Combination of two food wastes - pomegranate peel and orange juice by-product - into one multipurpose functional food

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Pomegranate (*Punica granatum* L.) is one of the oldest known edible fruit that contains the highest concentration of total polyphenols in comparison with other fruits studied. During the industrial processing of pomegranate, large volumes of industrial wastes (i.e. peels and seeds) are produced, disposal of which has become an environmental problem. Pomegranate peel is the main waste fraction of pomegranate fruits, which have been widely studied, because it contains numerous biologically active compounds, including natural antioxidants such as phenolic acids and flavonoids. The objective of this work is to develop a new method for pomegranate peels application in food industries based on the spray drying encapsulation of the phenolics compounds.

The replacement of maltodextrins as carriers for the spray drying of sticky and sugar based bioactives is an important development for the food industry. The properties of maltodextrins, in terms of undesired taste alteration and also being an unnatural additive, mean that a suitable alternative carrier for spray drying needs to be found. This carrier needs to have appropriate encapsulation properties. It is possible that natural fibers may be able to fulfill this role, and this possibility has been investigated here. During orange juice production, only around the half of the fresh orange weight is transformed into juice, generating great amounts of residue, which accounts for the other 50% of the fruit weight. This huge amount of waste is, in most cases, spread on soil in areas adjacent to the production locations, for its final use as a raw material in animal feed, or else it is burned. This method of waste handling produces highly polluted wastewater in terms of chemical and biological oxygen values, which can negatively affect the soil and the ground and superficial waters. In this work, orange juice industry by-product was used to obtain high dietary fiber powder. The effect of processing variables (direct drying and washing previous to drying) on functional properties, fiber content, and physicochemical properties of the fiber was evaluated. The obtained fiber powder had good functional and favorable physicochemical characteristics to be used as a wall material.

Total phenolics extracted from pomegranate peels by ultrasound-assisted technique were encapsulated by spray drying using orange fiber powder as wall material. The effects of various parameters on encapsulation efficiency and yield were studied: inlet air temperature, (150-190 ^{o}C); drying air flow rate, (17.5-22.8 m^3/h); ratio of wall to core material, (2.3/1-9.0/1); compressed air flow, (0.6-0.8 m^3/h). In all experiments the feed solids concentration was 5% w/w. Characterization of powder properties was accomplished to determine if successful development of the product is achieved. Measurements of moisture content, bulk density, and hygroscopicity are all important considerations.

Thus, the proposed encapsulation process combines two food wastes that are beneficial to health - the edible fruit fiber and the antioxidant pomegranate peel extract - into one multipurpose functional food.