Can storage stability of citrus fiber powder be explained by modifications of their physicochemical properties?

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Citrus, consisting of orange, lemon, mandarin, and grapefruit, is the most important crop in the world, with worldwide production of 144 million tons in 2019. Most of the fruits produced are used for juice production, pectin, and flavonoid extraction, which results in a huge quantity of by-products corresponding to 50-60% of the original whole fruit weight. Biopolymers are the main constituents of these agro-industrial wastes and present many properties that make them interesting for applications such as sustainability, inexpensive, biodegradability, friendly to the environment, and recyclability. Citrus fiber powders (CFP), manufactured from pectin extraction of lemon juice industry by-products, are characterized by an ability to retain moisture and good emulsifying stability and could have many food applications in baked products, meats, dairy products, sauces, and dressings. The fibers are dried to facilitate distribution and commercialization as a food ingredient. The quality of the dehydrated powder is influenced by the processing and storage condition. However, the mechanism of the modifications induced by storage on functional properties of the powders and especially rehydration properties were not understood. This study aimed at investigating the mechanisms responsible for CFP stability upon storage. Samples were stored in different conditions of temperature and humidity for 12 months. Gelation, water holding capacity, and swelling capacity were used to evaluate the effect of storage on functional properties. In addition, powder surface composition, morphology, and chemical and physical properties were analyzed to understand the modification of physicochemical properties during storage. The results highlighted that properties related to moisture retention, emulsifying stability, and rehydration decreased with increasing aging time. The loss in functionality was accelerated at 40 °C and 75%RH compared to 25 °C and 30% RH. These modifications might be linked to the chemical structure of the biopolymers further than to surface composition and morphology.