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EVALUATION OF ARTIFICIAL NEURAL NETWORK IN DETERMINING THE QUALITY AND CLASSIFICATION OF EDIBLE OIL

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Abstract

This paper reviews the application of artificial neural network (ANN) in determination of the quality and classification of edible oils. This point should be considered that other modern methods for examining these parameters are time consuming, so that presenting new methods which are strongly relevant to determination parameters and yet are quick in respond can help to control the oil quality. Moreover, only one test cannot interpret any terms of experiment. One of latest technologies and developed science achievement is modeling which presents sophisticated tools to analyze, interpret and understand the world around us. Nowadays, with the development of processing technology, benefits of artificial intelligence technology such as artificial neural networks, are widely used to model processes. The results showed that the artificial neural network optimization is a successful method for evaluating the parameters. Ultimately, time saving, cost, experimental errors will lead to closer scrutiny and appropriate matching between experimental data and data obtained from the neural network.

Keywords: *Artificial Neural Networks, Modeling, Edible oil*

1. Introduction

Oil quality is a complex issue that is measured by alteration of the physical and chemical composition of organoleptic experiments. Despite the physical and chemical parameters are easily measured, usually they are not directly related to the sensory results. Artificial neural networks have been put in use, in food sciences for more than two decades. ANN is a useful tool for the analysis of quality and food safety, including modeling of health and food safety, spectroscopy data interpretation and quality and performance properties prediction as well as chemical and physical properties of food products during processing and distribution. Modeling is one of the most instrumental tools for rapid and cost-beneficial identification of various system outcomes and process parameters on the output of the process. Nowadays modeling as is a synergetic method for identifying and describing the observed processes and forecasting them under different conditions. Thus, the adverse effect of the process is controlled through having the proper knowledge of how to prevent the occurrence of harms. The theory of artificial neural networks inspired by biological nervous systems of the human brain performs processing operations, so that ANN generation information processors are so powerful that are made of set of internal connections between neurons and acts as a unit and solves and preserves specific complications without any prior knowledge of discovering the intrinsic connection between the data.To analyze the structure of neural networks, it is proved that they are divided into single-layer and multi-layer networks. Layers are composed of three different multilayer neural networks. The existence of three layers to form a neural network is essential. Neurons are constituent elements of the layers in the neural networks. Elements of each layer are associated with all other elements of layers but are not correlated with other elements in

the same layer. Three layers of multi-layer networks consist of input layer, hidden layer or mid layer and output layer[1,4].
All parameters associated with input and output of artificial neural networks has been optimized for this purpose using the MATLAB software in Table 1.

Table 1: parameters included in optimization of artificial neural networks

The addressed parameters	Input layer	output layer	ANN used
Quality evaluation	Oil compounds (Structure,..)	Quality Assessment	MLP
The quality of olive oil during extraction	Technical, farming, warehousing factors	Peroxide, acidity	BPN
Qualitative Evaluation of Oil and fat	Fatty acids	Classification of Oil	BPN
Fatty acid analysis of soybean oil	Exposure to fatty acids	Classification of Oil	BPN
Quality of vegetable oils	The amount of oleic acid	Classification of Oil	BPN
Chemical changes	Absorbed Wavelength	Peroxide, Anysidin	BPN
Geometric classification of edible oil	The oil structure	Chemical analysis	BPN

It is worth mentioning that other modern methods for examining these parameters are time consuming, so that presenting new methods which are strongly relevant to determination parameters and yet are quick in respond can help to control the oil quality. Moreover, only one test can not interpret any terms of experiment. One of latest technologies and developed science achievement is modeling which presents sophisticated tools to analyze, interpret and understand the world around us. Zheng, (1997) studied the Qualitative evaluation method using neural network application. They concluded that the process of quality assessment is a multi-input and multi-output system in which the components are an input and quality assessment considered as an output. Mathematical modeling of such a system is difficult; due to the large number of input and output data, even if all the data is obtained from tests of samples. Thus, it is concluded that the ANN method is a successful method for qualitative assessment and classification of edible oils. And it also can be functional in other areas of work such as optimization of food compounds, development of new products and evaluation of sales and other studies of this kind[6].
In another study conducted by Rocco Feb Frey et al, artificial neural network was used to estimate the oil quality in sequential extraction of olive oil. In this study, software was invented to estimate two parameters; the quality level of acidity and peroxide value, in which a numerical method called artificial neural network (RE), is combined. The procedure was as follows; The ANN predicts the quality parameters and then the numerical method is used to refine the prediction. The purpose of this invention was the fast and reliable quality control without laboratory analysis. Errors were calculated six to eight percent, comparing the measurements obtained in invented method, to and the values obtained in the application of chemical analysis. The maximum error that can affect the procedure was calculated about 15% in this work. Mentioned systems were actually applied for quality control during the process of oil, in Italy. Analysis estimation of peroxide value and acidity levels was done by artificial neural network by learning the qualitative parameters such as warehousing, packaging, mixing, analysis of oil content and fragmenting. The mentioned software used some of the technical and agronomic

parameters as an input and anticipated peroxide value and oil acidity levels. The benefit of this work is the frequent prediction of oil quality during extraction. The application requires gathering the data during the extraction process which takes about 30 minutes and data is saved in memory. Then data is sent to the estimation software to estimate data in about three seconds. Thus the result of the estimation of qualitative parameters is ready in output, before extraction is complete. According to studies, work was carried out in three stages: firstly, the estimation performed with the experimental data over the years - 1999 to 2004 were collected and then were stored to be used to get to the innovation system in an integrated database. Secondly, development of artificial neural network software was done; to predict the acidity level and peroxide value while knowing some process parameters. At the start point learning of a limited set of parameters was completed, then neural network predicted those two quality parameters based on the input. Thirdly, estimations obtained from the application of artificial neural network with the help of some effective factors relating to both technical and agronomic parameters were refined. This innovative software has proved that it is capable of accurate estimation of qualitative parameters which are oil acidity and peroxide value. And if this is the goal of the factory to increase the quality of the extracted oil plant, using this software is suggested to optimize some technical parameters [3].
In another study conducted in 2007 by AndrásFülöp et al, different modeling methods for determining vegetable oils quality were compared. Various models which have been used in the comparison include PCA - MLR and PLS and PCA - ANN and GA-ANN. Models were calibrated using concentration of oleic acid oils. Models were compared based on the accuracy of their predictions. Handling the information extracted from NIR spectroscopy and modeling the relationship between them is a major problem. To verify information obtained from spectroscopic NIR, the PCA and GA were utilized and also for prediction, MLR and ANN were the models involved in the study. External validations of calibrated models were done by specified content of oleic acid of vegetable oil samples. The test results show the prediction capability of models by RMSEP. According to the results and comparison of various methods and determining the amount of the RMSEP in the compounds, RMSEP with GA - ANN was a better tool of prediction. It should be considered that this is a complicated and time consuming method, because a large number of model parameters should be involved in optimization process and it takes time[1].

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