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## Dry fractionation of wheat bran for the manufacture of functional ingredients

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The current wheat milling process aims at recovering white flour (starchy endosperm) and discarding bran and germ. Wheat bran is thus a by-product used for animal feeding, even if due to its high nutritional potential, it could be used as food ingredients to increase the nutritional quality of human foods. Dry fractionation processes can be developed in order to make better use of all the different parts of wheat grain, and aim at recovering separately the different layers of the bran, to produce fractions rich in the different bran tissues, like pericarp-rich fractions (rich in fibers) or aleurone-rich fractions (rich in vitamins, minerals, antioxidants). A study on the different steps of wheat bran fractionation has been carried out. A methodology based on biochemical markers of the different bran tissues has been developed in order to track the different parts of the grain and their behaviour upon processing. The potential of two processes was studied in particular : ultra-fine grinding and electrostatic separation. First, the mechanical properties of the different bran layers were studied, to define the conditions in which these bran layers were the most brittle. Grinding tests were then carried out at small scale, to evaluate the effect of low temperatures on particles size reduction. As very fine particles were obtained, ultra-fine grinding was tested at larger scale to compare cryogenic and ambient grindings, and to produce ultra-fine bran with a median particles diameter inferior to 50 $\mu$ m. In these ultra-fine fractions, most of the bran layers and cellular structures were found to be dissociated. In a second time, the sorting of bran particles according to their origin (aleurone, pericarp...) was studied, using electrostatic separation. Therefore, the electrostatic properties (like the ability of particles to get charged by triboelectrification and to keep an acquired charge) were studied for whole bran and for pericarp-rich and aleurone-rich fractions. As these different types of particles were found to exhibit contrasted properties, the electrostatic separation of ultra-fine bran was carried out at pilot scale, and allowed to obtain bran fractions that were found to exhibit different biochemical compositions and to contain different bran tissues proportions (one richer in pericarp particles, and one richer in aleurone particles). The different fractions obtained by ultra-fine grinding and electrostatic separation were incorporated into white flour to prepare pseudo whole breads. These breads then underwent an *in vitro* digestion, so the influence of the bran fractions on the bioaccessibility of bioactive compounds was measured. This study showed that wheat bran and bran fractions have a good potential as food ingredients.