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RESEARCH ARTICLE

# Changes of Phytochemical, Antioxidant Characteristics of Sunflower Seed Roasting

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## Abstract

Sunflower seeds have various target specific biological activities. There has been an increase of awareness and interest in this valuable medicinal plant in recent times. Roasting is the key process in the production of value-added nuts having better taste, aroma, and a crunchy texture and exhibit enhanced crispiness. However changes of phytochemical, antioxidant characteristics of sunflower seeds during roasting have not been well understood. This research evaluated the roasing method affecting the phytochemical and antioxidant characteristics of sunflower seeds. The total polyphenol, flavonoid contents, the antioxidant activity characteristics in sunflower seeds were examined thoroughly. It may be desirable to use roasting at 200°C in 15 minutes to minimize the loss of total polyphenol, total flavonoid contents; maintain the most antioxidant activity.

**Keywords:** *Sunflower seed, Roasting, Total polyphenol, Total flavonoid, Antioxidant.*

## Introduction

Sunflower seeds are attributed to the presence of phytosterols, unsaturated fatty acids, proteins, variety of vitamins and minerals [1]. Sunflower seeds possess significant antioxidant activity [2]. The antioxidant potential of defatted sunflower meal and sunflower seed shells is determined mainly by the content of phenolic compounds [3, 4]. Sunflower seeds are rich in polyunsaturates (linoleic acid) and monounsaturates (oleic acid) and low in saturates [5].

Sunflower oil is susceptible to oxidation during frying and roasting [6]. The influences of microwave heating on the composition of sunflower seeds and to extend our knowledge concerning the changes in oxidative stability, distribution of FA, and contents of tocopherols of sunflower seed oil were explored [7]. The effect of roasting method and conditions on some physicochemical properties of sunflower seed kernel was investigated [8].

The effect of roasting conditions, including hot air temperature (120-160°C), infrared power (400-600 W) and roasting time (3-10 min) on energy and specific energy consumption, color parameters, texture, moisture content, chemical properties, pH and total phenolic contents, peroxide value and sensory properties of sunflower kernel were investigated [9].Objective of this our study focused on the effectiveness of roasting method affecting the phytochemical and antioxidant characteristics of sunflower seeds.

## Material and Method

### Material

Sunflower seeds were harvested from Soc Trang province, Vietnam. After collecting, they must be conveyed to laboratory for experiments as soon as possible. Chemical substances such as Folin-Ciocalteu reagent, $Na_2CO_3$, Gallic acid, $NaNO_2$, $AlCl_3 \cdot 6H_2O$, NaoH, catechin, ethanol, methanol, potassium per sulfate, phosphate buffer, potassium hexacyanoferrate, trichloroacetic acid solution, ferric chloride, ascorbic acid, ferrous sulfate, FRAP reagent, acetate buffer, were all supplied from Van Dai Phat Co. Ltd.

### Researching Procedure

Sunflower seeds (300g per sample) were roasted in different condition (180°C in 20 minutes, 200°C in 15 minutes, 220°C in 10 minutes).

Thereafter, they were cooled by air at ambient temperature. All treated samples were then stored in dry cool place before analysis.

### Physico-chemical, Sensory and Statistical Analysis

Total phenolic (mg GAE/ 100g) was estimated spectrophotometrically using Folin-Ciocalteu reagent [10]. Total flavonoid (mg GE/ 100g) was estimated spectrophotometrically [11]. DPPH (%) and ABTS (%) radical-scavenging activity were determined using reducing power assays [12]. The FRAP of sunflower seeds extract was determined as described by Chung H et al [13]. The experiments were run in triplicate with three different lots of samples. Statistical analysis was performed by the Stat graphics Centurion XVI.

## Result & Discussion

### Total Polyphenol and Flavonoid Contents

The total polyphenol and flavonoid contents in sunflower seeds subjected to different drying treatment methods are presented in table 1. Raw samples showed the highest total polyphenol content of 42.18 mg GAE/100g dry weight. Roasted samples at 180°C in 20 minutes exhibited the lowest total polyphenol content of only 24.36 mg GAE/100g dry weight. Raw samples contained higher total flavonoid contents both roasted at 200°C in 15 minutes and 220°C in 10 minutes.

The highest total flavonoid contents of samples after being roasted at 200°C in 15 minutes and 220°C in 10 minutes were 13.27 and 10.34 mg CE/100g dry weight, respectively, both lower than that of raw samples. Based on these results, it may be desirable to use roasting at 200°C in 15 minutes to minimize the loss of total polyphenol and total flavonoid contents.

**Table 1: Total polyphenol and total flavonoid contents in raw, roasted sunflower seeds**

| Roasting treatment | Total polyphenols (mg GAE/100g) | Total flavonoids (mg CE/100g) |
|---|---|---|
| Raw | 42.18±0.12$^{a}$ | 17.85±0.07$^{a}$ |
| Roasting 180°C, 20 minutes | 24.36±0.28$^{d}$ | 7.72±0.12$^{d}$ |
| Roasting 200°C, 15 minutes | 36.45±0.13$^{b}$ | 13.27±0.09$^{b}$ |
| Roasting 220°C, 10 minutes | 30.74±0.21$^{c}$ | 10.34±0.23$^{c}$ |

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%)

Sunflower seed kernels were roasted under two different conditions, i.e. by microwave at 2450 MHz and 900 W and by electrical oven at 190°C for different time periods. Roasting had significant effect on color as the kernels became darker over time. Roasting resulted in reduced moisture content extracted oil percentage and hardness of the kernels while acidity and peroxide values increased as the time of roasting was prolonged. Fatty acid composition was found within the standard range for both methods. Regarding the sensory property, the kernels roasted by electrical oven showed more total acceptability than microwave-roasted ones [8].

### Antioxidant Activity

DPPH was a stable free radical, which accepts an electron or hydrogen radical to become a stable diamagnetic molecule. It was usually used as a substrate to evaluate anti-oxidative activity of antioxidants [14]. There was positive correlation between the quantity of phenolic compounds and the DPPH free radical scavenging effect [15, 16].

ABTS was a protonated radical. It decreased with the scavenging of the proton radicals [17].The FRAP assay (ferric reducing ability of plasma) evaluates total antioxidant power and is chosen to assess the presumable effects of medicinal plants [18]. FRAP method is sensitive in the measurement of total antioxidant power of the fresh biological fluids [19, 20].

The antioxidant capacity of Sunflower seeds was compared among the roasting conditions: 180°C in 20 minutes, 200°C in 15 minutes and 220°C in 10 minutes. The highest inhibition of DPPH radical formation in raw sample was 36.41% compared with 27.61%, 32.19% and 30.56% in roasting at 180°C in 20 minutes, 200°C in 15 minutes and 220°C in 10 minutes, respectively. Raw, roasted 180°C in 20 minutes, 200°C in 15 minutes and 220°C in 10 minutes of treated samples

 

showed ABTS radical-scavenging activities at 31.12%, 25.38%, 28.49%, and 26.13%, respectively. Raw, roasted 180°C in 20 minutes, 200°C in 15 minutes and 220°C in 10 minutes of treated samples showed FRAP at 0.42%, 0.21%, 0.37% and 0.30%, respectively (see Table 2). Based on these results, it may be desirable to use roasting at 200°C in 15 minutes to minimize the loss of antioxidant activity

**Table 2: Antioxidant activity in raw, roasted sunflower seeds**

| Roasting treatment | DPPH (%) | ABTS (%) | FRAP (mm $Fe_2^+$/L, %) |
|---|---|---|---|
| Raw | 36.41±0.14$^a$ | 31.12±0.07$^a$ | 0.42±0.00$^a$ |
| Roasting 180°C, 20 minutes | 27.61±0.09$^d$ | 25.38±0.04$^d$ | 0.21±0.01$^c$ |
| Roasting 200°C, 15 minutes | 32.19±0.12$^{de}$ | 28.49±0.09$^{de}$ | 0.37±0.02$^d$ |
| Roasting 220°C, 10 minutes | 30.56±0.20$^e$ | 26.13±0.02$^e$ | 0.30±0.00$^e$ |

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%)

## Conclusion

Sunflower seeds, a nutrient dense food have been found a therapeutic potential role with various health benefits. They are used widely as functional food with different phytochemical attributes.

Through this research, changes of phytochemical, antioxidant characteristics of sunflower seeds during drying have been well understood. This will help producers having better knowledge to preserve their valuable components during processing and preservation.

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