International Journal of Educational Research and Studies
www.multiinnovationjournal.com
Online ISSN: 2664-6811
Received: 24-11-2025, Accepted: 19-01-2026, Published: 03-02-2026
Volume 8, Issue 1, 2026, Page No. 1-2

Chemical composition of ibuprofen determined by IR spectroscopy

Ioana Stanciu*
Department of Physical Chemistry, Faculty of Chemistry, University of Bucharest, Elisabeta Blvd, Bucharest, Romania
DOI: https://doi.org/10.66856/ijers.2026.8.1.8005

Abstract
In this article, we determined the composition of ibuprofen by IR spectroscopy using the PerkinElmer FT-IR System spectrometer. Ibuprofen has absorption bands between 3300 and 550cm^{-1}. Ibuprofen is a nonsteroidal anti-inflammatory drug (NSAID) derived from propionic acid, structurally characterized by the presence of a substituted aromatic nucleus and a carboxylic group that confers its pharmacological properties. The active substance, (RS)-2-(4-isobutylphenyl)propionic acid, is a racemic mixture, of which the S enantiomer exhibits the main anti-inflammatory activity. Commercial pharmaceutical formulations include, in addition to the active ingredient, excipients specific to the presentation form — such as binding, filling, disaggregation, sweetening or stabilizing agents — designed to ensure the stability, absorption and tolerability of the drug. The chemical composition and excipients used contribute to the anti-inflammatory, analgesic and antipyretic profile of ibuprofen, making it one of the most widely used NSAIDs in medical practice.

Keywords: Ibuprofen, chemical composition, IR spectroscopy

Introduction

Ibuprofen (trade names Brufen Advil) is a nonsteroidal anti-inflammatory drug from the propionic acid derivative class, used as an anti-inflammatory, analgesic and antipyretic. The main indications include: mild to moderate pain, fever, rheumatoid arthritis, osteoarthritis and dysmenorrhea. The available routes of administration are oral, intravenous, topical and rectal.

It is on the World Health Organization's list of essential medicines. The drug was discovered in 1961. It is available as a generic drug. Ibuprofen was first launched on the market in 1969 in the United Kingdom and in 1974 in the United States of America. Analgesic in mild to moderate pain degenerative and inflammatory rheumatism, disc-vertebral disorders, extra-articular rheumatism [1, 5].

Nausea, vomiting, epigastralgia, diarrhea, rashes, pruritus, headache, dizziness, anxiety. Less common side effects include esophageal ulcers, heart failure, high blood potassium levels, impaired kidney function, confusion, and bronchospasm. Ibuprofen can worsen asthma, sometimes fatally. Allergic reactions, including anaphylaxis and anaphylactic shock, can occur.

A Canadian study of pregnant women suggests that those taking any type or amount of NSAIDs (including ibuprofen, diclofenac, and naproxen) were 2.4 times more likely to have a miscarriage than those who did not take these drugs. However, an Israeli study found no increased risk of miscarriage in the group of mothers using NSAIDs [6, 13].

In December 2015, an Australian court ruled that the drug's manufacturer, pharmaceutical giant Reckitt Benckiser, must recall some boxes of the popular painkiller Nurofen from Australian pharmacies, on the grounds that false advertising had been used. The court's decision came after nine months ago, the Australian Competition and Consumer Commission (ACCC) told the court that Nurofen was being sold for various conditions in different boxes, even though the active ingredient was identical in all of them [14, 17].

Materials and methods

Fourier-transform infrared (FT-IR) spectra of ibuprofen were obtained using IR spectrophotometer (PerkinElmer FT-IR System, Spectrum BX, Perkin-Elmer, UK). The samples were scanned over the wave number range from 4000 to 550 cm^{-1}.

Fig 1: PerkinElmer FT-IR System

Results and discussions

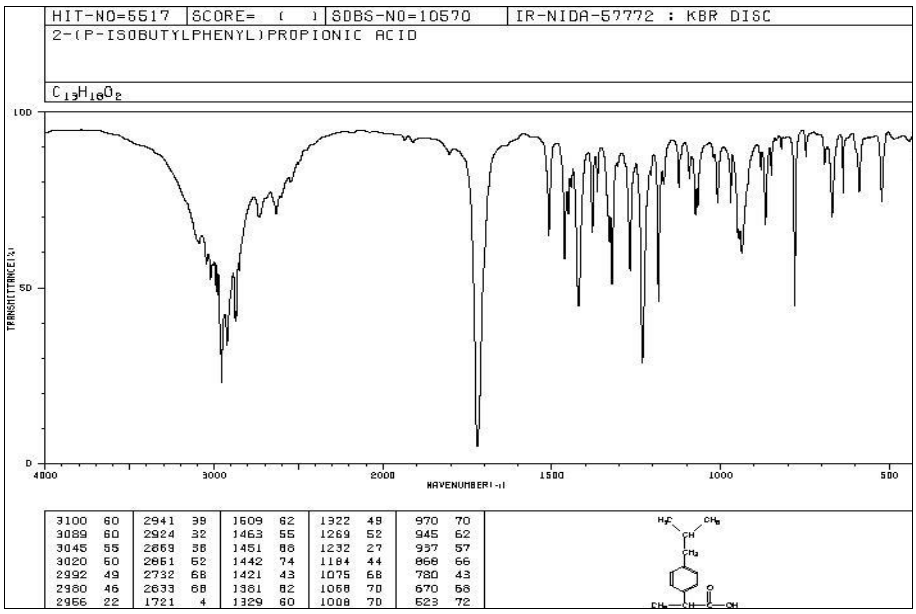

Fig 2: Spectrul ibuprofenului

In FT-IR analysis (fig. 2), the spectrum of pure ibuprofen showed an intense and well-defined bands characteristic to ibuprofen at 1720 cm^{-1} (carbonyl stretching of isopropionic acid group) and 3000 cm^{-1} (hydroxyl stretching).

Conclusions

Ibuprofen (trade names Brufen Advil) is a nonsteroidal anti-inflammatory drug of the propionic acid derivative class, used as an anti-inflammatory, analgesic and antipyretic and has absorption bands between 3300 and 550cm^{-1}. The composition of ibuprofen, based on its aryl-propionic acid structure and the racemic mixture of the two enantiomers, explains its anti-inflammatory, analgesic and antipyretic efficacy. The excipients used in the different pharmaceutical forms contribute to the stability, absorption and tolerability of the active substance, without modifying its fundamental mechanism of action. Overall, both the chemical characteristics of ibuprofen and the composition of its pharmaceutical formulations justify its widespread use as a safe and effective nonsteroidal anti-inflammatory drug.

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.