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Spray Nebulisation Drying: Alternative Method to Produce Microparticulated Proteins

Authors : Josef Drahorad, Milos Beran, Ondrej Vltavsky, Marian Urban, Martin Fronek, Jiri Sova

Abstract : Engineering efforts of researchers of the Food research institute Prague and the Czech Technical University in spray drying technologies led to the introduction of a demonstrator ATOMIZER and a new technology of Carbon Dioxide-Assisted Spray Nebulization Drying (CASND). The equipment combines the spray drying technology, when the liquid to be dried is atomized by a rotary atomizer, with Carbon Dioxide Assisted Nebulization - Bubble Dryer (CAN-BD) process in an original way. A solution, emulsion or suspension is saturated by carbon dioxide at pressure up to 80 bar before the drying process. The atomization process takes place in two steps. In the first step, primary droplets are produced at the outlet of the rotary atomizer of special construction. In the second step, the primary droplets are divided in secondary droplets by the CO2 expansion from the inside of primary droplets. The secondary droplets, usually in the form of microbubbles, are rapidly dried by warm air stream at temperatures up to 60ºC and solid particles are formed in a drying chamber. Powder particles are separated from the drying air stream in a high efficiency fine powder separator. The product is frequently in the form of submicron hollow spheres. The CASND technology has been used to produce microparticulated protein concentrates for human nutrition from alternative plant sources - hemp and canola seed filtration cakes. Alkali extraction was used to extract the proteins from the filtration cakes. The protein solutions after the alkali extractions were dried with the demonstrator ATOMIZER. Aerosol particle size distribution and concentration in the draying chamber were determined by two different on-line aerosol spectrometers SMPS (Scanning Mobility Particle Sizer) and APS (Aerodynamic Particle Sizer). The protein powders were in form of hollow spheres with average particle diameter about 600 nm. The particles were characterized by the SEM method. The functional properties of the microparticulated protein concentrates were compared with the same protein concentrates dried by the conventional spray drying process. Microparticulated protein has been proven to have improved foaming and emulsifying properties, water and oil absorption capacities and formed long-term stable water dispersions. This work was supported by the research grants TH03010019 of the Technology Agency of the Czech Republic.

Keywords : carbon dioxide-assisted spray nebulization drying, canola seed, hemp seed, microparticulated proteins
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