

## THE EFFECT OF TEMPERATURE AND ROASTING DEGREE ON THE TOTAL PHENOLIC CONTENT OF COFFEE BREWS

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**Abstract:** Coffee has been consumed throughout the world because of its aroma, taste and physiological effects. The aim of this study was to determine changes in total phenolic content of coffee brews prepared from coffee roasted at temperatures of 200°C, 220°C and 240°C. At roasting temperature of 220°C coffee is roasted to give light, medium and dark coffee samples. The total phenolic content of coffee brews was determined by the Folin-Ciocalteu method. The total phenolic content is depending on temperature and roasting degree. Our results suggest that light and medium roasted coffee might protect cells from damages.

**Keywords:** *coffee, roasting temperature, degree of roasting, total phenolic, antioxidant activity*

### INTRODUCTION

Coffee is the seed of a cherry from a tree which belongs to *Rubiaceae* family. Although there are different species of coffee plants, there are 2 specific species, *Arabica* and *Robusta* used for trade. Coffee tree can grow only in certain regions with tropical

climates. The conditions for a coffee tree to grow are: high altitude, abundance of water, and a temperature between 19-30°C [1].

Coffee is a mixture of chemical compounds which are either occurring or formed during the roasting process.

Green coffee beans contain several phenolic compounds. The chlorogenic acids are esters formed between quinic acid and cinnamic acids such as caffeic, ferulic and p-coumaric acid [2].

During roasting, coffee beans are heated at 200-240°C depending on the degree of roasting (light, medium, and dark roasted coffee). The beans change their color with the temperature increase and their density decreases due to the volume increase of the beans. The chemical composition of the beans is modified and hundreds of chemicals which give coffee's aroma and taste are formed. Roasting is responsible for a decrease in the content of protein, aminoacids, chlorogenic acid and for the increase in volatile compounds and melanoidins formation [3]. Chlorogenic acids are degraded proportional with the roasting degree; the loss is higher in dark roasted coffee. Degradation of chlorogenic acids leads to quinic acid and to others phenols found in coffee's aroma [4].

## MATERIALS AND METHODS

*Arabica* coffee beans were roasted in a batch cycle roaster at 200°C, 220°C and 240°C. At roasting temperature of 220°C, coffee beans were roasted to give light, medium and dark coffee samples. All roasted coffee samples were ground to extract the total phenolic [5, 6].

Coffee brews were prepared with distilled water at 90°C followed by filtration. The content in total phenolic of coffee brews was monitored by Folin-Ciocalteu method using tannic acid as standard [7]. Standard tannic acid solution (0.1mg/mL) were obtained by dissolving 25 mg tannic acid in 25 mL distilled water and then diluted 1:10 in distilled water.

To prepare the etalon curve, volumes of the above standard tannic acid solution were added. The volumes were diluted with water to obtain a known concentration in tannic acid and absorbances at 725 nm were recorded.

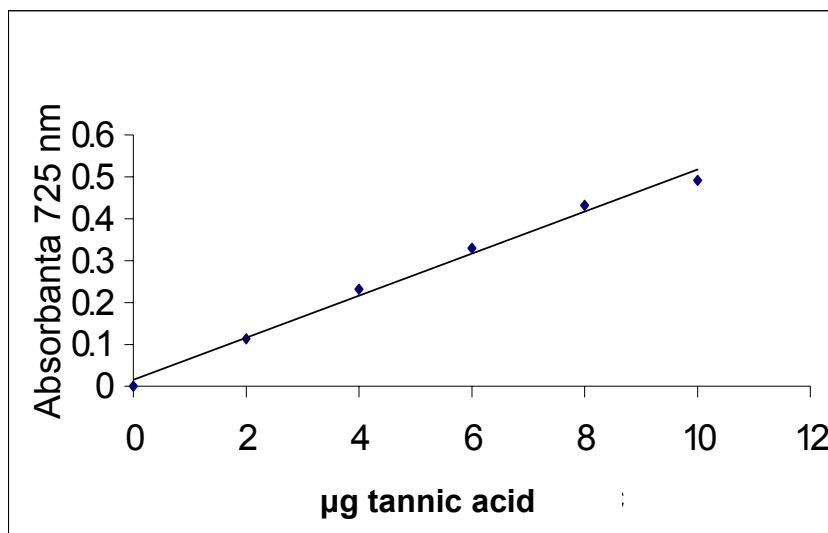
## RESULTS AND DISCUSSIONS

The etalon curve of tannic acid (Figure 1) is used to determine the total phenolic content of brews by photochlorimetric method using the Folin-Ciocalteu reagent.

The total phenolic content of coffee brews obtained with coffee roasted at temperatures of 200°C, 220°C (with all roasting degrees) and 240°C is presented in Table 1.

**Table 1.** Determination of total phenolic in brew prepared with coffee roasted at all 3 temperatures of roasting including the roasting degree at 220°C

Roasting temperatures of coffee samples				
200 °C	220 °C			240 °C
	Light	Medium	Dark	
Concentration, g tannic acid/100 g coffee brews				
2.95	2.50	2.38	2.13	1.98



*Figure 1. Etalon curve for tannic acid*

The total phenolic content of brews decreased with the increase of roasting degree, at all roasting temperatures.

## CONCLUSIONS

The temperature and also the roasting degree play an important role on antioxidant activity of brews by decreasing the total phenolic content.

Although coffee roasted at 200°C has the highest content in total phenolic of brews, the taste of them is not characteristic for the roasted coffee aroma.

## REFERENCES

1. Clarke, R.J., Macrae, R.: *Coffee*, vol.1. Chemistry, Elsevier Applied, **1985**, pp. 3-18
2. Illy, A., Viani, R.: *Espresso coffee-The chemistry of quality*, Academic Press, **1988**, pp. 87-88.
3. Ho, C.T., Hwang, H.I., Yu, T.H., Zhang, J.: An overview of the Maillard reactions related to aroma generation in coffee, *Proceedings of the 15<sup>th</sup> Association Scientifique Internationale du Café*, Montpellier, **1993**, pp. 519-527.
4. Guyot, B., Tchama, E., Vincent, J.C.: Correlations entre caractéristique chimiques du café torréfié et paramètres de torréfaction, *Proceedings of the 11<sup>th</sup> Association Scientifique Internationale du Café, Colloquim*, **1985**, pp. 319-331.
5. Preda, M., Bită, M.G.: The influence of roasting temperature of coffee beans over the aqueous extracts, *Analele Universităţii din Craiova, seria Chimie*, **2002**, XXXI, 67-72.
6. de Silveira Duarte M.S., et al.: Effect of processing and roasting on the antioxidant activity of coffee brews, *Ciencia e Tecnologia de Alimentos*, **2005**, 25(2), 518-531.

7. Singleton, V.L., Orthofer, R., Lamuela-Raventos, R..M.: Analysis of total phenols and other oxidation substrates and antioxidants by means of Folin-Ciocalteu Reagent, *Methods in Enzymology*, **1999**, **299**, 152-178.