



Abstract

Optimization of Extraction Conditions for Bioactive Phenolic Compounds from Orange Peels Using Response Surface Methodology [†]

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Orange peels, often deemed as waste, are in fact a natural reservoir of polyphenols, which are phytochemicals with antioxidant properties beneficial to health. Regular consumption of these, particularly through infusion, can enhance overall well-being and mitigate the risk of chronic diseases.

Optimizing the extraction process of orange peels results in a higher-quality infusion and increased yield. This ensures maximum extraction of beneficial compounds, enhances taste and aroma, and preserves heat-sensitive nutrients. By fully harnessing these bioactive substances, it becomes feasible to augment the concentration of antioxidants in the extracts, thereby offering additional health advantages.

The aim of this study is to optimize the infusion-based extraction conditions to elevate the total polyphenols content (TPC) in the extract. To achieve this, we employed response surface methodology (RSM) in conjunction with a Box Behnken Design plan (BBD). We simulated interactions among three extraction variables: the mass–solvent ratio (from 1:100 to 1:50 g/mL), extraction temperature (from 40 to 60 °C), and extraction time (from 15 to 30 min). Their effects on the TPC, expressed in mg GAE/g DW, were scrutinized.

ANOVA analysis underscored the significant quadratic model ($p = 0.0005$), with a regression coefficient R^2 exceeding 0.9, signifying a robust correlation between the chosen extraction conditions and polyphenols concentration. Optimal conditions for maximal polyphenols extraction encompassed a plant–solvent ratio of 1:50 g/mL, an extraction temperature of 60 °C, and an extraction duration of 30 min. These parameters yielded a higher TPC output of 1600 mg GAE/g DW.

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