**High-performance liquid chromatograph (HPLC) with an autosampler**

*(completed by the responsible coordinator of equipment)*

**Equipment:** *High-performance liquid chromatograph (HPLC) with an autosampler, DAD detector, and mass spectrometer (MS) with a single quadrupole* ***(Pro-NanoEnviCz III)***

**No. of Equipment: *UFCH35***

**Responsible coordinator: Ing. Jiří Rathouský CSc.**

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**Equipment Description**

Liquid chromatography is one of the key separation and analytical techniques. It plays a crucial role in addressing the degradation of new types of water contaminants and in developing new nanotechnologies for environmental protection.  
The instrument is equipped with an HPLC quaternary pump with a pressure of up to 1050 bar, pH tolerance from 1 to 14, and a flow rate of 0.0001–10 mL/min. It features an autosampler with pressure resistance up to 1050 bar. The injection volume ranges from 0.1 to 50 µL, with injection linearity of ≥ 0.9999. The autosampler has a capacity of 162 standard vials (12 mm, volume 2 mL). Samples in the autosampler can be thermostated at 4–45 °C. The PDA detector has a wavelength range of 190–800 nm with a maximum sampling frequency of 100 Hz. Wavelength accuracy is ≤ ± 1 nm, and wavelength reproducibility is ≤ ± 0.1 nm. The MS detector is a single quadrupole type, using ESI + APCI ionization (a DUIS source). The m/z range is from 2 to 2000, with a scanning speed of 15000 Da/s and a polarity switching speed of 10 ms. Mass resolution is ± 0.7 Da, with mass determination accuracy of ± 0.1 Da.

**Specification of expertise relevant to NanoEnviCz workpackages:**

|  |  |
| --- | --- |
| **WP3 SYNTHESIS AND DESIGN OF NEW MULTIFUNCTIONAL NANOMATERIALS FOR ENVIRONMENT PROTECTION** | |
| Conceptually new nanostructured materials with the potential for application in innovative technologies | x |
| Computer aided nanomaterials design |  |
| Low dimensional materials and their composites (carbon dots, nanotubes, graphene derivatives) | x |
| Nanofibers |  |
| Magnetic hybrids |  |
| Metal and metal oxide NPs |  |
| Redox active nanomaterials |  |
| Nanomaterials for biomedical applications |  |
|  | |
| **WP4 HETEROGENEOUS CATALYSIS FOR ENVIRONMENTAL PROTECTION** | |
| Nanomaterials for catalytic degradation of pollutants in water, soil and air | x |
| Nanostructured heterogeneous catalysts for abatement of pollutants from industrial processes and automotive transport | x |
| New “clean” catalytic processes for chemical production |  |
|  | |
| **WP5 NOVEL NANOMATERIALS AND TECHNOLOGIES FOR SUSTAINABLE PRODUCTION** | |
| Processes and technology for sustainable energy and chemical production |  |
| Catalytic processes for transformation of natural gas to liquids |  |
| Nanomaterials for utilization of renewables; Magnetically separable green catalysts |  |
|  | |
| **WP6 EFFECTIVE PHOTOCATALYTIC TECHNOLOGIES** | |
| Mastering nanomaterials for photocatalysis | x |
| Effective photocatalytic processes | x |
| Photovoltaic paints |  |
| Functional surfaces for environmental protection | x |
| Hybrid materials combining photocatalysts and heterogeneous catalysts | x |
| Thin photocatalytic films for direct solar splitting of water | x |
|  | |
| **WP7 NANOTECHNOLOGY FOR TRAPPING AND CHEMICAL DEGRADATION OF POLLUTANTS** | |
| Nanomaterials for sorption | x |
| Natural based nanomaterials produced by “green” technology | x |
| Reactive sorbents for degradation of pesticides and highly toxic agents | x |
| Degradation of chemical warfare agents |  |
| Analysis of filtering capabilities of nanomaterials |  |
| Elimination of radionuclides contamination |  |
| Modified nanofiber filters; Advanced antimicrobial filters/membranes |  |
| Nanoiron for groundwater and waste water treatment |  |
| Nano-trapping of heavy metals |  |
|  | |
| **WP8 SENSING AND MONITORING OF POLLUTANTS** | |
| Efficient sensing of pollutants | x |
| Biosensing by new devises |  |
| Application of new sensors in monitoring of pollutants |  |
| Magnetic sensors; Magnetically assisted SERS sensors |  |
| Advanced electrochemical sensors |  |
| Graphene based nanosensors |  |
|  | |
| **WP9 TOXICITY AND RISKS OF NANOMATERIALS** | |
| Health risks |  |
| Environmental risks |  |
| „In vitro“ and „in vivo“ toxicity tests – cytotoxicity, genotoxicity, interactions with membrane |  |
| RNA gene expression changes and protein expression changes |  |
| Complete eco/aquatoxicity ecotoxicity evaluation |  |
| Toxicity against bacteria and fungi |  |

**Detailed description of expertise**

**Please, specify the main research topics connected with equipment**:

The equipment is primarily used for studying the degradation of emerging water contaminants (pesticides, pharmaceuticals, drugs, persistent organic pollutants). It also supports the development of advanced nanotechnologies for environmental protection.

**Please, specify the secondary research topics connected with equipment**:

The instrument aids in optimizing chemical processes in wastewater treatment. It also contributes to the analysis of novel photocatalytic materials.

**Keywords describing research area:**

HPLC, water pollutants, water contaminants, pesticides, pharmaceuticals, water quality, PDA, LCMS

**Competence**

**Relevance for applied and industrial research:**

This equipment is crucial for improving water purification technologies in industrial settings. It helps in testing the effectiveness of new materials for environmental applications.

**Relevance for fundamental studies:**

The device allows for in-depth investigation of chemical reactions at a molecular level. It also supports fundamental research in environmental chemistry and materials science.