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Comparison of the sorption properties of starch from Horse chestnut (*Castanea sativa* Mill.) and London plane tree (*Platanus acerifolia*) fruits

Abstract: Plantain, commonly referred to as a cooking banana, and sweet chestnut, known as marron, are tree fruits that are commonly found only in selected regions of the world. The fruits of both plants grow on trees, which undoubtedly constitutes a shared characteristic. Moreover, both plantain and sweet chestnut are rich sources of dietary fiber, vitamin B6, vitamin C, and potassium. Therefore, it is worthwhile to seek as many applications as possible for these valuable raw materials. Increasing attention has recently been paid to gluten-free diets in the context of celiac disease. Both plantain and sweet chestnut are processed into powdered forms with a high starch content. It is possible that these gluten-free powders exhibit properties similar to those of gluten-containing flours and may become useful in everyday culinary practice for individuals with celiac disease. The aim of the present study was to compare the hygroscopic properties of two high-starch powders obtained from the fruits of sweet chestnut (*Castanea sativa* Mill.) and London plane tree (*Platanus acerifolia*). The comparison of these properties was carried out on the basis of sorption isotherm parameters identified using the Brunauer–Emmett–Teller (BET) and Guggenheim–Anderson–de Boer (GAB) models. The empirical data forming the basis for the application of the BET and GAB transformations were obtained using the static desiccator method. Water content was determined in accordance with the Polish standard PN-EN ISO 712:2012 using an SLW 75 SMART laboratory dryer. Water activity was measured using an AquaLab 4TE device (Decagon Devices, Inc., Pullman, WA, USA). The size, shape, and number of particles in the tested powders were characterized using a Morphologi G3 automatic particle analyzer (Malvern Instruments). The obtained results indicate that the tested powders differed in their initial state, both in terms of the size and shape of the particles composing them, as well as in terms of their initial water content and water activity. Particles of the plane tree powder bound water more strongly than particles of the sweet chestnut powder. The course of the sorption isotherms also indicated that these powders differed in terms of hygroscopicity. The identified isotherm parameters demonstrated that the interaction between the particles of both powders and water molecules was physical in nature. The monolayer capacity of plane tree powder particles was 1.6 to 2.1 times greater than that of sweet chestnut powder, which confirms its higher hygroscopicity. Analysis of the results in terms of size and shape parameters showed that particles of the plane tree powder were larger and more massive than those of the sweet chestnut powder. Both tested powders were characterized by a shape markedly deviating from circularity, while particles of the plane tree powder were additionally distinguished by lower convexity. This observation, indicating a greater development of the particle surface in the plane tree powder, may be associated with its higher monolayer capacity and greater ability to bind water, which in turn leads to a reduction in water activity. The findings of this study provide new information relevant to the management of the production process, as well as to the safety and stability of these powders.