

IMPACT OF VEGETABLE FLOURS ON STRUCTURAL CHARACTERISTICS OF SUSTAINABLE BREAKFAST CEREALS OBTAINED BY EXTRUSION PROCESSING

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The use of vegetable flours in the formulation of processed foods is interesting, as they permit appeals for healthy, natural, and “clean label” products, also attending demands for sustainability and waste reduction. Among the technologies used in food preparation, we can highlight thermoplastic extrusion, due to advantages such as versatility in the products obtained, low production costs with high yield, and the non-generation of industrial waste, which allows the classification of this technology as environmentally friendly (“green processing”). Expanded breakfast cereals are among the products made by extrusion processing, and in recent years they have acquired a different profile due to the use of raw materials rich in nutrients such as fibers, bioactive compounds, minerals, proteins, and vitamins, improving their nutritional quality. Therefore, this work evaluated the use of vegetable flours from carrots (CF), spinach (SF) and beets (BF), rich in natural pigments (carotenoids, chlorophylls and betalains, respectively), obtained from vegetables with visual characteristics that are not attractive for retail marketing (too large, too small, crooked), as ingredients in a multi-colored breakfast cereal formulation, obtained by thermoplastic extrusion processing. For the preparation of the breakfast cereals, four tests were carried out, three were made by mixing broken rice (RB) with vegetable flours (CF, SF and BF) (90:10), and another using only broken rice (BR, as control). The cereals obtained (CFBC, SFBC, BFBC and BRBC) were evaluated regarding structural characteristics: expansion, density, alveoli formation (ImageJ software) and scanning electron microscopy (SEM). The incorporation of vegetable flours affected the physical structure of SFBC, CFBC and BFBC cereals, as evidenced by reduced expansion, increased density, greater surface porosity, formation of smaller and irregular alveoli when compared to BRBC. This is mainly due to the composition of vegetable flours, the low availability of starch and the presence of fibers and other components. However, the use of vegetable flours as ingredients in the preparation of expanded extruded breakfast cereals, in the proportion used in this work, proved to be promising for the development of sustainable, naturally colored breakfast cereals, that can be classified as “clean label”.