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Extended Abstract

The Effect of Microwave Pretreatment on the Oxidative Stability and Some Quantity and Quality of Extracted Oil from Rapeseeds

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Abstract

Canola or rapeseeds oil, comparing to sunflower oil, corn oil and soybean oil, is more qualified because of existence of unsaturated fatty acids and lack of cholesterol in its ingredients. In this study, the effect of the microwave time (0, 30, 60, 90, 120, 150, 180, 210, 240 and 270 seconds) on the phenolic compounds, oxidative stability and physicochemical properties of rapeseed oil such as oil extraction yield, density, refractive index and acidity of the oil using a completely randomized design with three replications. The results showed that by increasing the microwave time, density and color index increased. By increasing the microwave time at first to increase the oil extraction yield, acidity, oxidative stability and total phenol were then reduced For example, by increasing the microwave time to 240 seconds, the oil extraction yield increased, but further increase in microwave time led oil extraction yield reduction. The analysis of variance results showed that the studied microwave time had no effect on the refractive index (P>0.05). According to the information obtained from this study, it can be concluded that the microwave time (for 150 seconds) for pretreatment of rapeseeds to extract oil via screw press was effective in improving the quantitative and qualitative characteristics of the oil achieved.

Keywords: Microwave Pretreatment, Oil Extraction Yield, Oxidative Stability, Rapeseed Oil

Introductıon

Canola or rapeseed is produced from Brassica napus and Brassica rapa that their glucosinolate of press cake and erucic acid of oil are respectively less than 30 micromoles and 2% per gram. After soybean and palm, Rape seeds is the third global source of vegetable oil. Canola oil, comparing sunflower oil, corn oil and soybean oil, is more qualified because of existence of unsaturated fatty acids and lack of cholesterol in its ingredients (Shahidi, 2005). Different extraction methods, such

as liquid solid extraction (by stirring), soxhlet, sonication and supercritical fluid extraction have been used to isolate oils from the plants seeds. However, none of these is optimal (Rostami *et al*., 2014; Anderson, 1996; Mandal *et al*., 2007; Bakhshabadi *et al*., 2017; Anjum *et al*., 2006). The main disadvantages of soxhlet extraction are the generally long extraction time and limited solvent choice. However, the use of solvent have some disadvantages such as long-time process, high costs, safety issues, emissions of volatile organic compounds into the environment and low quality of the products created through processing at high temperatures. MAE uses microwave radiation as the source of heating for the solvent sample mixture. Due to the particular effects of microwaves on matter (namely dipole rotation and ionic conductance), heating with microwaves is instantaneous and occurs in the interior of the sample, leading to rapid extractions. In this study, it was attempted to examine the influence of effective parameters in oil extraction from rapeseeds by treatment microwave.

Material and methods

In the present study rapeseed after preparation including cleaning and passing resistance of the samples in front of air and moisture have been shifted and preserved in a plastic bag until the experiments. Then, they have been pre-treated with microwave within different processing times (0, 30, 60, 90, 120, 150, 180, 210, 240 and 270 s). Afterwards, seeds' oil have been extracted by screw rotational speed levels approach, then different selected parameters including extraction efficiency, oil acidity value (Bakhshabadi *et al*., 2017), color (AOCS, 1993), density (AOCS, 1993), refractive index (AOCS, 1993), oxidative stability (AOCS , 1993) and total phenol (Bail *et al*., 2008) have been detected with three repetitions. Data analysis was done using a completely randomized design with three replications. SAS software was used for data analysis and comparing the averages of the studied treatments for each property of Duncan's multiple range test at the 5% level and the diagrams were drawn using Microsoft Excel software.

Results and discussion

By increasing the process time of the microwave to 240 seconds, the oil extraction efficiency increased due to the greater evaporation of the water from the structure of the plant materials and the increase in the internal pressure of the seeds as a result of decomposition of the cell membrane (Aguilera & Stanley, 1999), and with increasing process time due to the further degradation of the internal tissue and the closure of the oil exit stomps resulted in reduced oil extraction efficiency (Figure 1). As the microwave process time increased, the density and oil color index increased. Increasing the time of the microwave process initially increased the acidity, oxidative stability and total phenol, and then reduced them. For example, by increasing the time of microwave up to 240 seconds, the oil extraction efficiency increased, but by increasing the process time, the oil extraction efficiency decreased. Analysis of variance of the data obtained from the refractive index of the oils showed that the time of the microwave process did not affect the refractive index of the oils (P>0.05). Figure (2) shows that by increasing the time of the microwave process, from 0 to 150 seconds, the amount of phenol increased by 22.97%. An increase of more than 150 seconds resulted in a decrease in phenolic compounds. The reason for this increase or decrease can be attributed to the release or destruction of these compounds.

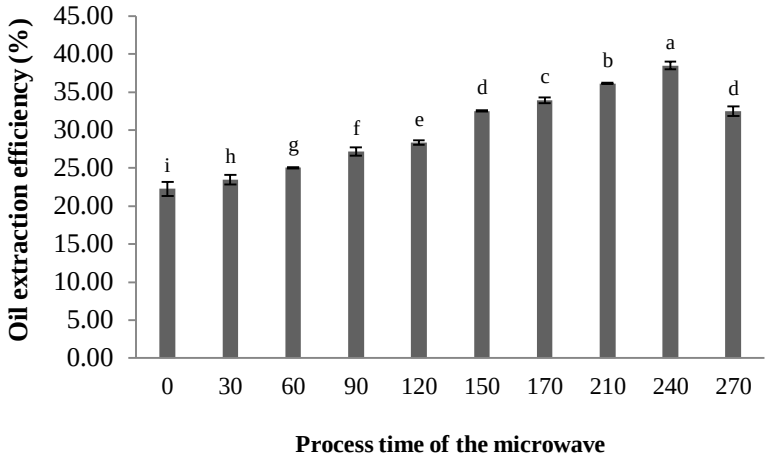

Figure 1. Effect of microwave processing time on the oil extraction efficiency of canola seeds

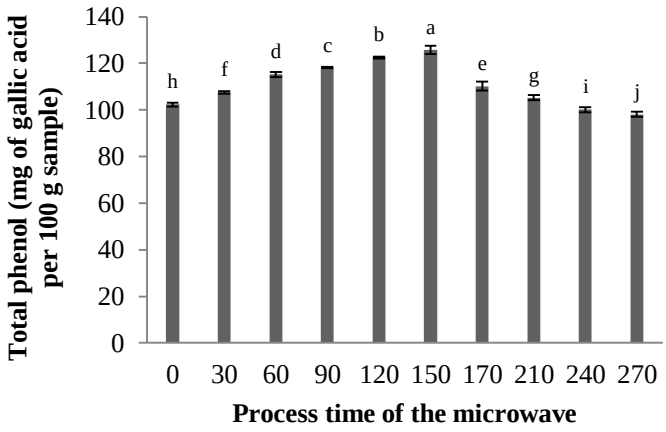

Figure 2. The Effect of microwave processing time on total phenol content of oils

Conclusion

According to the data obtained from this study, it can be stated that the use of microwave process time (for 150 seconds) to treat rapeseeds before oil extraction with spcrew press was effective in improving the qualitative and quantitative properties of oil.

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