

Abstract

In the recent years, dehydrated food industry has gained prominence in the world. In concern with increasing demand of high quality and healthy products and changing customer behaviour, the food market needs to maintain at a high level nutritional and sensory properties of the initial fresh products. Drying of fruits and vegetables enables the availability of these products on the global markets during all seasons.

The aim of this research was to investigate the effects of different pre-treatments (i.e natural - innovative dipping solutions, microwave and ultrasound applications) and hot air drying process conditions on the drying characteristics and quality properties of selected fruits in terms of colour, shrinkage, total phenolics, antioxidant activity, volatile aroma compounds, microstructure, texture, preliminary sensorial evaluation, rehydration behaviour. New mathematical models were derived using drying parameters and new models may be very useful for the design and optimization of industrial dryers. The optimal pre-treatment and drying process conditions were determined according to the type of fruits to dry. From this viewpoint, the combined drying pre-treatment and optimal drying conditions have been proposed with the aim of reducing adverse changes and obtaining high quality/healthy dried snacks. Furthermore, 'Annurca' apple and 'Terzarola Gialla' peach (traditional Southern Italian fruits), as well as, 'Rocha' pear (traditional Portuguese fruit) were used in this research to valorize the traditional fruits.

'Annurca' apple, a Southern Italian cultivar, is known for its reddening, taste and flavour among the other types of apples, and also for health promoting effects. The aim of this part was to evaluate the effect of a novel carbohydrate/salt dipping pre-treatment, and of drying process conditions (temperature and time) on drying kinetics and quality attributes of dried apple slabs. Drying experiments were carried out by convective drying at temperatures of 50, 55, 60 and 65°C at a constant air velocity of 2.3 m/s. Pre-treatment solution provided an increment of moisture loss, and a reduction of drying time and shrinkage at all temperatures. The combination of pre-treatment and drying at 65°C assured the lowest colour changes, the best preservation of structure, less shrinkage, higher rehydration capacity and the highest score for sensorial overall acceptability. On the contrary, the used pre-treatment combined with lower drying temperatures (50 and

55°C) better preserved the antioxidant activity of apple slabs. In conclusion, the proposed solution enabled to reduce the processing time and better retain the quality attributes (i.e. physical, chemical, nutritional, sensorial) of dried apples slabs for their commercialization as snacks. Also, the influence of this pre-treatment and drying/rehydration temperatures on quality attributes of rehydrated 'Annurca' apple slabs were investigated. The rehydration experiments were carried out at both rehydration temperatures of 30 and 70°C. The combination of pre-treatment, higher drying temperature of 65 °C and low rehydration temperature of 30°C enabled to the best preservation of rehydrated apples' quality in terms of rehydration indices (i.e. water absorption capacity, rehydration ability, water holding capacity), structure and colour properties.

'Terzarola Gialla' is known traditional cultivar of peach in Southern Italy. The impacts of novel dipping pre-treatment and air-drying temperatures (45, 50, 55, and 60°C) on drying characteristics and quality attributes of 'Terzarola Gialla' peach slabs were investigated using a convective dryer and fixed air velocity of 2.3 m/s. Physical, chemical and sensory properties of peach samples were assessed. The obtained results revealed that novel pre-treatment solution not only affected the drying kinetics of peach slabs, it also improved the quality attributes. The combination of pre-treatment and higher drying temperature of (60°C) exhibited shorter drying time, better colour retention, less shrinkage, and higher rehydration capacity. Treated samples dried at 55 and 60°C had higher scores of overall quality attributes by untrained panelists. The antioxidant activity was better retained at lower drying temperatures and the highest antioxidant activity was found in treated dried ones at 50°C. In conclusion, this proposed novel solution was effective to shorten drying time of peach slabs and preserve the overall quality attributes.

'Rocha' pear is the main traditional cultivar produced in Portugal, which is characterized by flavour, crispness and also its sweetness. This part of the thesis was carried out on in collaboration with the Centre for the Biotechnology and Fine Chemistry (CBQF) of the Catholic University, Porto, Portugal. In this framework, microwave (MW) and ultrasound (US) applications were used as a pre-treatment prior to the drying process. Vacuum-packed pear slabs were treated with ultrasound in an ultrasonic bath using 35 kHz for 10 min. The microwave pre-treatment was applied to pear slabs at a frequency of 2450 MHz and microwave power 539 Watt for 4 min. Drying experiments were carried out at three different drying temperatures (55, 60, 65°C) using the pilot convective tray dryer at a constant air velocity of 0.75 m/s. The final dried pears' quality were evaluated by means of colour, shrinkage, total phenolic, antioxidant activity, texture and rehydration capacity. The ultrasound pre-treatment did not accelerate the drying process

of pear slabs, while microwave pre-treated samples had shorter drying time in comparison with control and ultrasound pre-treated ones at each investigated temperature. The combination of ultrasound pre-treatment and higher drying temperature of 60°C resulted in less colour changes and shrinkage, better retained total phenolics and antioxidant activity, as well, higher rehydration capacity. On the other hand, microwave pre-treated dried samples indicated the lower overall quality attributes. Therefore, the combined application of ultrasound pre-treatment and higher drying temperature of 60°C may be promising technique for the efficiency of 'Rocha' pear drying and the better quality pear snacks.