Foam-mat drying of prickly pear and beetroot: Drying kinetics and comparison with conventional drying methods.

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Drying is an ancient technique which still remains immensely relevant for the processing of perishable foods, like fruits and vegetables. Foam-mat drying is basically a variation of conventional hot air drying, which usually is the simplest and cheapest method. In the present work, foam-mat drying has been investigated on prickly pear juice and beetroot pulp, compared to conventional drying approaches (spray drying for prickly pear and hot air drying for beetroot). Various proteins (albumin, whey protein, casein, pea protein, soy protein) and polysaccharides (xanthan gum, carboxymethyl cellulose) were tested in a range of concentrations. Buffers (pH 3-6) were also foam-mat dried as a model to evaluate the effect of pH on foaming and drying properties of aqueous systems. Foaming capacity and stability, drying kinetics, betalain retention, powder density and color were evaluated. For aqueous systems and prickly pear juice, proteins alone failed to offer good and stable foams. Xanthan gum addition drastically improved these properties, yielding better stability than carboxymethyl cellulose (0% drainage even at 0.25% concentration). Although albumin exhibited great foaming properties (overrun up to 250%), its drying performance was poor, leading to lower drying constant values. Beetroot on the other hand, proved to have very good foaming properties by itself, even though higher mixing times (15 min) were required. Mixing beetroot into a foam led to a 35% increase in the mass of beetroot that can be dried per hour, compared to unmixed beetroot pulp. Beetroot belatains were preserved at all drying temperatures. Overall, the findings of this study suggest that foam-mat drying has a great potential both for simplifying and for reducing the cost of drying. Search for suitable proteins- polysaccharide systems for foam-mat drying has the challenge that good foaming properties are required, but the blend must not form films with poor water permeability. Hence, future work should aim to find such systems that could be utilized in a great variety of juices and other aqueous systems.