arranz modified method, 2010 [2] (pasta quantity, extraction time, extraction temperature, extraction solution, centrifugation time, centrifugation speed, incubation time, incubation temperature).

XII. 3. **Main cinnamic acids (CA) determination** (ferulic, caffeic and cumaric acids) – high performance liquid chromatographic method (HPLC) (chromatograph characteristics, chromatographic conditions).

XIII. II. GROUP OF OUTPUT VARIABLES, represented by:

XIV. 4. **Microelements content** (ppm) in fortified pasta

XV. 5. **Total phenolic content (TP) and main cinnamic acids content (CA)** in fortified pasta (µg/g)

XVI. III. GROUP OF CONTROL VARIABLES, represented by the pasta production technology:

XVII. 6. **Characteristics of the raw materials** (concentrations)

XVIII. 7. **Parameters of the pasta machine** (rotation speed, process time)

XIX. 8. **Parameters of the drying operation** (time, temperature).

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Figure 1. Structure of the generalized input – output model for the characterization of fortified pasta with high nutritional value
3. Conclusions

Outgoing from the developed generalized input–output model it can be seen that the characterization of the fortified pasta can be controlled and ordered through the variation of the three categories of variables: input, output, control. Achieving this generalized model allows mathematical modeling of the entire production process.

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