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Modeling of Basil Leaves Drying by GA–ANN

Abstract: In this research, the experiment is done by a dryer. It could provide any desired drying air temperature between 20 and 120°C and air relative humidity between 5 and 95% and air velocity between 0.1 and 5.0 m/s with high accuracy, and the drying experiment was conducted at five air temperatures of 40, 50, 60, 70 and 80°C and at three relative humidity 20, 40 and 60% and air velocity of 1.5, 2 and 2.5 m/s to dry Basil leaves. Then with developed Program in MATLAB software and by Genetic Algorithm could find the best Feed-Forward Neural Network (FFNN) structure to model the moisture content of dried Basil in each condition; anyway the result of best network by GA had only one hidden layer with 11 neurons. This network could predict moisture content of dried basil leaves with correlation coefficient of 0.99.

Keywords: basil, GA, moisture content, ANN

1 Introduction

Basil (Ocimum basilicum L.), belongs to the hamiaeaceae species, is an annual, herbaceous, 20–60 cm lengthened white-purple flowery plant which comes from India and Iran. It is cultivated in Mediterranean countries and in various regions with temperate and hot climates. Fresh basil is widely used in the Mediterranean kitchen, such as tomato products, vegetables, salads, pizza, meat, soups and marine foods. It is commonly known that the presence of essential oils and their composition determine the specific aroma of plants and the flavor of the condiment. As a spice dried and ground basil leaves are used in bakery products, confectionary, ice creams, vinegars, meat and flavor products [1]. Basil is an aromatic herb that is used extensively to add a distinctive aroma and flavor to food. The leaves can be used fresh or dried for use as a spice. Essential oils are also extracted from the fresh leaves and flowers for use as an aroma additive in food, pharmaceutical, cosmetic and household products [2]. Some researches have been conducted on cereal grains. The economic cost, vigor and rate of germination of maize seeds were determined by drying with hot air flow [3]. The reduction of moisture is one oldest technique for food preservation. Mechanical and thermal methods are two basic methods to remove the moisture in a solid material [4]. Pietrzyk and Sumorek [5] carried out the convective drying of wheat grain in an electrostatic field. Raw foods have high amount of moisture and thus perishable. Many applications of drying have been successfully applied to decrease physical, biochemical and microbiological deterioration of food products due to the reduction of the moisture content to the level, which allows safe storage over a long period and brings substantial reduction in weight and volume, minimize the packaging, storage and transportation costs [6]. Mis and Grundas studied the influence of moistening and drying of wheat grain on its hardness. The principal of modeling is based on having a set of mathematical equations which can satisfactorily explain the system. The solution of these equations must allow calculation of the process parameters as a function of time at any point in the dryer based only on the primary condition [7]. Hence, the use of a simulation model is an important tool for prediction of performance of drying systems. Modern systems for designing air drying operations rely on the mathematical description of food moisture movement during the process [8].

The aim of this research was the evaluation and the modeling of the drying kinetics of mass transfer during the hot air-drying process of basil leaves, and the analysis of the influence of temperature, relative humidity and air velocity on drying rate and the kinetic constants of the proposed models. Drying foods and decreasing in moisture content is the one of the most important methods for industrial food preservation [6]. Air-drying is simultaneously heating and mass transferring process accompanied by phase change [9]. Many applications of drying have been successfully applied to reduce biochemical,