

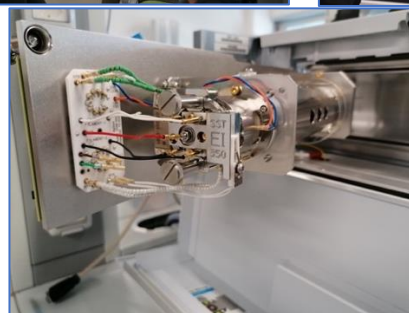
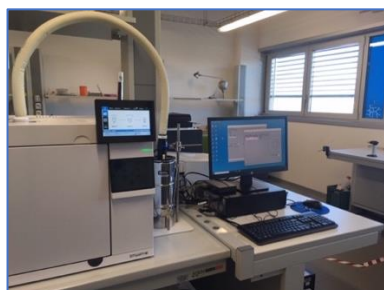
Analytical pyrolysis – gas chromatography – mass spectrometry (Py-GC/MS) with micro UV-irradiator system CISUP laboratory

2022 activity report - I semester

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Laboratory web page: <https://cisup.unipi.it/labs/multi-shot-pyrolyzer-gc-ms/>



1. Price list

The price list was published on the CISUP website with the instructions for quote requests (Table 1).

Table 1: Price list 2021, VAT excluded.

Type of experiment	UNIFI	Research institutes	Privates
Price for routine analyses (including both the analysis time and the time needed for instrument setup)	45 €/h	60 €/h	100 €/h
Sample preparation (milling, high precision weight of the sample, derivatization, observation under the microscope and photographic documentation of sampling)	20 €/h	25 €/h	40 €/h
Interpretation of chromatograms and spectra, data analyses and data treatment, writing of scientific report	60 €/h	60 €/h	60 €/h
Teaching packages for master students (supervised by experts)	25 €/h		

All fares refer to standard/routine applications and include the presence and support of authorized experts. For standard applications to a relevant number of samples or hours, special fares can be applied upon discussion with the Scientific Committee and request of a quote. The pricing for nonstandard applications (e.g. development of novel analytical procedures, application on non-routine samples) will be discussed for each individual case, including research projects, collaborations, agreements with research institutes. Interested users are invited to contact the Scientific Committee to discuss the specific case study and to request a quote.

2. Hours worked

Table 2 shows a breakdown of the hours worked by the Py-GC/MS instrument in the first semester of 2022. During the first half of 2022, the laboratory worked for 829.5 hours (maintenance hours excluded).

The income is ~18.0 k€.

Table 2: Py-GC/MS usage in 2022 (1st semester)

User type	Hours	%
UNIFI (projects)	64.5	8
UNIFI (single users)	9	1
UNIFI education	614.5	74
External/private	141.5	17
<i>Total</i>	<i>829.5</i>	<i>100</i>

4. User statistics

The users of the instrument over the first half of 2022 include 5 research groups from departments of the Università di Pisa, considering activities carried out for single analyses, more complex projects or PhD students' research (Dipartimento di Chimica e Chimica Industriale; Dipartimento di Scienze Agrarie, Alimentari e Agro-ambientali), in some cases in the framework of collaborations with foreign universities and Research Institutions (University of Plymouth UK and University of Aalborg Denmark) accounting for almost the 80% of the total workload. The remaining 17% includes services for privates (in some cases in the framework of collaborations). The statistic for the different Departments shows that for most of the workload was related to projects led by researchers of the Dipartimento di Chimica e Chimica Industriale.

Projects:

- StAr project - Development of Storage and assessment methods suited for organic Archaeological artefacts - within the framework of Joint Programming Initiative on Cultural Heritage and Global Change (JPI-CH, <http://jpi-ch.eu/>) Conservation, Protection and Use (2020-2022);
- NAMC North Atlantic Microplastic Centre, Pillar 1 – Sensitive Analytical Methods, Research task: “Systematic assessment of matrix interference on the quali-quantitation of microplastics in environmental samples by Py-GC-MS” (2021-2022);
- JPI-Oceans HOTMIC project “Horizontal and vertical oceanic distribution, transport, and impact of microplastics”(2020-2023);
- Fondazione Carilucca – (Bando Ricerca 2019-21), 2019 CISUP project “Micro and nano-plastics: quantification, evaluation of their impact on marine and lacustrine ecosystems, and remediation strategies (2019-2022)”;
- PRIN2020 project SUPERSTAR “Sustainable Preservation Strategies For Street Art” (2022-2024).

PhD students:

- Federica Nardella (DCCI – DSCM, 34° cycle), thesis title “Advanced analytical pyrolysis techniques for studying complex mixtures of natural and synthetic polymers”;
- Tommaso Nacci (DCCI – DSCM, 36° cycle), thesis title “Investigating the potential of analytical pyrolysis coupled to mass spectrometry in the study of particles derived from textile fibers and tire wear in the environment”;
- Adele Ferretti (DCCI – DSCM, 36° cycle), thesis title “Multi-analytical approach for the identification and characterization of historical and modern inks”;
- Greta Biale (DCCI – DSCM, 37° cycle), thesis title “Study of the fate and interactions of microplastics and nanoplastics in the environment”;
- Jeannette Lykkemark (Department of the Built Environment, University of Aalborg), thesis title “Quantification of anthropogenic particles in environmental matrices” in the context of the activities of the Research Network with NAMC (North Atlantic Microplastic Centre, Norway);

- Maria Maisto (Corso di Dottorato di Ricerca in Scienze e Tecnologie per L'ambiente e la Salute, XXXVI Ciclo, Università del Sannio).

5. Research products

The CISUP Py-GC/MS was used in several national and international research projects, in master theses and PhD research projects. The activities were mainly related to the field of environmental science, marine science, innovative materials for biomedical use, lignocellulosic materials and biomasses, and cultural heritage objects. This led to several publication in international journals as:

List of publications

1. R. D'Orsi, J.J. Lucejko, F. Babudri, A. Operamolla, Kumagawa and Soxhlet Solvent Fractionation of Lignin: The Impact on the Chemical Structure. ACS Omega 2022, 7, 25253-25264, doi:10.1021/acsomega.2c02170.
2. J. La Nasa, G. Biale, F. Modugno, Al. Ceccarini, S. Giannarelli, "Magic extraction: solid phase extraction and analytical pyrolysis to study polycyclic aromatic hydrocarbon and polychlorinated biphenyls in freshwater", 2022, Environmental Science and Pollution Research, in press (<https://doi.org/10.1007/s11356-022-22435-9>)
3. J. La Nasa, P. Carnazza, S. Francone, M.P. Colombini, F. Modugno, "Is this tar? Analytical pyrolysis to study the chemical composition of Alberto Burri's paint materials", Journal of Analytical and Applied Pyrolysis, 2022, Vol. 163, article number 105483 (<https://doi.org/10.1016/j.jaap.2022.105483>)
4. F. Saliu, G. Biale, C. Raguso, J. La Nasa, I. Degano, D. Seveso, P. Galli, M. Lasagni, F. Modugno, "Detection of plastic particles in marine sponges by a combined infrared micro-spectroscopy and pyrolysis-gas chromatography-mass spectrometry approach", Science of the Total Environment, 2022, Vol. 819, article number 152965 (<https://doi.org/10.1016/j.scitotenv.2022.152965>)
5. V. Menicagli, G. Biale, A. Corti, J. La Nasa, F. Modugno, V. Castelvetro, C. Lardicci, "Leached degradation products from beached microplastics: a potential threat to coastal dune plants", 2022, Chemosphere, Vol. 303, article number 135287 (<https://doi.org/10.1016/j.chemosphere.2022.135287>)
6. T. Nacci, F. Sabatini, C. Cirrincione, I. Degano, M.P. Colombini, "Characterisation of textile fibers by means of EGA-MS and Py-GC/MS", Journal of Analytical and Applied Pyrolysis, 2022, Vol. 165, article number 105570 (<https://doi.org/10.1016/j.jaap.2022.105570>)
7. T. Nacci, D. Roversi, F. Sabatini, I. Degano, B. Ferriani, N. Strada, F. Modugno, "Multianalytical approach to characterize composition and degradation processes of synthetic high-fashion textiles from the Nanni Strada Design Studio archives" Journal of Physics: Conference Series, 2022, 2204(1), 012012

Theses

Bachelor theses (Corso di laurea triennale in Chimica)

- Aurora Celati, thesis title “The study of modern and ancient papyri using GC-MS and Py-GC/MS”
- Matilde Vespi, “Caratterizzazione della cera giapponese usata come legante pittorico tramite tecniche di cromatografia e spettrometria di massa”
- Marina Deri “Studio della degradazione di plastiche biodegradabili in teli di pacciamatura tramite pirolisi analitica e spettrometria di massa”

Master theses (Corso di laurea magistrale in Chimica)

- Stefano Pezzini, “Plastiche e bioplastiche in ambiente marino: monitoraggio dei processi di alterazione con un approccio multi-analitico”
- Giulio Messina, “Estrazione di lignina da biomassa e sua caratterizzazione tramite tecniche basate su pirolisi analitica, cromatografia e spettrometria di massa”
- Lucia Andrei “Nuovi metodi basati su pirolisi analitica per lo studio delle frazioni molecolare e macromolecolare di ambre geologiche”
- Federico Vitale “Invecchiamento artificiale di salviette umidificate: studio e caratterizzazione tramite Py-GC/MS ed EGA/MS”
- Filippo Marchi, thesis title “Characterization of archaeological finds in wood and leather, and the assessment of their state of decay before and after the application of conservation protocols” within the JPI-CH StAr project.

6. External services

Analyses were undertaken for private companies, such as:

- Norce (Norway): Analysis of plasticizers in fish samples;
- Opificio delle Pietre Dure (Florence): characterisation of organic materials in samples collected from works of art, in the frame of diagnostic or restoration campaigns;
- Adarte (Florence): characterisation of organic patinas on the surfaces of sculptures from the Loggia del Bigallo, from the bronze statue by Benvenuto Cellini; characterisation of organic materials in paintings;
- Silma S.r.l. (Italy): characterization of synthetic polymers by Py-GC/MS for the characterization of additives;
- Matex Lab Switzerland SA: characterisation of PEG-DE standard samples.