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Chemical composition of vitamin K1 determined by IR spectroscopy

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Abstract
Vitamin K1 (phylloquinone) is essential for blood clotting and bone health, and is present in numerous plants and dietary supplements. In this study, the chemical structure of vitamin K1 was investigated by FTIR spectroscopy to identify characteristic functional groups and assess sample purity. The FTIR spectrum revealed specific bands corresponding to quinone (C=O), alkyl (C–H), and aromatic (C=C) groups, confirming the identity and structural integrity of vitamin K1. The results demonstrate that FTIR is a rapid, non-destructive, and efficient method for the qualitative characterization of vitamin K1, useful in the quality control of pharmaceuticals and dietary supplements.

Keywords: Vitamin K1, IR spectroscopy, composition

Introduction

Vitamin K1 is a water-soluble compound found in certain foods in the form of phylloquinone and phytomenadione. The main food sources of vitamin K1 are spinach, broccoli, lettuce, cabbage, fennel, parsley, wheat germ, rapeseed oil and olive oil.

Vitamin K1 is involved in physiological coagulation processes through its ability to confer biological activity to certain proteins synthesized in the liver - the vitamin K-dependent coagulation factors (prothrombin, proconvertin, factor IX and X, protein C and S). It has been demonstrated that vitamin K has an anti-inflammatory and antioxidant role in the central nervous system, supporting the proper functioning of nerve cells [1, 3].

Vitamin K is a group of vitamins that the body needs for blood clotting and faster wound healing. This vitamin is essential for health, mainly because it regulates blood clotting in the body. Moreover, there are studies that support vitamin K's contribution to bone and cardiovascular health, but more research is needed in this regard.

Vitamin K deficiency includes easy bruising and excessive bleeding from cuts. Sources of nutrients for vitamin K include: some foods: green leafy vegetables (spinach, broccoli), vegetable oils, cereals, meat, dairy products; dietary supplements [4, 7].

Vitamin K is the generic name given to a group of substances that can dissolve in fats and oils (fat-soluble). They play an important role in: blood clotting; preventing calcification of blood vessels (thus reducing the risk of cardiovascular disease); bone metabolism (maintaining healthy bones); regulating calcium levels in bones.

It is important to say that vitamin K is found throughout the body, but especially in the liver, brain, heart, pancreas, and bones. Vitamin K breaks down very quickly and is eliminated through urine or stool. This is why vitamin K rarely reaches toxic levels in the body (as sometimes happens with other fat-soluble vitamins).

Vitamin K (also known as phytomenadione) plays a fundamental role in the production of proteins necessary for blood clotting. Without this vitamin, we would bleed to death. Vitamin K is known to help produce proteins necessary for blood clotting, or bone strengthening, such as: prothrombin: a vitamin K-dependent protein that is directly involved in blood clotting; osteocalcin: a protein that requires vitamin K to produce healthy bone tissue [8, 11].

The period in which vitamin K acts in the bleeding process depends on the cause. If it is a small wound, then the time is shorter, if on the contrary, the wound is severe, then the time in which vitamin K must act is longer.

Regarding bleeding during menstruation, triggered by stress, hormonal disorders or drug treatments, vitamin K can help improve them, helping in the clotting process. However, it should be remembered that vitamin K does not stop menstruation, it only significantly reduces bleeding.

Contraindications for vitamin K and contraindications for vitamin K2 are related to the patient's sensitivity to this vitamin. There are no known cases of toxicity associated with the administration of vitamin K (either K1 or K2), perhaps because the surplus of the vitamin is eliminated naturally by the body. However, it is good to know that the form of vitamin K3 can cause a significant degree of oxidative stress at the level of cell membranes. If this vitamin is administered by injection, it can lead to liver toxicity, jaundice or hemolytic anemia [12, 17].

Materials and methods

The study of the composition of vitamin K1 was done with the Bruker IFS 66v/S spectrophotometer.

Fig 1: Bruker IFS 66v/S spectrometer

Results and discussions

The carbonyl stretch vibrational mode, the quinonic and the aromatic ring vibrational modes are indicated as 1666 cm $^{-1}$

for (C=O), 1619 cm^{-1} for $(C=C)_{quin}$ and 1599 cm^{-1} for $(C=C)_{aro}$, respectively. a.u.: absorbance units. Accuracy of the frequency values: ±1 cm^{-1} (fig.2).

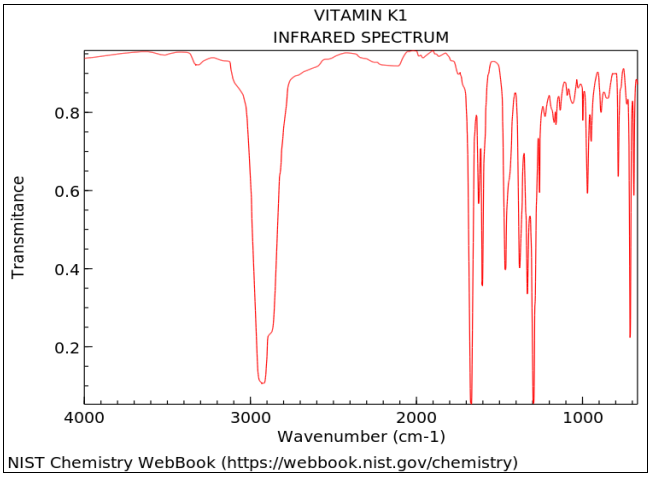

Fig 2: Vitamin K1 spectrum

Conclusions

FTIR spectroscopy allowed the identification of functional groups characteristic of vitamin K1, including quinone (C=O), alkyl (C–H) and aromatic (C=C). The bands observed in the spectrum confirm the chemical structure and integrity of the vitamin K1 sample. FTIR analysis has been shown to be rapid, non-destructive and efficient for the qualitative characterization of vitamin K1. The method can be used for quality control of pharmaceutical products and dietary supplements containing vitamin K1. The results provide a useful reference for further studies on the purity and stability of vitamin K1 in various formulations.

Reference

1. Subagio A, Morita N. Determination of fatty acid composition in oils. Food Chemistry,2003:81:97–102.
2. Dupont J, White PJ, Carpenter MP, Schaefer EJ, Meydani SN, Elson CE, *et al*. Effect of dietary lipids on human health. Journal of the American College of Nutrition,1990:9(5):438–470.
3. Veljković VB, Biberdžić MO, Banković-Ilić IB, Djalović IG, Tasi MB, Nježić ZB, *et al*. Renewable energy sources and sustainable fuels. Renewable and Sustainable Energy Reviews,2018:91:531–548.
4. Beadle JB, Just DE, Morgan RE, Reiners RA. Physical properties of vegetable oils. Journal of the American Oil Chemists' Society,1965:42(2):90–95.
5. Strocchi A. Rheological aspects of edible oils. Journal of Food Science,1982:47(1):36–39.
6. Stanciu I. Rheological behaviour of biodegradable lubricant. Journal of Science and Arts,2019:3(48):703–708.
7. Stanciu I. Rheological investigation of soybean oil from soya beans. Journal of Science and Arts,2019:4(49):938–988.
8. Stanciu I. Modeling the temperature dependence of dynamic viscosity for rapeseed oil. Journal of Science and Arts,2011:1:55–58.
9. Meneghetti SMP, Meneghetti MR, Wolf CR, Silva EC, Lima GE, Coimbra MDA, *et al*. Fatty acid composition of vegetable oils. Journal of the American Oil Chemists' Society,2006:83(9):819–822.
10. Stanciu I. Rheological study of vegetable oils. Journal of Science and Arts,2018:18(2):453–458.
11. Sheibani A, Ghotbaddini-Bahraman NASER, Sadeghi FATEMEH. Evaluation of oil properties. Oriental Journal of Chemistry,2014:30(3):1205–1209.
12. Stanciu I. Some methods for determining the viscosity index of hydraulic oil. Indian Journal of Science & Technology,2023:16(4):254–258.
13. Stanciu I. Rheological behavior of corn oil at different viscosity and shear rate. Oriental Journal of Chemistry,2023:39(2):335–339.
14. Stanciu I. Rheological characteristics of corn oil used in biodegradable lubricant. Oriental Journal of Chemistry,2023:39(3):592–595.
15. Stanciu I. Effect of temperature on rheology of corn (Zea mays) oil. Oriental Journal of Chemistry,2023:39(4):1068–1070.
16. Stanciu I. Study Rheological Behavior of Rapeseed oils Compared to Mineral oil. Oriental Journal of Chemistry,2021:37(1):247–249.
17. Stanciu I. Influence of Temperature on the Rheological Behavior of Orange Honey. Oriental Journal of Chemistry,2021:37(2):440–443.