

Heat Pump Drying – New Technologies and Operational Modes for Production of a New Generation of High Quality Dried Products

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Abstract

In the production of artificially dried ingredients in different dishes, soups and cereals we find today two dominating technologies, direct heated driers operated at 60°C to 90°C and vacuum freeze drying operated below –30°C. Direct heated dryers have a lower production costs than vacuum freeze dryers but with a much lower quality of the dried product. Vacuum freeze dryer, on the other side, is so expensive that its use is limited. This paper presents a new technology based on heat pump drying with production costs considerably lower than vacuum freeze drying but with similar qualities of the dried product. The focus is on the design, dimensioning and operation of such heat pump dryers using a combined mode with drying temperatures below and above the product freezing point.

By using heat pumps in drying of heat sensitive materials drying temperature and relative humidity can be controlled. The technology saves energy and is more environmentally friend than direct heated dryers. Several materials have been dried in test plants, like fish products, fruits, vegetables and dairy products. These products quality and properties can be controlled as for example color, taste, bulk density and rehydration. By changing the operation mode and time period with atmospheric freeze drying quality parameters will be influenced. Generally, the longer this time period is, the lower the product shrinkage and the higher the rehydration index.

The interaction between the air side of the plant and the heat pump is studied and different system solutions with ammonia as the working fluid are scrutinized. Consequences on the dryer thermal efficiency and the heat pump coefficient of performance are presented.

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