

**Title** Enhancing the availability of natural antioxidants in wheat-based food ingredients and food products through improved post-harvest treatments and processing conditions

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### **Abstract**

Wheat grain has significant antioxidant contents concentrated in the bran fraction, most of which may not be bioavailable in humans because they are not released from matrix materials during digestion. The present study developed solid-state enzymatic and yeast post-harvest treatments, and investigated the effects of these treatments and food processing on the extractable antioxidant properties of whole-wheat based food ingredients and food products. Antioxidant properties investigated in this study included scavenging capacities against cation ABTS radicals, peroxy radicals (ORAC), hydroxyl radicals, and DPPH radicals, and total phenolic contents and phenolic acid compositions.

The first part of this research developed and validated a high-throughput fluorometric hydroxyl radical scavenging capacity (HOSC) assay. The HOSC assay utilized a Fe(III)/H<sub>2</sub>O<sub>2</sub> Fenton-like reaction to generate hydroxyl radicals, fluorescein as detector probe, trolox as an antioxidant standard, and area under the curve measurements to quantify scavenging capacity. The hydroxyl radical purity and potential solvent interference in the assay system were evaluated using electron spin resonance. The HOSC assay was found to have acceptable performance characteristics including linear range, accuracy, and reproducibility.

The second part of this study investigated the potential of solid-state enzyme and yeast treatments to improve wheat bran antioxidant properties. Both enzyme and yeast treatments were capable of increasing available wheat bran antioxidant properties. Reaction parameters found to influence the effectiveness of these treatments to enhance wheat bran antioxidant properties included enzyme preparation and reaction moisture content for enzyme treatments, and yeast preparation along with dose and treatment time for yeast treatments.

The final part of this research evaluated the effects of processing conditions including bran particle size, fermentation time, and baking conditions on the antioxidant properties of a whole-wheat pizza crust. Baking increased extractable antioxidant properties up to 82%. Fermentation time caused some significant

increases, while bran particle size had no influence on extractable whole-wheat pizza crust antioxidant properties.

This study suggests that post-harvest treatment of wheat bran and optimized processing conditions for whole-wheat food products are potential approaches for increasing their extractable antioxidant properties.