# OPTIMIZATION OF PHENOLIC COMPOUNDS EXTRACTION FROM PEANUTS SEEDS USING RESPONSE SURFACE METHODOLOGY

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## MAIN CONCLUSION

The optimization of phenolic compounds extraction with antioxidant activity from peanuts seeds was successfully studied using response surface methodology.

Lower concentrations of ethanol/water combined with higher temperatures were the best conditions to extract phenolic compounds from peanuts seeds with antioxidant activity.

## INTRODUCTION

Peanut (*Arachis hypogaea* L.) have been recognized as a source of bioactives compounds beneficial to health due to their antioxidant and anti-inflammatory properties [1]. Among these compounds, phenolic acids, flavonoids and stilbenes have been already identified in peanut seeds which showed effective antioxidant activity in several *in vitro* assays. The extraction process to recovery phenolic compounds from plants materials is an important step to study these compounds and it is necessary to be optimized. The response surface methodology (RSM) is a tool for optimization of analytical methods based on statistical interpretation that indicates the interaction between variables. There is a lack of study on extraction of phenolic compounds from peanuts seeds, thus, in the present study, the extraction of phenolic compounds with antioxidant activity was optimized using RSM from two divergent peanut genotypes (BR1, upright and earliness, and LViPE-06, runner and late cycle), from the Brazilian Agricultural Research Corporation (EMBRAPA), Campina Grande, PB, Brazil.

## MATERIALS AND METHODS

After removing peels and fat from peanut seeds, the phenolic compounds were extracted following the central composite design (CCD) of two factors (temperature from 40 to 80°C and solvent ethanol/water from 35 to 85%) and five levels, totaling 13 runs. The total phenolics compounds were determined using the Folin-Ciocalteu method and the antioxidant activity of the extracts was measured by reducing the free radical ABTS and radical peroxyl (ORAC) scavenging [2]. The models from CCD were statistically validated by ANOVA using *F*-test ($p<0.05$).

## RESULTS AND DISCUSSION

The models for total phenolic content in both peanut genotypes extracts were better fitted using the quadratic terms than linear terms, which showed $R^2>0.94$, indicating the adequacy of the models.

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Both temperature and solvent effects were significant ($p<0.05$), however, the solvent effect is bigger than temperature effects on total phenolic compounds.

The total phenolics ranged from 1.25 to 4.27 μg gallic acid/mg for BR1 and 1.10 to 3.63 μg gallic acid/mg for LViPE-06 and, the highest results were obtained using ethanol/water 35-40% and higher temperatures (60-80°C). In general, for free radical ABTS reducing only linear effects of ethanol concentration and temperature were significant showing $R^2>0.90$. The highest results for BR1 (63.03-64.81 μmol Trolox/g) and LViPE-06 (47.56-51.89 μmol Trolox/g) were observed for ethanol/water ranging between 35-60% and temperatures 60-80°C. The models for ORAC were better fitted using quadratic terms ($R^2>0.80$) and the effect of ethanol/water were negative, significant and bigger than the effects of temperatures. The highest results were obtained when was used ethanol/water 40-60% and temperature 70-80°C or ethanol/water 35-50% and lower temperatures 40-45°C. The highest ORAC results for BR1 and LViPE-06 were 217.32 and 131.17 μmol trolox/g, respectively. In according to ANOVA analysis, all regression coefficients were significant ($p<0.05$) indicating the models are predictive (Table 1). Under conditions of temperature (50°C) and ethanol/water at 45%, the experimental values were in agreement with the predicted values (Table 2).

| | BR1 | LViPE-06 |
|---|---|---|
| **Total phenolics** | $Z=16,17-0.22*x+0.002*x^2-0.22*y+0.0014*y^2-0.0002*x*y$ $R^2=0.95$ | $Z=12.50-0.19*x+0.002*x^2-0.15*y+0.0011*y^2-0.0004*x*y$ $R^2=0.94$ |
| **ABTS** | $Z=41.86+0.191*x+0.652*y-0.0109*y^2$ $R^2=0.96$ | $Z=44.06+0.194*x-0.0109*y^2$ $R^2=0.96$ |
| **ORAC** | $Z=520.25-9.70*x+0.05*x^2+0.0012*y-0.05*y^2+0.067*x*y$ $R^2=0.94$ | $Z=499.65-10.12*x+0.069*x^2-3.4*y+0.041*x*y$ $R^2=0.80$ |

Table 1 Equations for the models and $R^2$. Axis *x* corresponds to the factor temperature (°C) and axis *y* corresponds to the factor solvent ethanol/water (%)

| Dependent variables | Predict value | | Experimental value | |
|---|---|---|---|---|
| | BR1 | LVipE-06 | BR1 | LVipE-06 |
| **Total phenolics (μg gallic acid/mg)** | 4.65 | 2.57 | 3.93±0.38 | 2.85±0.08 |
| **ABTS (μmol trolox/g)** | 58.67 | 31.61 | 56.30±4.82 | 43.53±3.17 |
| **ORAC (μmol trolox/g)** | 209.80 | 105.40 | 180.15±21.88 | 96.13±6.48 |

Table 2: Predicted and experimental values at 50°C and 45%

## REFERENCES

[1] J. Isanga and G. N. Zhang, *Food Rev. Int.*, **2007**, *23*, 123.

[2] P. S. Melo et al, *Food Chem.*, **2015**, *181*, 160.

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