

Article

Optimisation Using Response Surface Methodology of Quality, Nutritional and Antioxidant Attributes of ‘Wichita’ Pecan Nuts Roasted by Microwaves

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Abstract: Pecan (*Carya illinoensis*) nuts are rich in functional compounds (unsaturated fatty acids, phytosterols, polyphenols, and tocopherols) associated with various health benefits. Commercially, pecan nuts are roasted to enhance their physical, chemical, and sensory properties. In the present study, response surface methodology (RSM) was used to optimise the quality and nutritional and antioxidant attributes of ‘Wichita’ pecan nuts roasted by using a microwave process with a range of microwave power (96.45–803.55 W) and roasting time (1.37–5.62 min). The microwave-roasted pecan nuts were analysed for hardness, total colour difference (TCD), and radical scavenging activity and modelled using the central composite design. The results showed that microwave power and roasting time significantly ($p < 0.05$) influenced the quality attributes of the pecan. The quadratic model adequately described the changes in TCD and hardness, respectively, while the 2FI model adequately described the changes in DPPH radical scavenging activity. To obtain the desired pecan nuts quality attributes (TCD = 1863.391; hardness = 28.755 N and DPPH radical scavenging activity = 33.677 mmol Trolox/g), the determined conditions were 700 W and 2.24 min, with a desirability of 0.557. The primary unsaturated fatty acids, including *cis*-oleic, *cis*-linoleic, α -linolenic, and stearic acids, were not affected ($p < 0.05$) by microwave roasting the pecan nuts at determined conditions. Volatile compounds, such as alcohols, aldehydes, ketones, lactones, hydrocarbons, and carboxylic acids, were identified in both raw and microwave-roasted pecan nuts, with limonene, which possesses various health properties, being the major volatile compound. It can be concluded that microwave roasting may be optimised using response surface methodology to produce quality pecan nuts that can be used as snacks or as an ingredient in other snack products.

Keywords: microwave roasting; pecan nuts; response surface methodology; radical scavenging activity; total colour difference; fatty acids



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1. Introduction

Pecan (*Carya illinoensis*) nut, a member of the Juglandaceae family [1], is native to North America and primarily cultivated in Mexico, South Africa, Canada, Brazil, and Australia [2]. Mexico and the United States of America are the top two producers of pecan nuts, accounting for approximately 93% of the global production and an annual production of more than 40,000 metric tonnes [3].

Pecan nuts have been part of the human diet for centuries and are consumed either raw or roasted [4]. In addition, they are commonly used as an ingredient in snacks and confectionary products [3]. Pecan nuts contain functional compounds (unsaturated fatty acids, phytosterols, polyphenols, and tocopherols) [5–7] with various health benefits, including the reduction of low-density lipoprotein cholesterol [5] and the prevention of

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