

## Abstract

The *Brassica* genus, which belongs to the *Brassicaceae* family, contains plants like kale, broccoli, and cabbage that are important for agriculture and nutrition. Bioactive compounds such as polyphenols, which are well-known for their antioxidant properties and possible health advantages, are abundant in these vegetables. This study is to obtain the optimal condition that can optimize broccoli sprouts' best polyphenol and antioxidant activity using UAE. The parameters affecting extraction were analyzed and optimized using RSM with Box-Behnken Design (BBD), including ultrasonic power, extraction time, and ethanol concentration. The extracts were evaluated for extraction yield and total phenolic content using the TPC assay and antioxidant activity using ABTS, DPPH, and FRAP assays. The highest yield (39.41%), TPC (51.26 mg GAE/g BSE), ABTS (87.71%), DPPH (81.71%), and FRAP (56.67 mg TE/g BSE) were obtained under different extraction conditions. According to the results, the most important parameters for both TPC and ABTS were extraction time and ethanol concentration; ultrasound power had a smaller effect. In contrast, DPPH, FRAP, and yield responses were not significantly affected by the variables studied, and thus, no predictive models were developed. Furthermore, the optimal condition generated from the model and adjusted to suit the practical conditions was 70% ultrasound power, 25 minutes, and 25% ethanol concentration. The model's dependability was validated through validation experiments, where prediction errors were less than 10% and actual values closely correlated with predicted ones. These results support the potential of broccoli sprouts as a rich source of polyphenols and demonstrate the effectiveness of UAE for extracting antioxidant compounds.

**Keywords:** *Broccoli sprouts extract, polyphenols, antioxidant activity, ultrasonic-assisted extraction (UAE), and response surface methodology (RSM)*