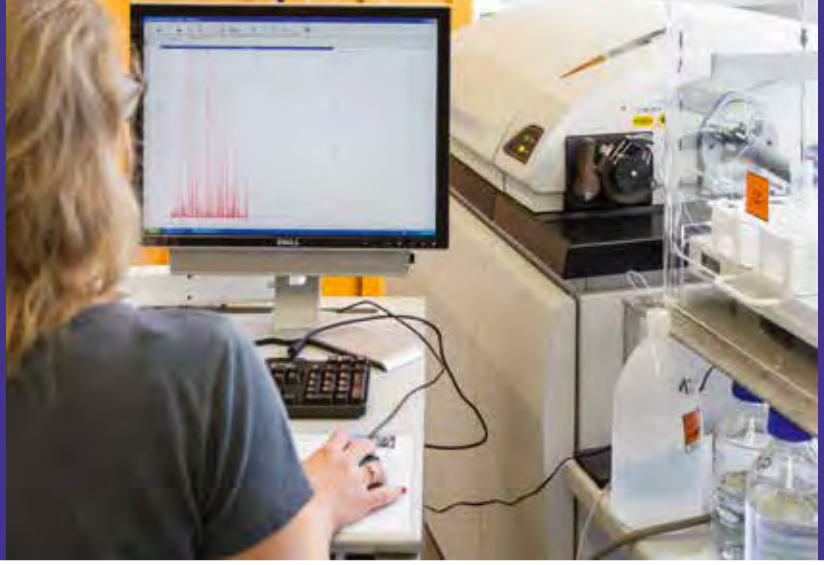
Fraunhofer
IGB

FRAUNHOFER INSTITUTE FOR INTERFACIAL ENGINEERING AND BIOTECHNOLOGY IGB

CHEMICAL ANALYTICS

PROCESS ANALYTICS, DAMAGE ANALYSIS, QUALITY ASSURANCE



ANALYTICS IN THE SERVICE OF RESEARCH

Reliable analytics is the basis for research and product development. The working group "Chemical Analytics" at Fraunhofer IGB offers chemical, physico-chemical and protein-chemical analyses. With our analytical competence we support your research for new applications and product developments, and also in quality assurance and damage assessment.

Standardized analytics for every specific question

Focusing on your specific requirements and working together with you, we choose the appropriate technologies from a broad range of methods. Standardized procedures and an extensive range of modern technical equipment are indispensable for our own scientific work – and as our customer you benefit from this.

Development of new test methods

Where there are no standardized analytical methods, we develop and validate test methods tailored exactly to your specific requirements.

Analytics in R&D

With our scientific expertise and many years of experience we deliver reliable research results. At the same time we can offer far more than the analysis of individual parameters. Together with process engineers, chemists, physicists and biologists from our institute we solve complex problems and assist in their implementation through to industrial scale. Our interdisciplinary teams also optimize methods with the aim of developing analyses for special requirements, thus opening up new and complex issues.

You can rely on us

A wide range of state-of-the-art technical equipment and motivated, highly qualified staff guarantee quick processing and handling of your analytical requirements. A quality management system and accreditation in accordance with DIN EN ISO/IEC 17025 insure that our analytics meets the highest of standards.

Individual expert advice and detailed documentation provide our customers with a genuine gain in knowledge. It goes without saying that we maintain absolute discretion with respect to third parties.

SERVICES

Development of methods in chemical analytics
Monitoring of raw materials, production processes and end products

Environmental analytics
Water, wastewater, soil, sewage sludge, hazardous waste, air and on textiles

Drinking water analyses
WasserCheck – a nationwide study of the quality of the drinking water supplied to consumers

Residue analysis
Detection of production residues, environmental chemicals, auxiliary substances in the textile industry

Trace analyses of organic contamination of surfaces
Detection of production residues

Quality control
Product control, incoming goods inspection

Food analytics
Fatty acid analysis, carbohydrate analytics, organic acids etc.

Analytics for damage assessment
Investigation of problems during production

Analytical investigations supporting clinical studies
Detection of metabolites

Environmental impact assessment of building materials
Foam glass ballast, for example

Outgassing studies
Insulation glass panes, electronic components, packaging

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ANALYTICAL COMPETENCE

Accreditation according to DIN EN ISO / IEC 17025

The flexible accreditation of our analytics guarantees that our own methods developed at Fraunhofer IGB are also validated to the required extent. The quality of our test methods is guaranteed even when standardized methods are not available.

The quality management system introduced at Fraunhofer IGB was successfully completed on presentation of the accreditation certificate in 2000, which was based on the accreditation of certain types of tests. Since then it has been further developed in accordance with the latest applicable directives. The accreditation is regularly renewed and extended.

Participation in suitability tests

We document the quality of our analyses by regularly participating in suitability tests.

1 *Accreditation certificate.*
2 *Headspace sampler.*

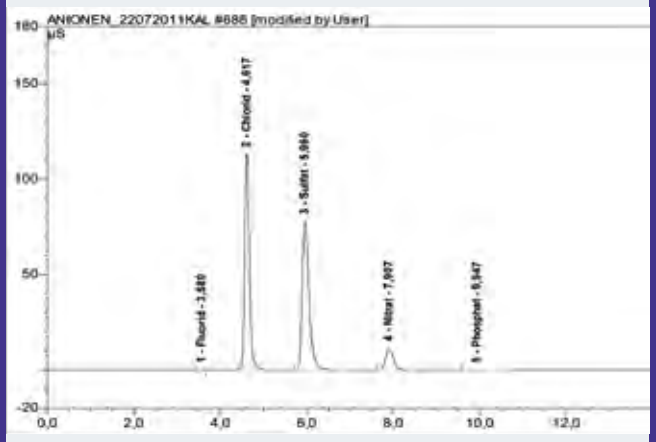
EQUIPMENT
GAS CHROMATOGRAPHY (GC)

Gas chromatography is a physico-chemical separation technique for the qualitative and quantitative analysis of substance mixtures, the components of which can be vaporized without decomposition.

GC systems and typical applications

- **Pyrolysis GC/MS**
  Characterization of polymers, copolymers, high-molecular organic substances, quality control of synthetic materials
- **Headspace GC/MS**
  Highly volatile substances in complex matrices (liquid or solid), e.g. solvents, aromatic substances, monomers
- **Thermal Desorption GC/MS**
  Workplace measurements, analysis of hazardous substances, airborne contaminations
- **Purge and Trap GC/MS**
  Trace analysis of highly volatile substances in liquid or solid samples, e.g. aromatic substances
- **Solid-Phase Microextraction (SPME) GC/FID**
  Enrichment of analytes, e.g. substances from solid or semi-solid samples, trace analysis in liquid samples
- **GC-MS/MS with Ion Trap and Quadrupole Technique**
  Mass spectroscopic identification of unknown substances, e.g. environmentally relevant pollutants and their degradation products, also for validating results
- **GC with Thermal Conductivity Detector (TCD)**
  Universal application, especially for gases
- **GC with Flame Ionization Detector (FID)**
  Universal application, e.g. for triglycerides, hydrocarbons, fatty acids, solvents

1 *Liquid sampler for gas chromatography.*
2 *Purge and Trap gas chromatography.*
3 *Anion chromatogram.*



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EQUIPMENT
HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) AND ION CHROMATOGRAPHY (IC)

High performance liquid chromatography (HPLC) is a physico-chemical separation technique for the qualitative and quantitative analysis of complex mixtures. In contrast to gas chromatography, which is a very good separation method for vaporizable substances, non-volatile substances can be analyzed using HPLC. Current HPLC developments with a higher sample flow rate, ever smaller sample volumes and improved resolution are called ultra high performance liquid chromatography (UHPLC). UHPLC, HPLC and ion chromatography units with various detectors are available.

HPLC equipment and typical applications

- **LC-MS/MS**
  With electrospray ionization (ESI) and atmospheric pressure chemical ionization (APCI), e.g. for the identification and quantification of unknown compounds, investigation of the metabolism of pharmaceuticals, the structural elucidation of compounds, sequencing of peptides

- **Refraction Index Detector (RI)**
  Universal application, e.g. for monosaccharides, disaccharides, organic acids

- **UV/VIS Detector**
  For active pharmaceutical ingredients, food additives, vitamins etc.

- **Diode Array Detector (DAD)**
  Identification and validation of results by means of UV/VIS spectra

- **Fluorescence Detector (FLD)**
  For amino acids, polycyclic aromatic hydrocarbons (PAH) etc.

- **Light Scattering Detector (ELSD)**
  For non-volatile substances that cannot be detected in the UV or fluorescence detector

IC equipment and typical applications

- **Electrochemical Detector (ED)**
  For monosaccharides, polysaccharides, phenols, catecholamines, cyanides, hydroxylamines

- **Conductivity Detector**
  For anions, cations, organic acids

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EQUIPMENT
ANORGANIC ANALYTICS

Digestion systems

A digestion procedure is a a method of sample preparation for solids using various mineral acids with the aim of transferring the analyte into solution and then analyzing it with a spectroscopic technique.

- High pressure asher
- Microwave digestion unit

Cation analytics

- **Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-OES)**
  In atomic emission spectrometry the atoms to be detected are excited by inductively coupled plasma (ICP), a gas ionized in the high-frequency field. The energy absorbed is emitted in the form of emission spectra. This method is employed in inorganic elemental analysis.

- **Inductively Coupled Plasma Mass Spectrometry (ICP-MS)**
  Inductively coupled plasma mass spectrometry (ICP-MS) is a robust, very sensitive mass spectrometric method of analysis in inorganic elemental analysis. Among other purposes, it is used for the trace analysis of heavy metals such as lead, cadmium, bismuth or rare earths.

Anion analytics

- **Ion Chromatography (IC)**
  Ion chromatography is a variant of liquid chromatography that permits the qualitative and quantitative analysis of ions on the basis of various separation mechanisms (ion exchange, ion exclusion, ion pair formation). At Fraunhofer IGB, ion chromatography is used with suppressor technology.

EXAMPLES OF PROJECTS

Analysis of mains water supplied to the consumer

In Germany drinking water is tested rigorously. This insures that only water of the highest quality leaves the waterworks. In a nationwide study covering the whole of Germany we test how good the quality of the household drinking water is that comes out of the water tap. Water pipes and fittings can, for example, cause contamination with heavy metals such as lead or the frequently allergenic metal nickel. We analyze samples of household water and well water by means of inductively coupled plasma atomic emission spectrometry (ICP-OES) for the metals lead, cadmium, nickel, copper, aluminum, iron, chromium, molybdenum and lithium as well as for the cations sodium, potassium, calcium and magnesium. Anions such as chloride, fluoride, nitrate, phosphate and sulfate are determined by ion chromatography.

Additionally, at Fraunhofer IGB we can also analyze the water samples bacteriologically to identify specific microorganisms.

Environmental impact assessment of foam glass ballast

Foam glass ballast is a heat insulator made of foamed used glass. So that this may be used as a building material, its environmental compatibility has to be demonstrated. For this purpose we produce extracts and test them for heavy metals by means of inductively coupled plasma mass spectrometry (ICP-MS) and inductively coupled plasma atomic emission spectrometry (ICP-AES).

Analysis of nanoparticles

Due to their extremely small size, nanoparticles have resulted in a broad range of applications. They are to be found in complex media such as foodstuffs and cosmetic products. Their extensive use causes an increased release of these particles into the environment.

At Fraunhofer IGB we have established a method of determining inorganic nanoparticles – alongside dissolved ions – directly, on the basis of the specific elements and with great sensitivity. In this method the particles are analyzed by means of inductively coupled plasma mass spectrometry (ICP-MS) in the single particle mode (SP-ICP-MS). The technique was established for titanium dioxide nanoparticles in wastewater and silver nanoparticles in certain foodstuffs, and is being extended for other nanoparticles and matrices.

1 *Samples for the detection of heavy metals.*
2 *Weighing digestion samples.*
3 *We test the quality of household and well water in a nationwide study.*
4 *Samples of foam glass ballast.*

Fatty acid analysis

Determining fatty acids in fats and oils and in biosurfactants

Surfactants are surface-active molecules that are used in many areas of everyday life. They can be manufactured chemically or with the help of microorganisms, often using plant-based oils. For a number of years Fraunhofer IGB has been working on the production of microbial biosurfactants.

Determining dicarboxylic acids

Long-chained dicarboxylic acids are interesting synthesis components for producing biobased synthetic materials. They can be manufactured biotechnologically. Fraunhofer IGB is working on providing fermentation strains for the conversion of fatty acids to dicarboxylic acids. We support the research work with standardized analytics by means of gas chromatography.

Analysis of micropollutants

Organic micropollutants, including cyanides or heavy metals depending on the functionality of the particles, can be removed from wastewater by using adsorber particles. For selected pharmaceutical drugs, e.g. diclofenac, metoprolol, sulfamethoxazole or carbamazepine, we have developed and carried out the supporting analytics of adsorption tests using model adsorbers.

WE LOOK FORWARD TO ADVISING YOU

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Fraunhofer IGB brief profile

The Fraunhofer IGB develops and optimizes processes and products in the fields of health, chemistry and process industry, as well as environment and energy. We combine the highest scientific standards with professional know-how in our competence areas – always with a view to economic efficiency and sustainability. Our strengths are offering complete solutions from the laboratory to the pilot scale. Customers also benefit from the cooperation between our five R&D departments in Stuttgart and the institute branches located in Leuna, Straubing and Würzburg. The constructive interplay of the various disciplines at our institute opens up new approaches in areas such as medical engineering, nanotechnology, industrial biotechnology, and environmental technology. The Fraunhofer IGB is one of 67 institutes and independent research units of the Fraunhofer-Gesellschaft, Europe's leading organization for applied research.

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Stay in contact:

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