FT-IR, FT-Raman & micro-Raman Laboratory

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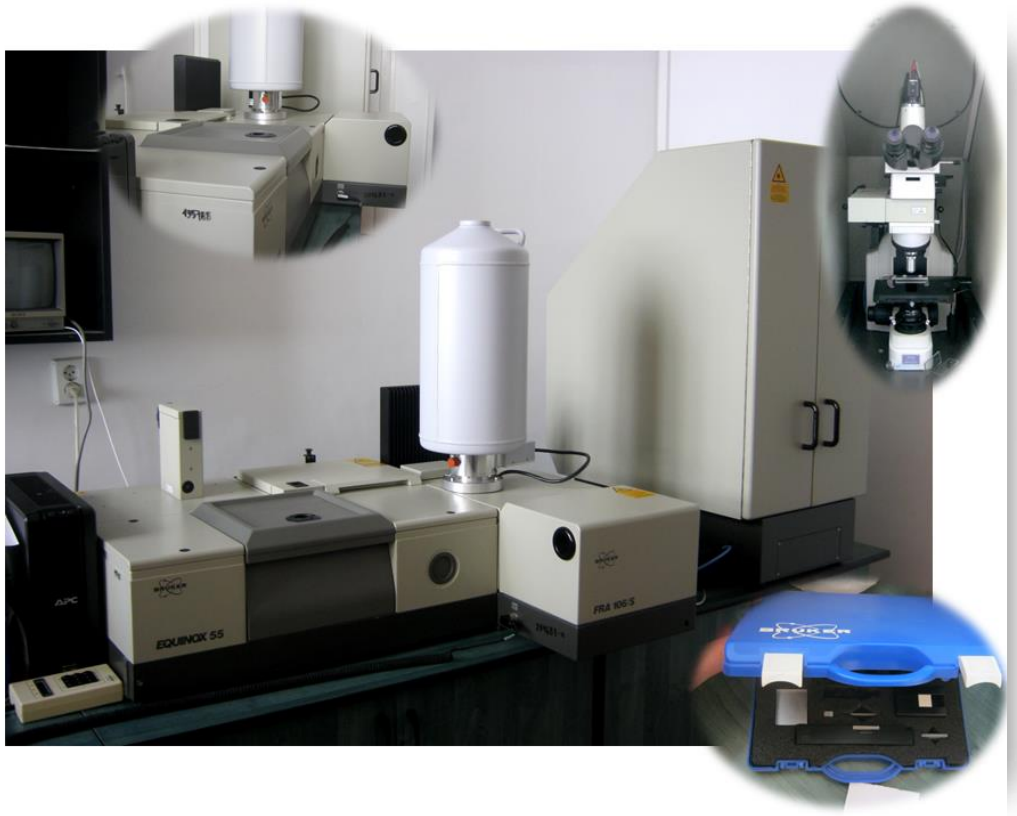
PhD Student: Ioana Brezestean
Technician: Physicist, Mircea Puia

Equipment:

FT-IR, FT-Raman, FT-micro-Raman


EQUINOX 55
FRA 106 S

Equipment

FT-IR, FT-Raman, system

Bruker, FT-IR spectrometer, model Equinox 55, with FRA 106S Raman module

FT-micro-Raman

First Raman microscope from Romania, acquired through the World Bank Grant & Romania Gov., 2002, Grant Director, Dr. Simona Cinta Pinzaru

FT-IR, FT-Raman & micro-Raman system description

Bruker FT-IR Spectrometer, Equinox 55 Model

Operation range 7500-370 cm^{-1}, maximal performance in mid-IR (MIR, 4000-400 cm^{-1}, resotution 0,5 cm^{-1}; IR Source: Globar (MIR); detector: DLATGS with KBr window;

FT-Raman FRA 106/S Module

Spectral range: 3600-70 cm^{-1}(Stokes) and [-2000 - (-100)]cm^{-1} (anti-Stokes). Resolution 1 cm^{-1}.

Raman Microscope (RamanScope II), Nikon model ECLIPSE E400 fiber optic coupled to the FT-Raman module; objectives: x10; x50;

Excitation: Nd:YAG laser, operable at 1064 nm, output power 500 mW;

Ultrasensitive detection with the **nitrogen cooled D418-T Ge detector**;

Video-camera monitor Sony (black-white) allows sample observations before, during and after laser exposure and during measurement;

Crystal ATR (ZnSe) MIRacle Single Reflection HATR Accessory for the attenuated total reflectance Fourier transform infrared spectroscopy (ATR-FT-IR), without KBr pellet, in the 650-4000 cm^{-1} range;

SpeCAC Accesory for measurements at low temperature (up to -160 ^{0}C) for solid samples;

Acquisition software : OPUS 2.0.

Facilities

- Complete vibrational analysis;
- Consultancy in IR spectroscopy, Raman spectroscopy and their techniques and applications;
- Consultancy and applications in FT-SERS (Fourier-transform- surface enhanced Raman scattering)
- Vibrational spectra interpretation;
- Chemicals identification in complex samples (organic, inorganic, mineral, vegetal, animal models sample, human samples);
- Products authentication;
- Environmental pollutants detection and monitoring;
- Counterfeits detection in pharmaceutical products, food products, alcoholic beverages, works of art, jewels, narcotics and other products;
- Raman & IR spectral database built up within more than 14 years (more than 3000 organic or inorganic substances)
- Laboratory could provide training in Raman spectroscopy, IR spectroscopy and related techniques (entry level, basic level, advanced level);
- Consultancy in complex analyses;

Applications: Vibrational characterization of molecular species, nanostructures, nanomaterials, biological samples, pharmaceuticals, food products, polymers, composites, environmental samples;
Ability: detection, diagnostic, adsorption, molecular dynamics, monitoring, expertise in conservation/restoration, quality control, and so on.

Services provided: For invoices, info, terms and conditions, please contact lab staff.

Research projects

- Metal-adsorbate interactions and adsorption for molecular species of biomedical, pharmaceutical, industrial or environmental interest;
- Plasmonic nanostructures and SERS /FT-SERS markers for medical or environmental applications;
- Vibrational characterization of biological, medical or environmental interest compounds;
- New pharmaceutical formulations and their properties;
- Microorganisms identification and monitoring using linear Raman &IR techniques;
- Identification, characterization and monitoring of materials used in conservation-restauration of works of art;
- Identification, characterization and monitoring of toxins, pesticides, narcotics, contaminants in various products;
- Microorganisms incubation with nanomaterials and their characterization in vivo/ex-vivo ;
- Industrial applications, catalytic materials, environmental applications, process control;
- Food control;

Selected publications

1. Detection of thiabendazole applied on citrus fruits and bananas using surface enhanced Raman scattering
Csilla Müller, Leontin David, Vasile Chiş, Simona Cintă Pînzaru, Food Chemistry, 145, 814-820, 2014.

2. Surface-enhanced Raman scattering (SERS) and complementary techniques applied for the investigation of an Italian cultural heritage canvas
Gui, O. M., Fălămaş, A., Barbu-Tudoran, L., Aluaş, M., Giambra, B. and Cîntă Pînzaru, S. (2013),. J. Raman Spectrosc., 44: 277–282.

4. Molecular conformation changes along the malignancy revealed by optical nanosensors
Simona Cinta Pinzaru, Alexandra Falamas, Cristina Adriana Dehelean
Journal of Cellular and Molecular Medicine, 2013, 17(2):277-86

5. Evaluation and differentiation of the Betulaceae birch bark species and their bioactive triterpene content using analytical FT-vibrational spectroscopy and GC-MS.
Simona Cîntă-Pînzaru, Cristina A Dehelean, Codruta Soica, Monica Culea, Florin Borcan
Chemistry Central Journal, 2012; 6(1):67.

6. Amnesic shellfish poisoning biotoxin detection in seawater using pure or amino-functionalized Ag nanoparticles and SERS
Müller C, Glamuzina B, Pozniak I, Weber K, Cialla D, Popp J, Cîntă Pînzaru S
Talanta, 130, 108-116, 2014

7. New SERS feature of β-carotene: consequences for quantitative SERS analysis
Cintă Pinzaru, S., Müller, Cs., Tomšić, S., Venter, M. M., Cozar, B. I., and Glamuzina, B. (2015),
J. Raman Spectrosc., 46 (7): 597–604, 2015
doi: 10.1002/jrs.4713.

8. NIR-Raman spectrum and DFT calculations of okadaic acid DSP marine biotoxin microprobe
Cintă Pinzaru, S., Müller, Cs., Tódor, I. S., Glamuzina, B., and Chis, V.
Journal of Raman Spectroscopy, 47(6), 636–642, 2016

9. Live diatoms facing Ag nanoparticles: surface enhanced Raman scattering of bulk Cylindrotheca Closterium pennate diatoms and of the single cells, Simona Cinta Pinzaru, Csilla Müller, Sanja Tomšić, Monica M. Venter, Ioana Brezestean, Stijepo Ljubimir and Branko Glamuzina,
RSC Adv., 2016, 6, 42899-42910

Books and chapters

Spectroscopia Raman şi SERS cu aplicaţii în biologie şi medicină
Simona Cinta Pinzaru, Traian Iliescu Ed.M. Trifu, 11/2011; Casa Cartii de Stiinta., ISBN: 978-973-133-887-3

Aplicatii ale spectroscopiei vibrationale
T. Iliescu, Simona Cinta Pinzaru, D. Maniu, R. Grecu, S. Astilean I edited by M. Trifu, 03/2002; Casa Cartii de Stiinta., ISBN: 973-686-292-5;

SERS and Pharmaceuticals

Simona Cîntă Pînzaru, Ioana E. Pavel, in book: Surface Enhanced Raman Spectroscopy: Analytical, Biophysical and Life Science Applications, Wiley-VCH, 12/2010; DOI:10.1002/9783527632756.ch6 ISBN: 9783527632756 pp.129 – 154

Vibrational spectroscopy and theoretical studies on organometallic complexes

D. Moigno, I. Pavel, Simona Cinta, W. Kiefer 05/2001; , ISBN: 8177360647

Historical Facts Related to the Raman Effect, Simona Cinta Pinzaru, Wolfgang Kiefer, in book: Confocal Raman Microscopy, Second Edition, Dieing, Thomas, Hollricher, Olaf, Toporski, Jan (Eds.) Springer Series in Optical Sciences, Springer, 2016.

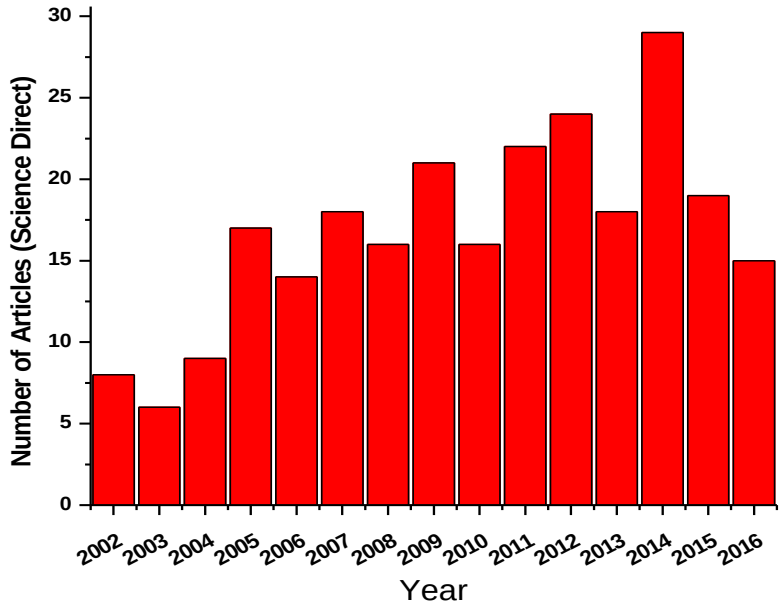
Lab statistical data

Number of acquisitions:

FT-Raman: 7400; Micro-Raman: 1850; FT-IR: 6600; ATR-FT-IR: 2846;

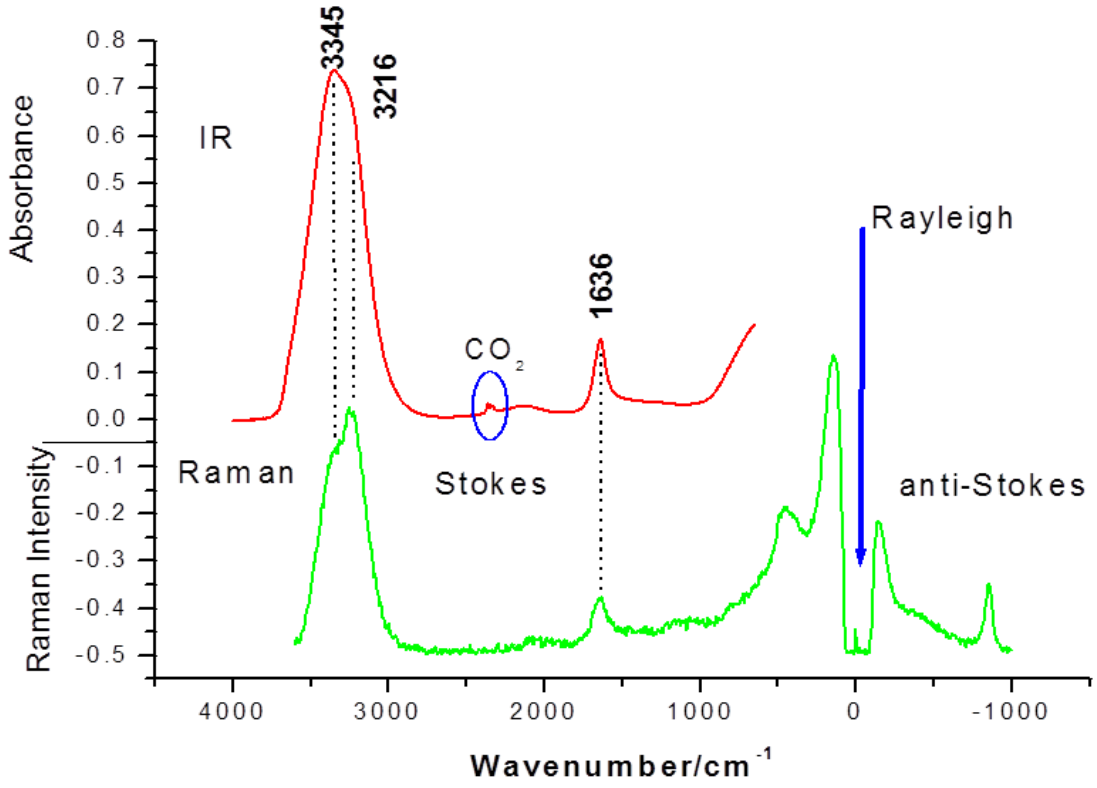
Total: 18696 files (*July 2002 - Oct. 2016)*

Number of publications (October 2002-October 2016), according to Science Direct and Scopus , subject search: FT-Raman, affiliation: Babes-Bolyai University



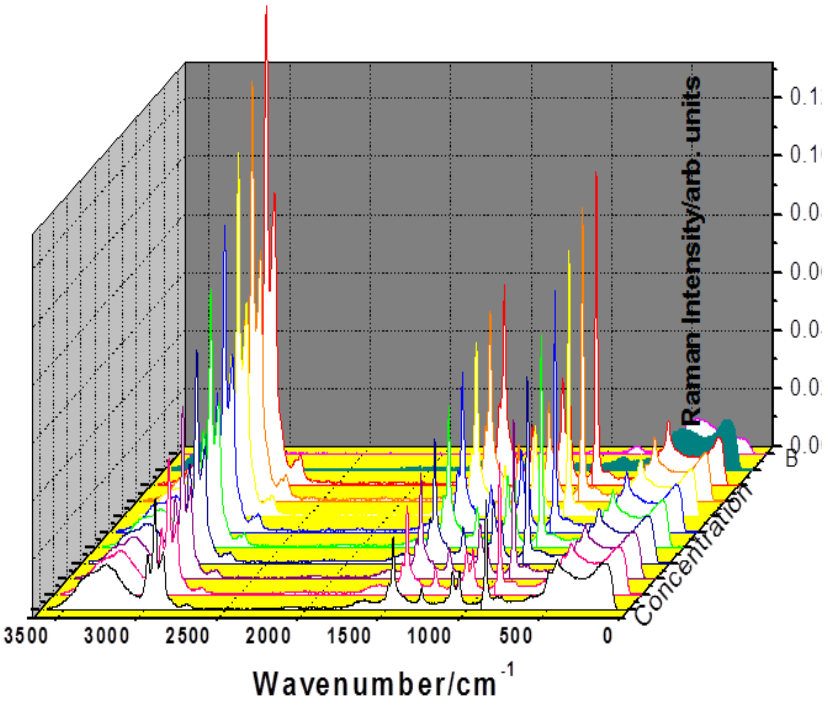
Spectra Gallery

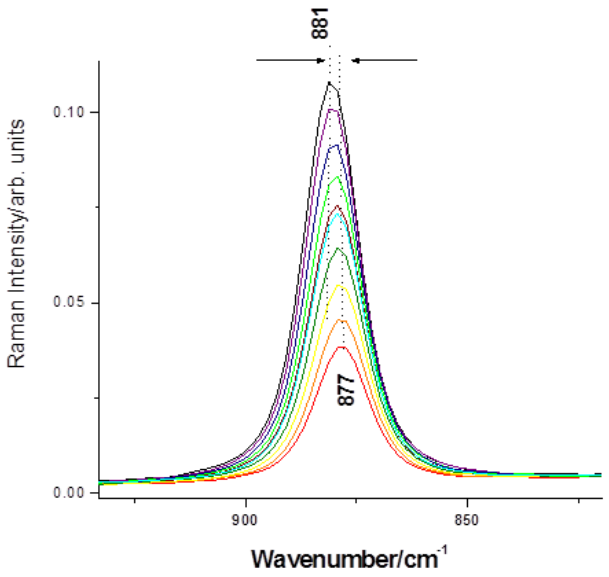
Drinking water



Spectra Gallery

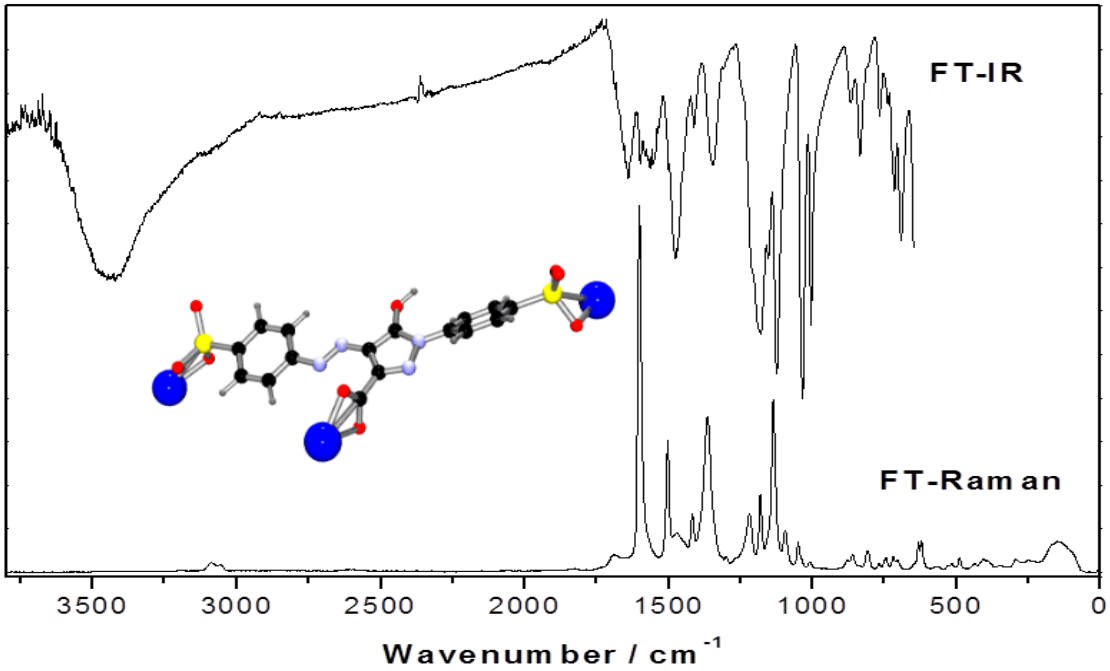
Ethanol-water mixture at different concentrations





Spectra Gallery

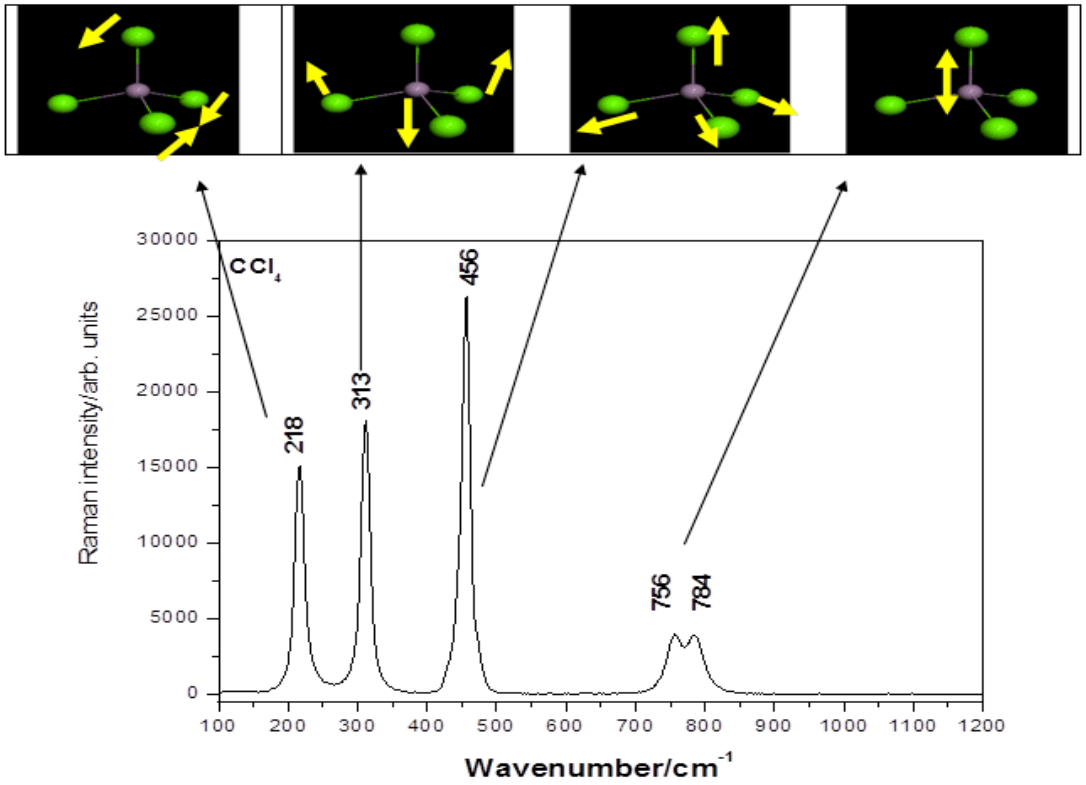
Tartrazine (E 102 food additive)



Ref. Peica, N., Pavel, I., Cîntă Pînzaru, S., Rastogi, V. K. and Kiefer, W. (2005), Vibrational characterization of E102 food additive by Raman and surface-enhanced Raman spectroscopy and theoretical studies. J. Raman Spectrosc., 36: 657–666. doi: 10.1002/jrs.1354.

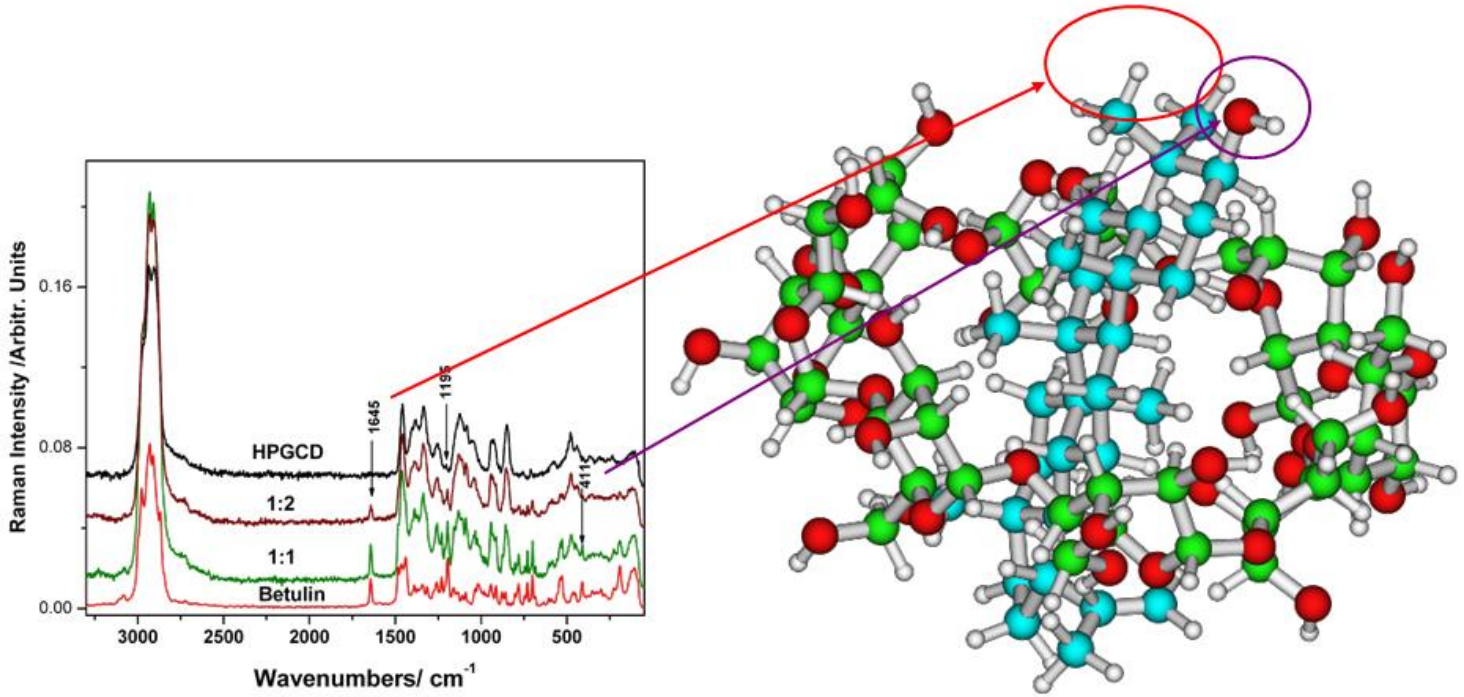
Spectra Gallery

CCl_4 -Carbon tetrachloride-vibrational modes and their assignment



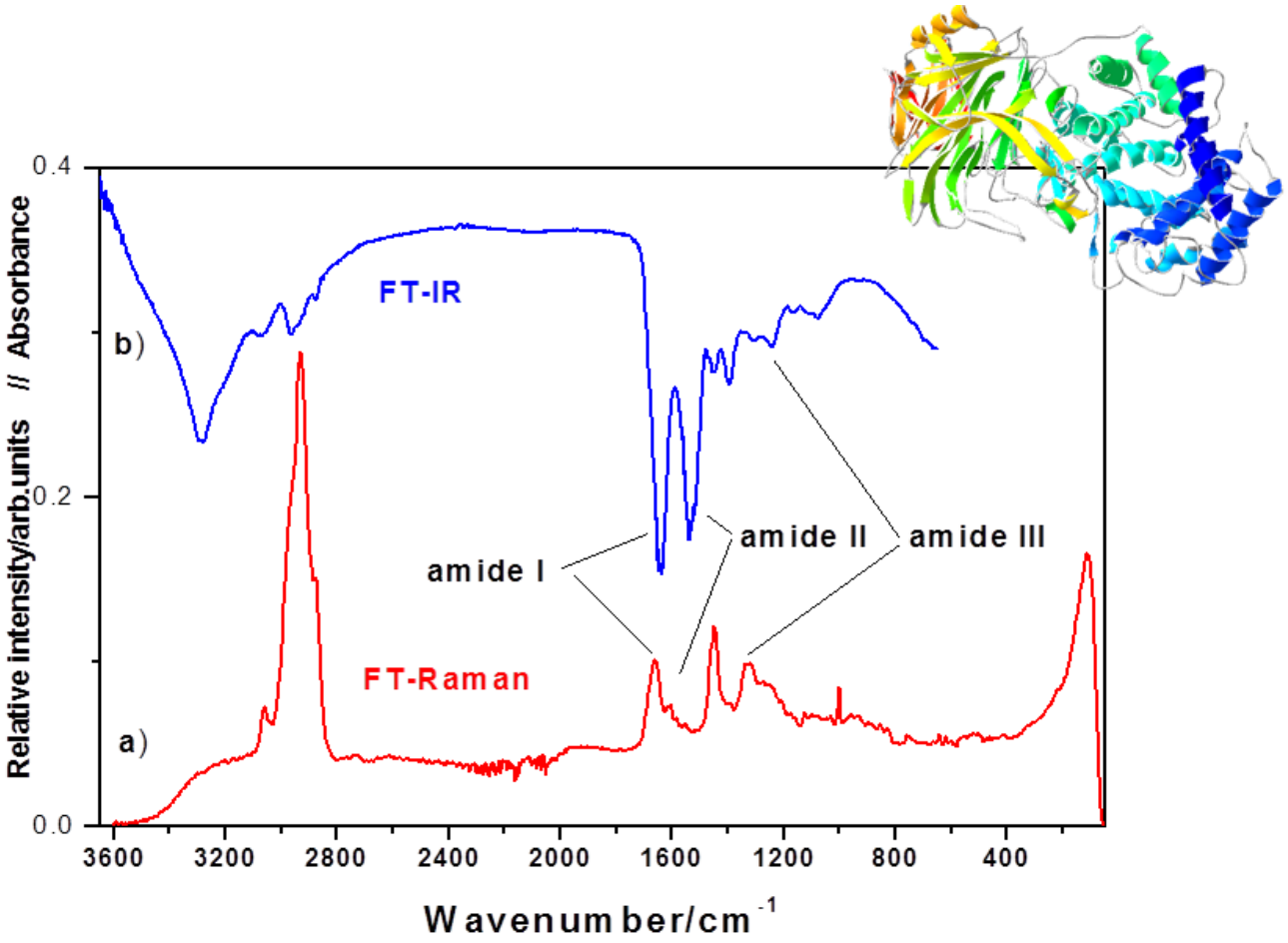
Spectra Gallery

Inclusion complexes: betulin- 2-Hydroxypropyl-γ-cyclodextrin



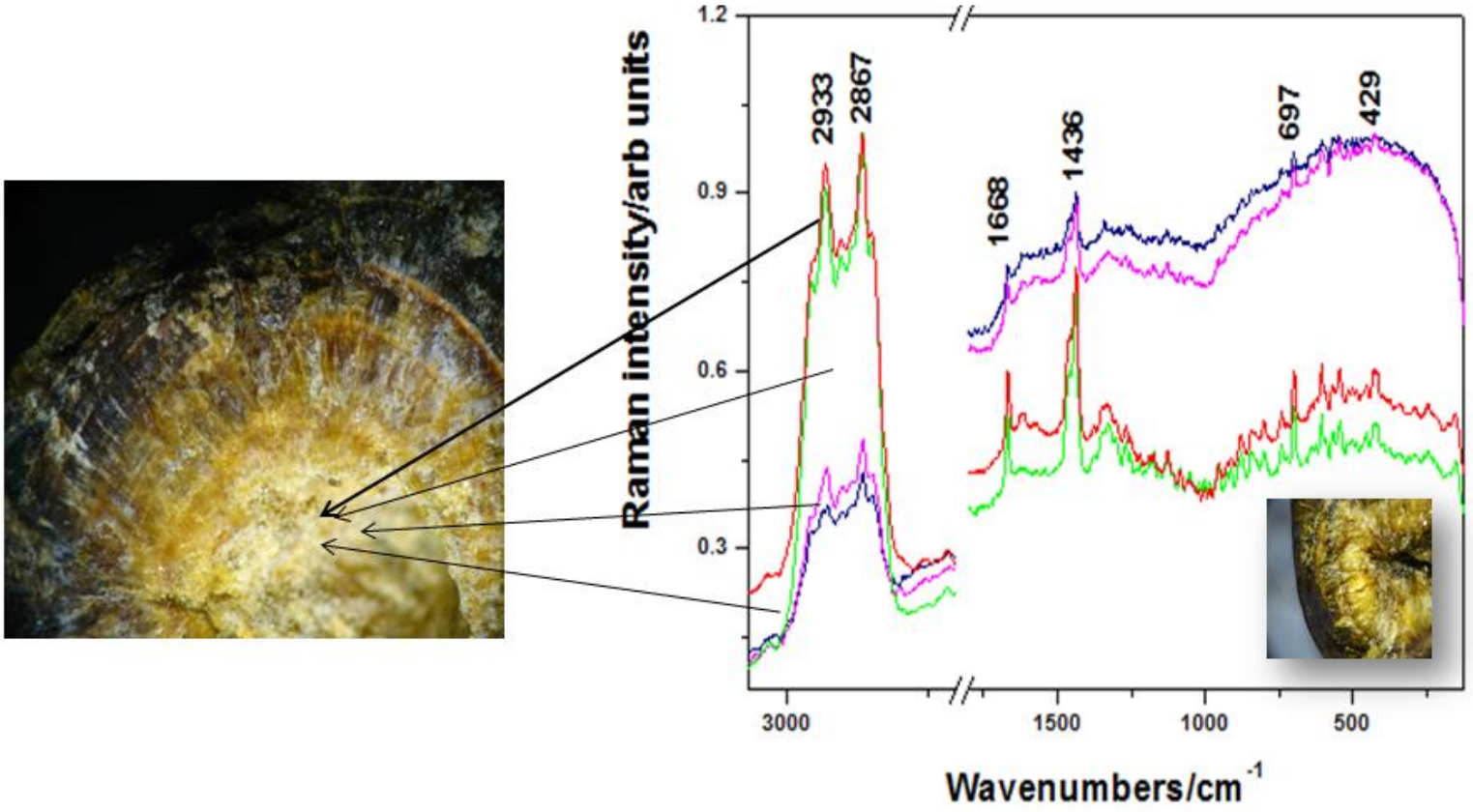
Spectra Gallery

Proteins (Hyaluronidase)- vibrational spectra



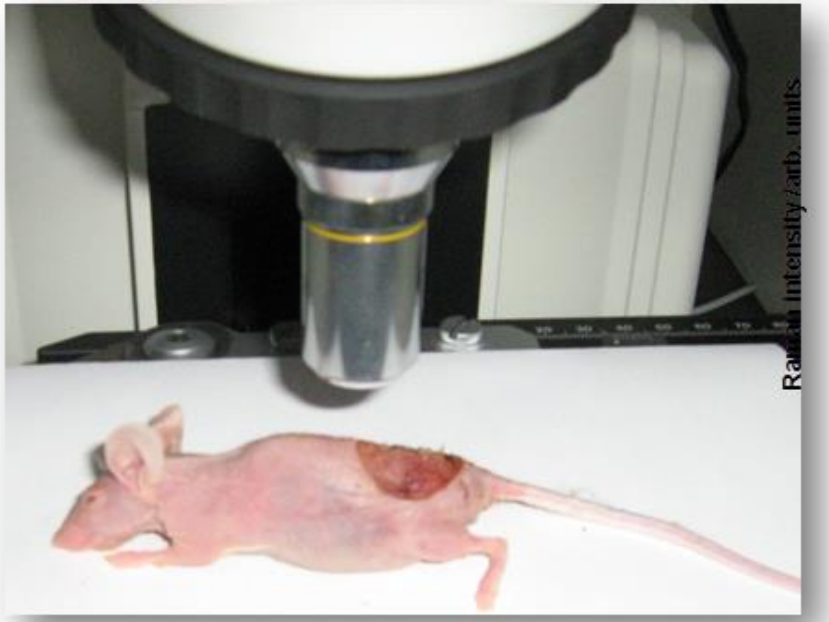
Spectra Gallery

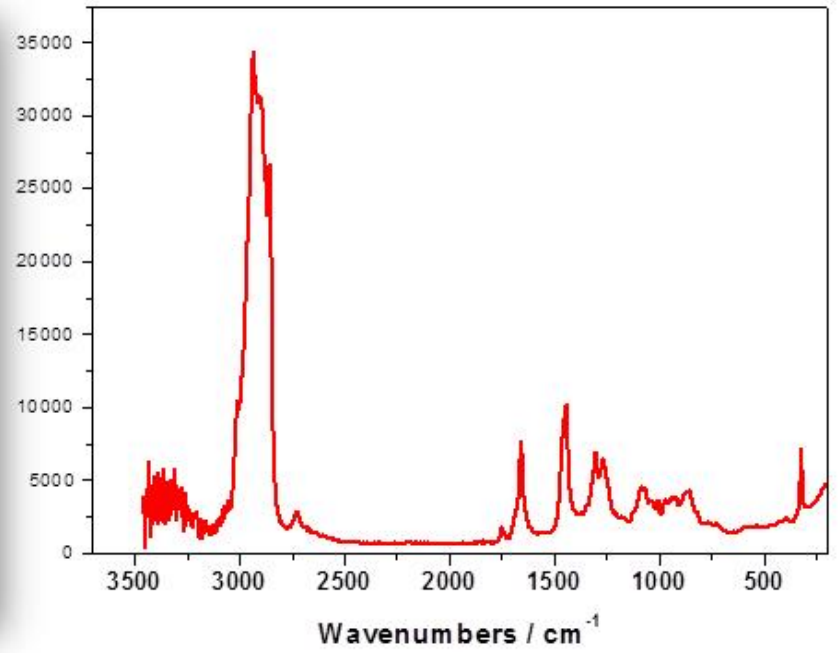
Gallstones: Micro-FT-Raman spectra collected from cross section



Spectra Gallery

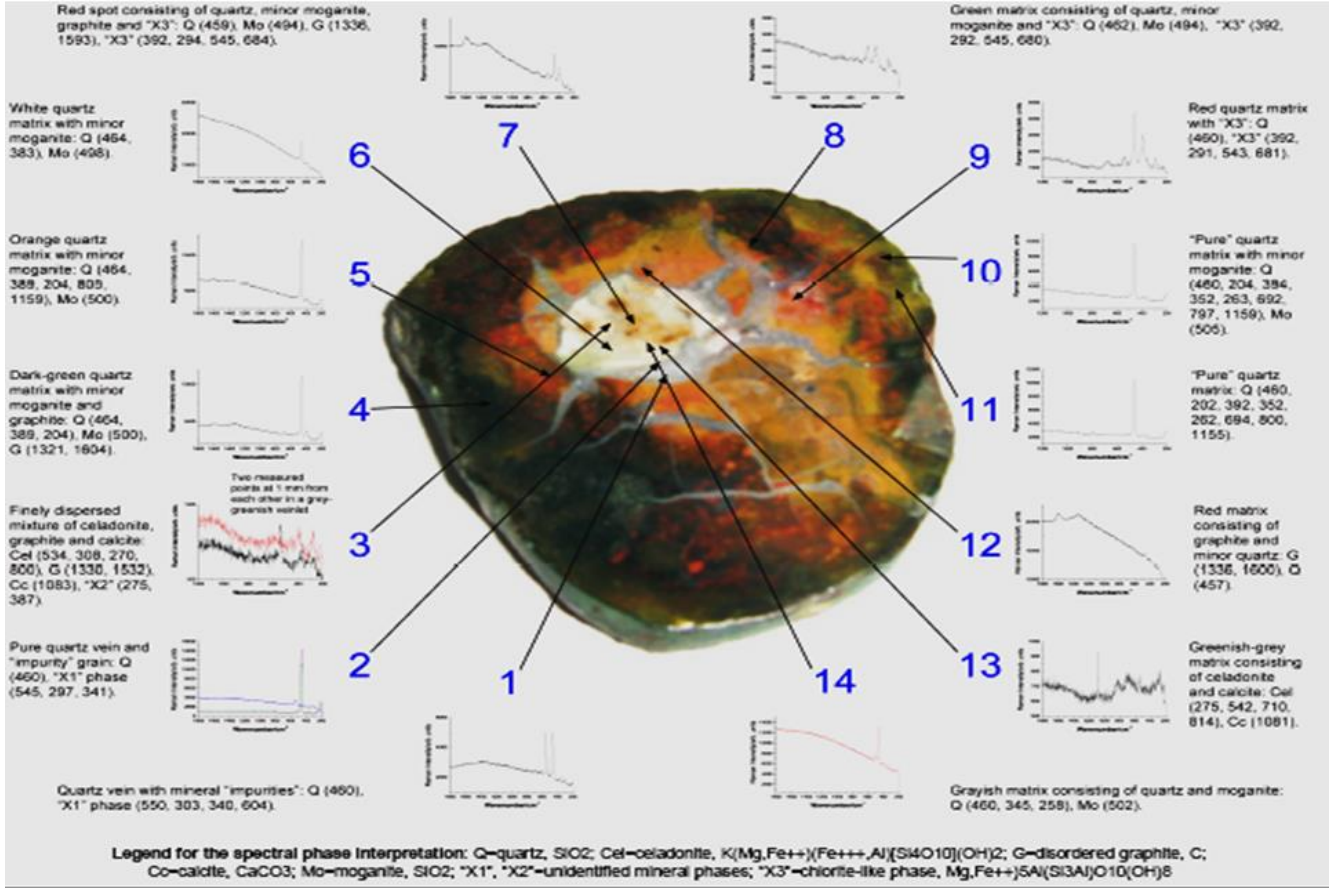
In Vivo animal models: Micro-FT-Raman signal from melanoma skin





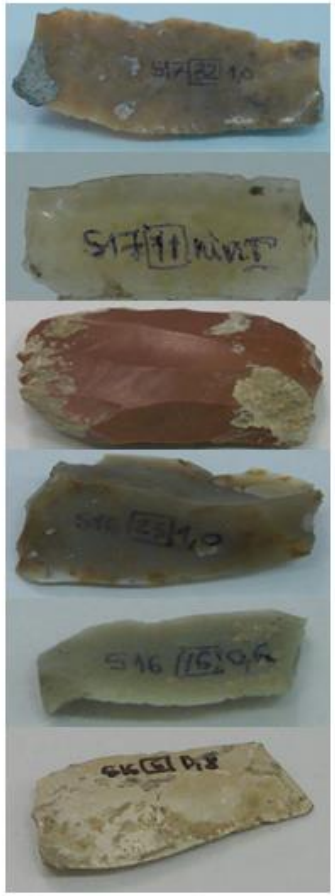
Spectra Gallery

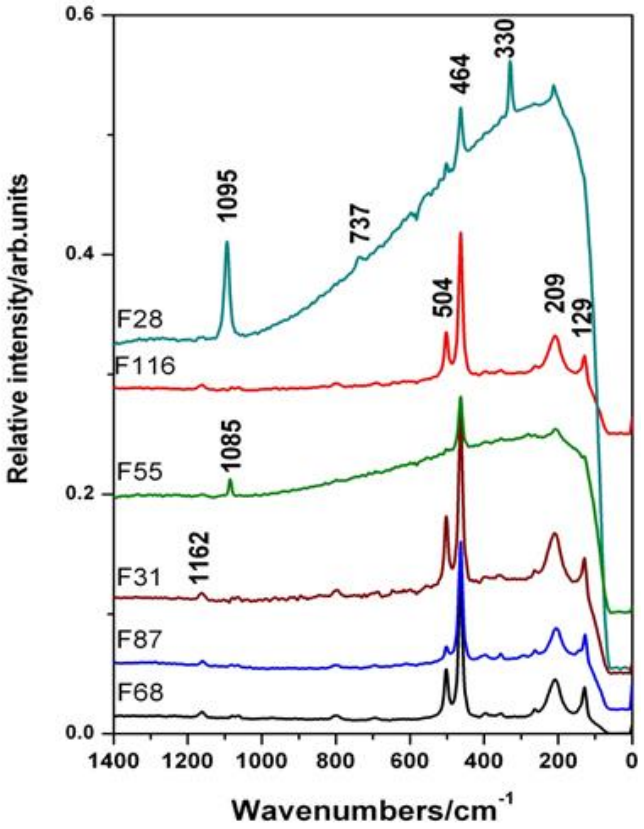
Minerals



Spectra Gallery

Archeological artefacts from a Neolithic site in Banat, Romania





Spectra Gallery

Microalga (*Cylindrotheca Chlosterium*)