Production of ferulic acid from wheat bran

Project number	219-0004		
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The challenge

Ferulic acid is a phenolic acid, which has many industrial applications, including: as a precursor for the synthesis of natural biovanillin through fermentation; and as an active agent in sun creams and anti-ageing skin care products due to its high antioxidant activity and UV absorbing capacity. It also has several potential applications for flavour/aroma in the pharmaceutical and chemical industries, as a precursor for the synthesis of various aromatic molecules, through processes based on synthetic chemistry or microbial and enzyme transformations. Ferulic acid is currently produced commercially from rice bran pitch, the waste oil generated during the production of rice bran oil. However, due to the increased commercial applications of ferulic acid, the industry is interested in obtaining ferulic acid from alternative, sustainable resources. Among the plant materials containing ferulic acid, wheat bran has a very good potential as it contains high amounts (5–15 g/kg) and is simpler to fractionate than corn bran.

The project

The aims of the proposed project are to study the effect of milling and debranning on the ferulic acid content of wheat bran and develop a scalable, efficient and cost effective process for producing ferulic acid from commercially available, low value wheat bran fractions.

Wheat bran is an abundant raw material, with production estimated at approximately 1 million tonnes per year in the UK, and is primarily used as animal feed for the cattle industry. Although the potential for producing ferulic acid from wheat bran is significant, there is currently little knowledge:

(i) on the ferulic acid content of various wheat cultivars from various locations in the UK,
(ii) on the effect of mechanical processing of wheat grains, i.e. conventional milling and debranning (pearling)
(iii) on the ferulic acid content of wheat bran,
(iv) on the development of a scalable bioconversion process, based either on the enzymatic deconstruction of wheat bran using a mixture of hydrolases, capable of releasing the ferulic acid linked to the arabinoxylans of wheat bran, and
(v) on the cost and scalability of such a process.

This research will address the above issues and generate the technical know-how for the development of a scalable, cost-effective and efficient process with commercial potential. For the development of the process, one industrial partner (Biocatalysts Ltd) will provide a commercial endo-xylanase and a novel highly active feruloyl esterase; whereas another industrial partner (Premier Foods, Rank Hovis) will provide us with bran samples from various stages of commercial milling processes and from different flour milling plants.

The benefits
The outcomes from the research are likely to benefit primary producers, such as wheat growers and millers, as they will gain a better understanding of the potential added value to their products by knowing the ferulic acid content of various wheat varieties and of bran fractions at different stages during conventional milling and debranning. Also, industrial consortia including secondary producers, such as chemical manufacturers and biorefinery companies, will have the opportunity to exploit the new technology and develop a commercial process for the production of a medium value product (ferulic acid) with high market potential from wheat bran.

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Lead scientist	Dr Dimitris Charalampopoulos, University of Reading
Scientific partners	Rothamsted Research
Industry partners	Biocatalysts Limited Premier Foods
Government sponsor	