Fraunhofer ISC

FRAUNHOFER PROJECT GROUP MATERIALS RECYCLING AND RESOURCE STRATEGIES IWKS

# OUR PORTFOLIO

Our services at a glance

- Analysis and characterisation of valuables and pollutants in secondary raw materials and waste waters
- Development and optimisation of recycling strategies
- Mechanochemical processing of mineral residuals
- Design of microbiological and chemical leaching and precipitation processes
- Synthesis of adsorption materials
- Electrochemical separation or elimination of substances from liquid media
- Exploitation of bio-based by-products for a substitution of mineral oil based materials
- Design of processes for the reprocessing of fibres and hemi-celluloses for bio-based materials, paints, textiles
- Enzymatic processing of bio-based residuals
- Development of biodegradable coatings for controlled release fertiliser

Technical equipment

- High-resolution light and electron microscopy (REM, EDX)
- X-ray diffraction (with high temperature measurement)
- Raman spectroscopy
- Elementaranalyse (ICP-MS, ICP-OES, WDXRF)
- Spectroscopy (FT-IR, UV-VIS)
- Chromatography (GC-MS, HPLC, IC)
- Thermogravimetry (TGA, DSC-MS, DTA)
- H2, O2, N2, C, S and Hg analysis
- Surface and pore analysis (BET)
- Particle size analysis (10 nm up to 30 mm)
- Static and dynamic fibre analysis

## CONTACT

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# BIOGENIC SYSTEMS






# BIO-BASED RAW MATERIALS

## Background

The increasing use of bio-based raw materials in various sectors in the industry provides access to prominent growth markets. The utilisation of these materials is decreasingly limited to an energetic use and comprises bio composite materials, cellulose based polymers including nano-cellulose and bio refineries of the 3rd generation. The sources for bio based raw materials are vegetable wastes from the food industry and agriculture. But also crops are grown especially for technical use. Keys for a successful use are the isolation, reprocessing of and a quality management for the relevant raw materials.

## Your challenges

- High requirements on quality for the raw materials
- In most cases bio based raw materials have to be isolated and reprocessed from a surrounding matrix
- Handling of secondary reaction products
- Adaptation or new solutions of physical and chemical processes for separation and reprocessing necessary
- Security of supply and quality of the raw materials

## Our solutions

- Development of processes for the recovery of natural fibres from by-products of the food industry
- Enzymatic degradation as a tool for the recovery of fibres-materials from their matrix
- Development of biogenic adhesion agents between fibres and matrices in compound materials
- Development of biodegradable coatings for fertilisers with a controlled nutrient release
- Analysis and evaluation of mass flows and development of resource efficient technologic improvements
- Compilation of environmental performance evaluation

## Your advantages

- Enhanced resource efficiency
- Access to alternative resources not yet used
- Establishment of value added chains
- Innovative cutting-edge role and expansion of your market position
- Competitive advantages by independent environmental certification
- Expanded sustainable product range

# POLLUTANT REMOVAL AND RECOVERY OF NUTRIENTS

## Background

Running short resources and accompanying rise in prices increase the part of raw material costs of a product. Therefore technologies and strategies for an efficient use of raw materials in industrial processes become a more and more important possible saving. Also in industrial processes and on chemical compounds used, the requirements on ecological harmlessness are of growing importance. For an optimisation of the resource efficiency it is not sufficient to recover valuable resources but also to minimise and reprocess potential secondary wastes.

## Your challenges

- High volumes of media that have to be treated
- High diversity of dissolved and particulate compounds in a wide range of concentrations
- Sanitary issues in the field of ground- and drinking water
- Excessive entry of phosphates and nitrates in surface and ground waters

## Our solutions

- Optimisation of processes for the treatment of waste water, process water, sludges and ashes
- Wet chemical dissolution and precipitation processes
- Development of particle based adsorption systems for organic and inorganic elements or compounds
- Selective separation even of traces and reversible desorption

## Your advantages

- Avoidance of harmful chemicals
- Determination of economic and easy available raw materials
- simple and robust production processes with broad variation possibilities
- multiple use of the same adsorption material due to desorption
- Separation and recovery of minor concentration of pollutants and valuable elements and compounds

# NUTRIENT RECYCLING CONCEPTS

## Background

Most of the phosphates that are mined end up as fertilisers in agriculture but they also play an important role in preserving agents, flame retardants, de-foamer, water softener and plasticiser. Missing natural phosphate deposits in Europe are the reason for the raising awareness in terms of the criticality of this resource.

Nitrogen as ammonia or nitrate is the other main nutrient for plants. Even if nitrogen is the most abandoned element in the air the conversion into plant available forms via the Haber-Bosch process is very energy consuming. Furthermore nitrate and ammonia are water soluble and are easily transferred as mineral or farm fertiliser into surface and ground water where they cause environmental problems.

## Your challenges

- Different determining conditions in the periphery of the recycling plant
- Recovered nutrients not yet a recycling product (marketable fertiliser)
- No sales market established for recycling products
- Different regional requirements for a recycling strategy
- Fulfilment of ordinances (fertiliser regulation, REACH)

## Our solutions

- Design of regional recycling concepts
- Strategic and technological support for WWTPs, local authorities and municipalities
- Optimisation, scale-up and implementation of existing technologies
- Evaluation and characterisation of recycling products according relevant ordinances
- Analysis of process and waste waters, sludges, ashes, farm fertiliser and secondary raw materials

## Your advantages

- Establishment of sustainable technologies
- Support during the transfer of ideas into a large scale production
- Avoidance of harmful chemicals
- Development of marketable products
- Saving due to reduced disposal costs
- Via IWKS access to a multiplicity of stakeholders and networks