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Determination of Some Metallic Elements in Olive Oil Produced in Misurata Region

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Abstract

The determination of Cu, Cr, Fe, Mn, Ni, and Zn in olive oil produced in Misurata region was performed by flame atomic absorption spectroscopy. The study assigned that wet-dry ashing method using sulfuric acid gave better results than dry and wet ashing methods. We found that the content of the heavy metals in all of the tested oils was lower than the maximum values recommended for FAO/WHO except Fe and Mn metals.

Keywords: Heavy metals; olive oil; wet-dry ashing; atomic absorption spectroscopy.

1. Introduction

Olive oil is a fat that is widely used in pharmaceuticals, cosmetic and cooking. Olive oil is popular in cooking due to its cholesterol lowering effect. Unlike animal fats that have cholesterol effect on humans.The quality of olive oil depends on the regional conditions of the producing country. Freshness, storability and toxicity of olive oil can be evaluated by determining the levels of several trace metals in the oil [1]. It is widely known that trace metals have negative effects on the oxidative stability of olive oil. Natural composition of olive fruit, natural contamination from soil, fertilizers, industrial applications or highways near the plantations are the main sources of metals in olive oil.The olive oil may also be contaminted with the metals during the production process and contact with storage materials. The level of trace metals in olive oil is one of the quality parameters and also effective on oil oxidation and human health. Oxidation leading to the development of unfavorable odours and taste is one of the major reasons of deterioration of olive oils. The factors that most affect the rate of oxidation are the degree of unsaturation,the amount of oxygen, temperature, light and the presence of metals (mainly transition metals such as Fe and Cu [2,3]. The trace metals enhance the rate of oxidation of edible oils by increasing the generation of free radicals from fatty acids or hydroperoxides. Benedet and Shibamoto[4] observed that trace amounts of Fe, Cr,Pb and Cd contribute oxidative effects to lipid peroxidation.It is very important to determine cumulative poisons such as Pb, contamination promoting rancidity ,like Cu, trace metals affecting taste(Cu and Fe). Sample preparation is a critical step in the analytical procedure for the determination of heavy metals in vegetable oils.Classical methods usually employed are wet-digestion, dry-ashing, acid extraction, closd vessel and focused open-vessel microwave dissolution and dilution[6,7].The determination of these metals in the vegetable oils requires specific analytical procedures such as emission and atomic absorption spectrophotometric techniques as well as electroanalytical techniques[8-12]. In this paper we report an investigation on the feasibility of wet-dry ashing for determination of some heavy metals in olive oil using H_2SO_4 acid. The comparsion with dry-ashing and wet- ashing was also discussed.

2. Materials and methods

All metals solutions under investigation were prepared from high-purity metals or its salts from Riedel-De-Hean,Cosmic Chemicas using double distilled water.The concentrated H_2SO_4 acid emplying was high purity specific for trace analysis. Flame atomic absorption spectrophotometer (Model Hitachi 180-30) was used for determination of metal ions. Samples of Olive oil locally available choosing from different areas in Misrata were purchased from the market used thought out study Procedures of dry ashing and wet ashing methodes were utilized by Oome and Van Pee [13], while wet-dry ashing used by Al-Ammar [14] employing H_2SO_4 acid.

3. Results and discussion

The results of analysis for Olive oil using various ashing methods are showen in Table(1) The concentrations of all metals obtained by dry-ashing were low compared with wet-dry ashing ,in addition the coefficient of variation for most metals under study was high. XThis variation might be due to partial voltalization for few metals and adsorption on crucible surface. The results of analysis by wet-ashing were better precssion than the dry-ashing except Mn metal w low efficiency of oxidizing agent resulting incomplete ashing. The results of analysis obtained by wet-dry ashing were more precise than both dry-ashing and wet-ashing, due to low coefficient of variation for most studied metals. The resultes of analysis for olive oils at various areas in Misurate regionfor studied metals are illustrated in Table(2). For Cu metal,the concentrations for all samples were close to each other and within the range of(0.06-0.10ppm) , and the concentration was within the standard according to FAO/WHO and Libyan standard limit(0.10ppm). The range of Cr metal was between(0.10-0.20ppm) and higher value at -Ad Dfniyah while the concentration for all areas was within the standard limit(0.30ppm).For Fe metal The range of concentration was between(3.30-8.70pp) and Fe metal was high in samples (6 and 7) respectively . The concentration of Fe metal in most samples was above concentration except sample no. 1 (3.30ppm). value of 0.53 ppm . the concentration of Mn in all samples was above standard limit (0.10ppm). The concentration of Zn metal ranged between (0.24-0.68ppm) and high value at samples(no.6 and 7) respectively , while the results were nearly the same . The results were within standard limit (0.60ppm). except Fe and Mn metals which might be due to the effect of pollution from Iron and steel company in Misurata city .also the storage period had no effect on metal content in samples (6 and 7).

4. Conclusion

The results of analysis of some heavy metals in Olive oils reaveled that wet-dry ashing using H_2SO_4 gave better results compared with both dry-ashing and wet-ashing. Also the results showed that metals presented in this study were within international standard limit except Fe and Mn in all areas of Misrata region.

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Table 1 : Analysis of some heavy metal in commercial Olive Oil using different ashing methods

ppm / Method	Cu		Fe		Zn		Cr		Ni		Mn	
	X	R.S.D	X	R.S.D	X	R.S.D	X	R.S.D	X	R.S.D	X	R.S.D
Dry Ash	0.18	30.1	6.6	22.5	0.46	15.1	0.10	28.5	0.94	20.8	0.44	32.1
Wet Ash	0.19	18.5	6.6	13.6	0.44	12.5	0.90	11.5	0.82	15.1	0.39	16.7
Wet Dry Ash	0.18	8.20	6.6	12.1	0.50	4.00	0.97	6.18	0.93	16.1	0.40	6.25

* using H_2SO_4

Table 2 : Analysis of local Olive Oil in Misurata different regions using wet-dry ashing method

ppm ⧹ method	Cu		Cr		Ni		Fe		Mn		Zn	
	X	R.S.D	X	R.S.D	X	R.S.D	X	R.S.D	X	R.S.D	X	R.S.D
Ad Dfniyah	0.07	14.3	0.19	15.8	0.15	20	3.3	12.0	0.3	13.3	0.31	3.23
Qasr Ahmad	0.08	7.79	0.15	21.8	0.18	11.1	6.2	14.8	-	-	0.25	2.43
Taminah	0.07	7.79	0.15	21.8	0.18	11.1	6.2	14.8	-	-	0.25	2.43
Zawyat Al Mahjub	0.10	10.0	0.12	12.2	-	-	8.0	12.5	0.53	14.3	0.51	9.8
krzaz	0.65	3.64	0.10	14.6	0.11	9.10	8.5	5.88	0.27	21.7	0.32	8.13
Center of the city	0.08	12.5	0.14	8.11	0.14	14.3	8.9	4.26	0.39	10.5	0.68	3.57
Two years storage	0.08	7.23	0.13	11.8	0.137	16.2	8.6	6.10	0.32	9.10	0.62	6.82
Libyan standard	0.10		0.30		0.20		5.00		0.10		0.60	

(-) represent the reading less than detection limit