The Cyprus Institute (CyI) is a non-profit research and educational institution with a strong scientific and technological orientation. It is an issue orientated institution, emphasizing international collaborations and cross-disciplinary research and post graduate education. CyI is being developed by establishing research centers to address important and challenging problems at both the regional and international levels. These research centers are developed in partnership with leading, world-class institutions in their respective thematic areas.

Established in 2016, the Facility for Chemical Analyses (FCA) has the mission to provide advanced environmental chemical analysis services to the Research Centers of CyI, to national and international academic and research communities and, in certain cases, to the public and private sectors.

FCA gathers the latest trace analytical techniques for environmental samples (atmospheric aerosols and gases, rainwater, etc.) following international, standardized operating procedures in compliance with EU environmental directives. Combining high tech (mass spectrometer) instrumentation and a team of experienced engineers, FCA provides a large range of quality controlled chemical analyses relevant for Air and Water quality. FCA instrumentation is fully automated, allowing for the chemical analysis of a very large volume of environmental samples in a timely and efficient manner.

FCA operates under the Vice-President for Research (VPR) of CyI who supervises its activities and performance. The scientific priorities and the budget of the Facility are set by a Scientific Committee. Ex-officio members of the Scientific Committee are the Directors of EEWRC and STARC. The Director of EEWRC is the chair the Scientific Committee of the Facility.

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Facility for Chemical Analyses (FCA)

Major Partners

Department of Labour Inspection (DLI, Cyprus)

National Observatory of Athens (NOA, Greece)

Environmental Chemical Processes Laboratory (ECPL), University of Crete (Greece)

Laboratoire de Sciences du Climat et de l'Environnement (LSCE, CNRS-CEA -UVSQ, France)

Agricultural Research Institute of Cyprus (ARI, Nicosia)

Max Planck Institute for Chemistry (Mainz, Germany)

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Research Projects & Networks

WMO-GAW: World Meteorological Organization - Global Atmospheric Watch

EMEP: European Monitoring and Evaluation Programme

ACTRIS2 (H2020): European Research Infrastructure for the observation of Aerosol, Clouds, and Trace gases

ACTRIS PPP (H2020): Aerosols, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project

BACCHUS (FP7): Impact of Biogenic versus Anthropogenic emissions on Clouds and Climate: towards a Holistic Understanding

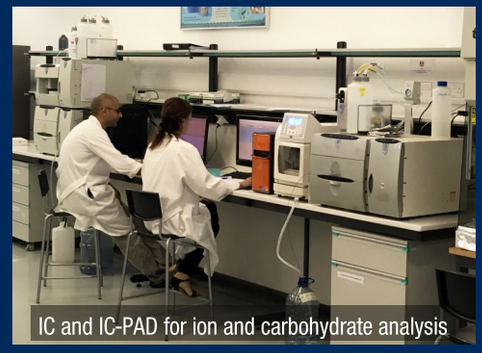
EU Directive 2008/50/EC on ambient air quality and cleaner air for Europe: Chemical analysis of trace elements (ions, carbon, metals) in aerosol samples (PM2.5, PM10) – Cyprus Air Quality Network

The Facility for Chemical Analyses (FCA)

The FCA is operating under controlled atmosphere and covers a total area of approx. 228 m² at the second floor of the New Technologies Laboratories building (Cyl premises at Athalassa). Facilities include a central laboratory (204 m²) dedicated to sample storage / preparation and ion / carbon / carbohydrate analyses, and two separate analytical rooms (12 m² each) for mass spectrometric analyses of trace metals and organics.

Instrumentation and Chemical Analyses

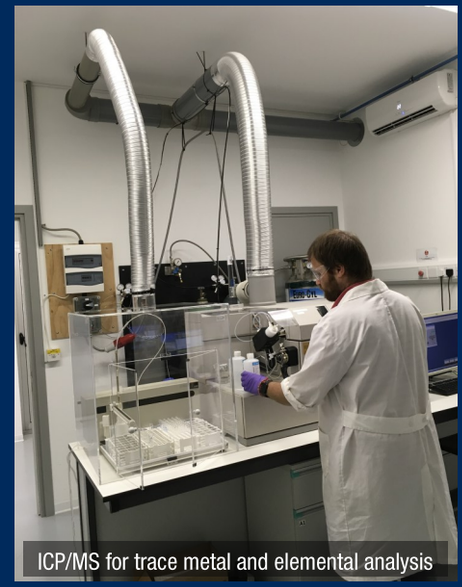
Anions/Cations in aqueous solutions are analyzed using a THERMO ICS-5000 Ion Chromatograph (IC) operating with Eluant generator and auto sampler for the quantitative determination of major anions (Methane sulfonate, Chloride, Nitrite, Bromide, Nitrate, Sulfate, Oxalate, Phosphate) and major cations (Sodium, Ammonium, Potassium, Magnesium, Calcium) at ppb (10-9 g/g) concentration levels. Conductivity and pH are analyzed using specific electrodes.



IC and IC-PAD for ion and carbohydrate analysis

Elemental and Organic Carbon (EC, OC): Atmospheric EC and OC are analyzed using a thermo-optical Sunset Laboratory instrument (EUSAAR 2 temperature protocol).

Carbohydrates in aqueous solutions are analyzed using a THERMO ICS-3000 Ion Chromatograph – Pulsed Amperometric Detection (IC-PAD) and auto sampler for the quantitative determination of anhydride sugars (levoglucosan, mannosan, galactosan, mannitol, arabitol, myo-inositol, glucose, mannose, galactose) at ppb (10-9 g/g) concentration levels.



ICP/MS for trace metal and elemental analysis

Trace metals (pre-treated with acid digestion) are analyzed using a AGILENT ICP-MS (7500 Series) and autosampler for the quantitative determination of elements (Pb, As, Cu, Cd, Ni, Hg, Cr, Zn, Al, Co, Fe, Mn, V) at ppt (10-12 g/g) concentration levels.

Trace organics Atmospheric (particles and aerosols) and other environmental (water, soils, etc.) samples are extracted for the subsequent separation and isolation of numerous organic trace compound classes. A high-resolution gas chromatograph (Agilent Technologies 7890B GC) connected to a mass spectrometer (Agilent Technologies 5977B MSD) in the electron impact or chemical (positive and negative) ionization modes is used for the identification and quantitation of relevant environmental organic chemicals (polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), polybrominated diphenyl ethers (PBDE), organochlorine pesticides (OCP), various volatile organic compounds (VOC), and others).

Research Activities at the Facility

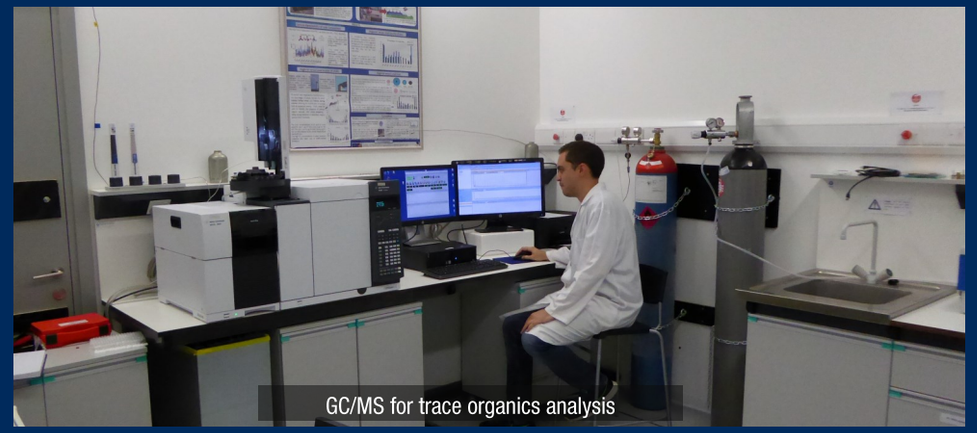
Atmospheric aerosols: Chemical composition / concentrations and sources

FCA supports research activities related to the various aerosol impacts on climate, air quality, and health. Aerosol chemical information is crucial in the compliance of several EU environmental directives (e.g. contribution of natural sources to PM_x), in the definition of local mitigation measures (identification of local vs regional sources contributing to PM_x), and helps to better depict aerosol toxicity (heavy metals, PAHs, persistent organic pollutants (POPs) such as PCBs, OCPs, PBDEs etc).

Aerosol chemical information is also crucial to better derive their (in)direct impact on climate (hygroscopicity, water-solubility, absorbing material, etc).

FCA provides comprehensive characterization of the major chemical components of airborne particles (ions, carbon, elements) allowing for a quantitative aerosol mass reconstruction in various aerosol size ranges (PM_1, $PM_{2.5}$, PM_{10}) and contrasted atmospheric environments (from remote to highly polluted areas). A large range of key macro-tracers allows for an additional apportionment of aerosols within various natural/human-made sources such as desert dust, sea salt, marine (phytoplankton) sulfur, pollens, fungal spores, biomass burning, crude oil (industry, shipping), transport emissions (light vs heavy duty vehicles; gasoline vs diesel), etc.

Additional information on atmospheric processes can be further obtained such as aero-



GC/MS for trace organics analysis