Semitechnical methods for the isolation of arabinoxylans from wheat bran

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Wheat bran is an important by-product of the wheat milling industry and accounts for 11 to 19% of the grain. For rye and barley it amounts to around 22 %. It mainly consists of dietary fiber (43-53%). The fiber fraction includes arabinoxylans (AX) (38-55%), cellulose (16-30%), lignin (5-20%) and other nonstarch polysaccharides.

Dietary fibers are generally associated with a reduction of the risk of civilization diseases. AX included in the fibers are prized for their potential to prevent colon cancer. Health benefits don´t depend only on the content of AX, but also on their physical properties such as solubility, viscosity, branching and molecular weight. Physical properties, e.g. the molecular weight of AX is influenced by cultivation conditions and cereal processing technologies. Arabinoxylans are readily fermented by the colonic microflora to short chain fatty acids (SCFA - acetate, propionate, butyrate). SCFA serve as an energy source for intestinal epithelial cells and reduce the pH in the intestine, thereby preventing the overgrowth of pathogenic bacteria. An important part of the AX is ferulic acid, which has antioxidant properties. The aim of this study was to optimize the parameters of the individual isolation steps for an economic production of AX from wheat bran. The experiments were carried out in a laboratory and semitechnical scale up to 10 kg of wheat bran in one batch. The content of AX was 24.5 % in dry matter (d.m.).

First of all starch and cold water-soluble compounds were separated by aqueous suspension and wet sieving. The subsequent extraction was performed either with hydrogen peroxide in a alkaline medium or with water under elevated pressure in a stirred autoclave. From the aqueous slurry of the bran the solids were removed by centrifugation using laboratory centrifuges. For preconcentration of AX and separation of low molecular weight compounds ultra- and diafiltration were choosen, using polysulfone membranes with a molar cut off of 10,000 g/mol. AX was subsequently precipitated from the solution by addition of 96% ethanol with a mass ratio of 3.2 to 1. To increase the shelf-life of the final products they were freeze or spray dried.

High purity AX (69.8% in d.m.) was achieved by using hydrogen peroxide in an alkaline medium. In this case the molar mass M_w was 70,200 g/mol. The isolated AX is excellent soluble in cold water and can be used such as a thickening agent in the food industry or for technical purposes.

By using water in a temperature range of 147-163°C as an extraction medium, the purity of the final products was considerable lower (47.3-58.6% AX in d.m.) The molar mass of these AX-products was significantly affected by the extraction conditions and ranged from 11,100-220,000 g/mol. The cold water solubility was poor.