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^{1}H NMR spectrum of refined sunflower oil

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Abstract
In this article, we determined the composition of refined sunflower oil by 1HNMR using a Bruker Advance II 400 NMR spectroscope. Refined sunflower oil contains peaks ranging from 0.80 to 5.33ppm. Thus, the composition of the studied oil contains the following functional groups: CH, CH2, -CH=CH.

Keywords: Spectrum, refined oil, sunflower

Introduction

In Romania, the most consumed oil is sunflower oil, almost 80% (according to the Nielsen research study conducted for 2008) of the total edible oil sold, olive oil accounted for 1.6%, the difference of up to 100% being awarded to the other varieties: soybean, rapeseed, pumpkin, corn, vegetable. Sunflower oil dominates the consumer market in Romania, Bulgaria and Hungary, and is preferred due to its low price but also the lack of information for buyers. In the Mediterranean countries - Greece, Italy, Spain, Portugal - olive oil is predominant, in Poland rapeseed oil, and in Slovenia cold-pressed pumpkin oil is popular, used especially in salads. In the world, the highest consumption is of soybean oil, then palm and rapeseed oil, with sunflower oil only ranking fourth.

In Romania, on average, approximately 11 liters of oil are consumed per capita, unlike the Germans and Austrians, who consume 6 liters of oil annually. Hungarians and Bulgarians consume 7 liters per capita, and the Italians 13 liters of oil per capita, but, considering that they consume olive oil, the data of the problem changes.

From one hectare, a production is obtained valued at 4000 - 6000 lei. The profit is 2000 - 4000 lei/ha and is 1.5-2.0 times higher than the profit obtained from one hectare of winter wheat and corn for grains.

One hectare of sunflower, with a harvest of 2.5 t/ha, ensures the production of:

- 1200 kg of oil,
- 800 meal (300 kg of protein),
- 500 kg of husks (70 kg of yeast),
- 1500 kg of calatidia (1000 kg of quality hay),
- 30 - 40 kg of honey,
- other products.

Sunflower fruits contain, in a percentage of 50%, oil with exceptional food qualities and a high degree of preservation, it is used in human nutrition (refined) and in the food industry (margarines, canned goods, soap, lecithin, phosphatides, etc.). Through industrialization, after oil extraction, meal remains, used as a source of protein in animal feed and raw material for protein concentrates in the sausage industry. From the seed shells, furfural is manufactured, used in the artificial fiber and plastic industries. Sunflowers can also have medicinal uses: the ligulate flowers contain quercitrin, anthocyanin, choline, betaine, xanthophyll, from which an alcoholic extract is obtained. Ground, the shells are used to manufacture feed yeast, approximately 150 kg / ton of product.

Vegetable oils, fatty acids and other byproducts from vegetable oil refining have been used as sustainable alternatives to petroleum-based materials for industrial applications such as soaps, detergents, cosmetics, lubricants, coatings and paints [2].Major seed oils like linseed, soybean, coconut and castor oil have been traditionally used for the synthesis of different kinds of polymer resins like alkyd [3], epoxies [4] and polyester amide [5].

The other oils like cashew nut [6], karanja [7], annona squamosa [5], natural rubber oil [8], etc. are also under progress for the synthesis of polyurethane [9], polyester amide and alkyd resins [3]. These resins have applications in different fields such as paint, coat-ing, adhesives and binder for composites. Vegetable oils and other green renewable raw materials are common sources in the organic coating industry, especially for alkyd resin synthesis in preference to petroleum products due to increased worldwide awareness of environmental concerns [10-20].

Materials and methods

Materials: Refined sunflower oil were obtained from Romania. The oil has the composition given in table 1.

Table 1: Fatty acid composition of refined sunflower oil.

Type of fatty acid	Refined sunflower oil (%, w/w)
Palmitic acid	7.9±0.4
Stearic acid	3.0±0.3
Oleic acid	31.6±0.6
Linoleic acid	57.01±0.9
Others	0.49±0.1

^{1}H NMR spectra of oil were recorded in $CDCl_3$ at 300 MHz using Bruker Advance II 400 NMR spectrometer.

Fig 1: Bruker Advance II 400 NMR spectrometer.

Result and discussion

Table 2 shows the physicochemical properties of refined sunflower oil.

Table 2: Physicochemical properties of refined sunflower oil.

Properties	Refined sunflower oil
Acid value (mg of KOH/g)	0.19±0.02
Saponification value (mg KOH/g)	197.4±0.45
Iodine value (g I2 per 100 g)	124±0.80
Unsaponifiable matter (%)	1.5±0.40
Moisture content (%)	0.1±0.12
Specific gravity (28 ◦C) (g/cm^3)	0.9162±0.05
Colour (Gardner scale)	6
Free fatty acid (% as oleic acid)	0.095
Viscosity (cP)	42.60
Flash point (◦C)	272
Pour point (◦C)	+14

^{1}H NMR spectra of the refined sunflower oil has characteristicpeaks which are shown in Fig. 2. Characteristic peaks at δ 0.81-0.906 ppm correspond to the protons of theterminal methyl group. Peaks at δ 1.26-1.31 ppm are for the pro-tons of all the internal CH_2 groups present in the fatty acidschains. For the protons of CH_2 group attached next to theabove terminal methyl group, the peaks appear at δ 1.6-1.638 ppm.Characteristic peaks at δ 2.003-2.07 ppm are for allylic protons of -CH_2, at δ 2.28-2.35 ppm for α-protons of ester groups and at δ 2.74-2.78 ppm for CH_2 of double allylic protons. Characteristic peaks at δ 4.14-4.32 ppm are for protons of glyceridemoiety. The peaks for protons of the -CH= CH moiety appears at δ 5.33-5.36 ppm.

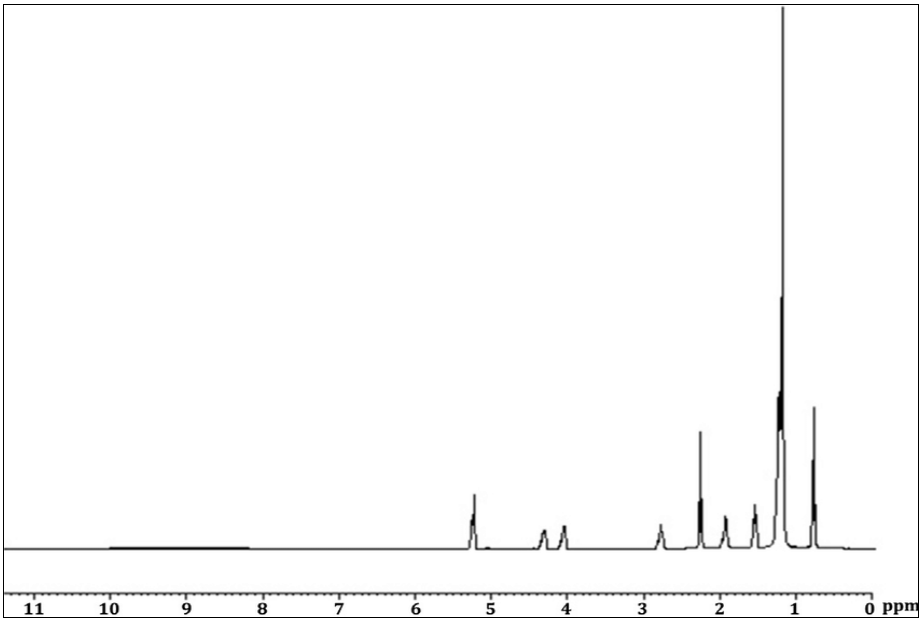

Fig 2: ^{1}H NMR spectrum of refined sunflower oil.

Conclusion

The composition of refined sunflower oil was determined by 1HNMR using a Bruker Advance II 400 NMR spectroscope. This oil contains peaks ranging from 0.80 to 5.33ppm. The composition of refined sunflower oil contains the following functional groups: CH, CH2, -CH=CH.

References

1. Stanciu I. Journal of Science and Arts. 2019;3(48):703-708.
2. Lluch C, Ronda JC, Galiá M, Lligadas G, Cádiz V. Biomacromolecules. 2010;11:1646-1653.
3. Gaykar DV. Paint India. 2001;7:55-60.
4. Clayton AM, editor. Epoxy Resin Chemistry and Technology. 2nd ed. New York: Decker; 1988. p. 942.
5. Ahmed S, Ashraf SM, Naqvi F, Yadav S, Hasnat A. J Polym Mater. 2001;18:53-60.
6. Bhunia HP, Nando GB, Chaki TK, Basak A, Lenka S, Nayak PL. Eur Polym J. 1999;38:1381-1391.
7. Shende PG, Dabhade SB. Polymers synthesis and applications. In: Vohra DK, Singh D, Singh P, editors. Proceedings of the National Seminar on Polymers. Allied Publishers Ltd.; 1997. p. 104-110.
8. Aigbodion AI, Pillai CKS, Bakare IO, Yahaya LE. Indian J Chem Technol. 2001;8:378-84.
9. Patel JV, Sony PK, Sinha VK. J Polym Mater. 2001;18:103-110.
10. Pramanik S, Sagak K, Konwar BK, Karak N. Prog Org Coat. 2012;75:569-578.
11. Stanciu I. Rheological behaviour of biodegradable lubricant. J Sci Arts. 2019;3(48):703-708.
12. Stanciu I. Rheological investigation of soybean oil from soya beans. J Sci Arts. 2019;4(49):938-988.
13. Stanciu I. Modeling the temperature dependence of dynamic viscosity for rapeseed oil. J Sci Arts. 2011;1:55-58.
14. Stanciu I. Some methods for determining the viscosity index of hydraulic oil. Indian J Sci Technol. 2023;16(4):254-258.
15. Stanciu I. Rheological behavior of corn oil at different viscosity and shear rate. Orient J Chem. 2023;39(2):335-339.
16. Stanciu I. Rheological characteristics of corn oil used in biodegradable lubricant. Orient J Chem. 2023;39(3):592-595.
17. Stanciu I. Effect of temperature on rheology of corn (Zea mays) oil. Orient J Chem. 2023;39(4):1068-1070.
18. Stanciu I. Study of rheological behavior of rapeseed oils compared to mineral oil. Orient J Chem. 2021;37(1):247-249.
19. Stanciu I. Influence of temperature on the rheological behavior of orange honey. Orient J Chem. 2021;37(2):440-443.
20. Stanciu I. Rheological study of orange honey with influence of concentration. Orient J Chem. 2021;37(4):864-867.