International Journal of Research in All Subject
www.multiarticlejournal.com
ISSN: 3107-5878
Received: 22-02-2026, Accepted: 25-03-2026, Published: 09-04-2026
Volume 2, Issue 2, 2026, Page No. 7-8

Composition of normal human blood determined by FTIR

Ioana Stanciu
Faculty of Chemistry, Department of Physical Chemistry, University of Bucharest, Elisabeta Blvd, Bucharest, Romania

Abstract
Blood is a vital liquid tissue, representing approximately 7–8% of total body weight, and performs essential transport, defense, and regulatory functions. Its composition consists of two main parts: plasma and formed elements. Plasma, which constitutes approximately 55% of blood volume, is a straw-yellow liquid composed of ~90% water, 7–8% proteins (albumins, globulins, fibrinogen), and 2% other constituents (electrolytes, nutrients, hormones, waste products). Formed elements, which represent approximately 45% of the volume, include erythrocytes (red blood cells, responsible for transporting oxygen and carbon dioxide), leukocytes (white blood cells, involved in immune defense), and platelets (essential for hemostasis and coagulation). Normal values vary depending on sex, age, and physiological state, but maintaining a balance between these components is crucial for the body's homeostasis.

Keywords: Spectrum, human blood, composition, FTIR

Introduction

FTIR (Fourier-transform infrared spectroscopy) is a technique used to identify and analyze the chemical composition of samples by measuring the absorption of infrared light. When applied to human blood, FTIR spectroscopy can provide valuable information about the molecular composition of blood components, including proteins, lipids, nucleic acids, and other biomolecules. It works by measuring the vibrational frequencies of chemical bonds in the sample.

In the context of human blood, FTIR can be used for several purposes, such as:

- FTIR spectra can help identify biomarkers related to certain diseases (like cancer or diabetes) by detecting changes in blood composition.
- FTIR can assess alterations in blood composition due to metabolic disorders.
- It can be used to analyze the different constituents of blood (e.g., plasma, red blood cells, white blood cells, platelets) and their molecular properties.

Drug Interaction: FTIR can also be used to study how drugs or treatments affect the molecular composition of blood [1-5].

The FTIR spectrum of human blood is complex because it contains many different components, but certain features can be identified, such as:

Proteins is peaks around 1600 cm⁻¹ (amide I) and 1540 cm⁻¹ (amide II) correspond to protein-related vibrations.

Lipids is peaks around 1740 cm⁻¹ typically correspond to the C=O stretching of lipids.

Carbohydrates is peaks in the range of 1000-1200 cm⁻¹ are associated with C-O and C-C vibrations in carbohydrates.

FTIR can provide non-invasive, rapid, and sensitive analysis of blood samples, making it a promising tool in medical diagnostics and research [6-12].

Materials and methods

Here the terminologies and concepts associated with FTIR spectroscopy, namely the IR region, IR radiation and molecular vibrations in human blood, FTIR techniques and Michelson interferometer, are presented.

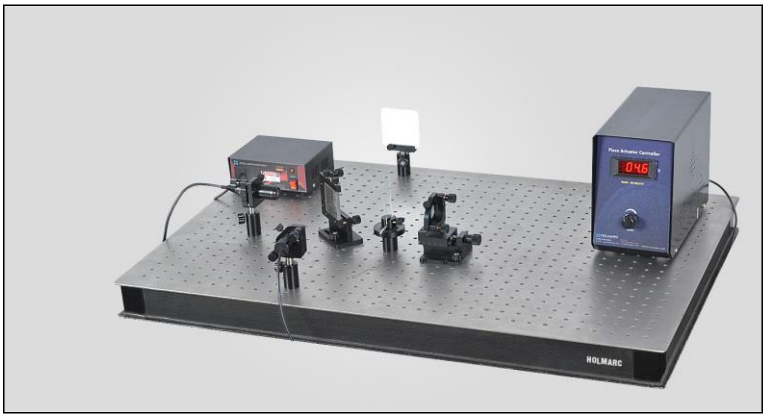

Fig 1: Michelson interferometer

Result and discussion

In the FTIR spectra of the whole blood,without irradiation to laser presented Fig. 2 and Table 1 shows the groups O-H, C=O, N=O, C – H, NH, and C–O in the region between the wave numbers 4000 to 500 cm^{-1} In the spectral region 2800–3700 cm^{-1}, the band with λmax = 3444.63 cm^{-1} is O–H bond peak. Amide-I is mainly associated with C-O, C=O, and C-H stretching vibrations and also related to the backbone conformation. The wave numbers 1650.95 cm^{-1}, 1548.73cm^{-1} 1452.30cm^{-1} indicate C = O, N=O and C-H peaks respectively. The absorption peak in the 1317.29 cm^{-1} and 1168.78 cm^{-1} arises due to the N-H stretching vibrations of the proteins methylene group of the proteins, and gives rise to the existence of glucose due to C-O symmetric stretching, The prominent absorption peak 3444.63 cm^{-1} is due to the N – H stretching mode (amide - A) of proteins. The most intense absorption band in proteins is the amide I peak, which is observed at 1650.95 cm^{-1}. Amide I is mainly associated with C=O symmetric stretching and or C-O stretching vibrations. There are another very strong prominent amide absorptions one at 1545 cm^{-1} due to strong N-H in-plane bending and termed as an Amide II band [20, 21].

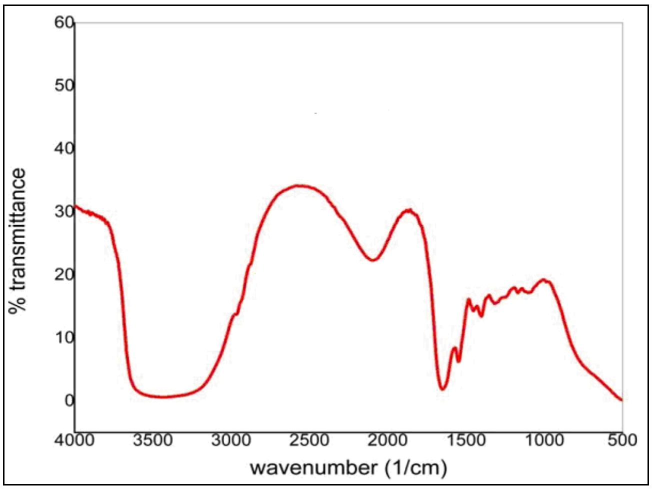

Fig 1: FTIR spectrum for normal blood samples

Table 1: Show the FTIR spectral data (wave number, function group and transmission) for blood sample

Wave number cm^{-1}	Group	% T
3444.63	O-H	0.48
1650.95	C=O	1.19
1548.73	N=O	6.36
1452.30	C-H	14.26
1317.29	N-H	15.3
1168.78	C-O	17.12

Conclusion

Blood is a complex liquid tissue, indispensable for life, which ensures the transport of substances, the defense of the body and the maintenance of internal balance. Its normal composition includes plasma (approximately 55%) and figured elements (approximately 45%), proportions that must be maintained for the optimal functioning of the body. Erythrocytes, leukocytes and platelets have well-differentiated but interdependent roles: transport, immunity and coagulation. Any significant change in the normal composition of blood may indicate a physiological or pathological disorder. Maintaining blood composition within normal limits is essential for health and survival.

Reference

1. Subagio A, Morita N. Food Chemistry,2003:81:97–102
2. Dupont J, White PJ, Carpenter MP, Schaefer EJ, Meydani SN, Elson CE, *et al*. 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 and Sustainable Energy Reviews,2018:91:531–548
4. Beadle JB, Just DE, Morgan RE, Reiners RA. Journal of the American Oil Chemists’ Society,1965:42(2):90–95
5. Strocchi A. 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*. Journal of the American Oil Chemists’ Society,2006:83(9):819–822
10. Stanciu I. Journal of Science and Arts,2018:18(2):453–458
11. Sheibani A, Ghotbaddini-Bahraman NASER, Sadeghi FATEMEH. 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
18. Hunsom M, Saila P, Chaiyakam P, Kositnan W. International Journal of Renewable Energy Research,2013:3:2
19. Catterick J, Thornton P. Advances in Inorganic Chemistry and Radiochemistry. HJ Emeleus, AG Sharpe (eds.),1977:20
20. Gunasekaran S, Uthra D. FTIR and UVVisible spectral study on normal and jaundice blood samples. Asian Journal of Chemistry,2008:20(7):5695
21. Rathore S, Ali B. Effect of He-Ne laser radiation on viscometric behavior of human blood. Journal of Chemical, Biological and Physical Sciences,2013:3(3):2124