

Development of turnip snacks through atmospheric freeze-drying: combination of pulsed electric field pretreatment and ultrasound application

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The production of dried snacks with a high nutritional value represents an alternative to reduce food waste and increase in value production surplus of, for example, turnip. Atmospheric freeze-drying (AFD) is the drying method that better preserves the nutritional properties of food products because it does not entail high temperatures. However, this technique involves long process times. The use of new technologies such as pretreatment with pulsed electric fields (PEF) or the application of ultrasound (US) during drying could contribute to shorten the drying. In this sense, the objective of this work was to assess the effect of different PEF pretreatments and the application of US during AFD of turnip with the aim of producing snacks. For this purpose, 3 mm thick samples of turnip, non-treated (non-PEF) or PEF pretreated were dried at -10 °C and 1 m/s. Two different conditions were considered for the PEF pretreatments (electric field strength of 1.34 kV/cm, pulse width of 20 µs and frequency of 50 Hz) regarding the number of pulses: a mild treatment of 32 pulses (PEF-M) and a more intense treatment of 1438 pulses (PEF-I). During AFD, US (200 W, 25.9 kHz) were applied through a plate transducer coupled to an atmospheric freeze dryer. The results showed that, the PEF pretreatment did not significantly affect drying time compared with non-PEF samples, regardless the number of pulses applied. However, the application of US during AFD did show a clear increasing of drying rate. Moreover, the combination of PEF pretreatment and US shortened the process, being the shortening greater in PEF-I samples than in PEF-M. Therefore, it could be concluded that the combination of PEF pretreatment and US application significantly enhance the AFD processes of turnip, which could make possible the obtaining of high quality of turnip snacks.