Functional magnetic (nano)particle composites have the potential to enhance the performance and economics of bioseparation processes, because of their extremely high surface areas, rapid binding kinetics, and unique physical and chemical properties. The two major barriers to implement the industrial use of magnetic (nano)particle composites are the safe and effective large-scale manufacturing of appropriately functionalized (super)paramagnetic particles, and the lack of large-scale process technology to separate these particles from the production streams. The goal of the MagPro²Life project is to address these barriers and demonstrate the use of functional magnetic (nano)particle separation at pilot-scale for selected feed, food, and biopharma products.

In this part the main focus is to develop a set of inexpensive (super)paramagnetic nano-(composite) materials that have enhanced physical and chemical properties. A large variety of synthesis routes will be established.

- **Continuous Suspension Synthesis**
- **Solution / Spray- Process**
- **Laser Pyrolysis/ Precipitation**
- **Rotating Membrane Pore Extrusion**

In the next step magnetic matrices will be coated and biochemically functionalized in many ways to obtain powerful nano- and micromaterials with unique adsorptive properties. Current techniques will be developed further to analyze molecular and particle interaction as well as binding kinetics at the µ-scale.

In-situ product removal of enzymes applied in Feed during fermentation

- Fermentation intensification via the integration of multi in situ magnetic separation steps
- Prevention of product degradation by e.g. capturing proteases

Applications to be tested

**Recovery of nutraceutical biomolecules from large-scale natural Food streams**

- Exploitation of high value functional food proteins from soy process streams with specific attributes for health, well-being and/or prevention of diseases

Demonstration of the validity of magnetic separation technology for high throughput food industries

**Direct capture of high-value Biopharma proteins from crude feed streams**

- One step purification of novel antibody fragments (Fabs) with potential applications as therapeutics, medical diagnostics and analytics.

Systematic benchmarking of magnetic nanoparticle-based bioseparation processes against established DSP approaches, e.g. S/L separation followed by chromatography

**Project partners**

- Solae
- Karlsruhe Institute of Technology
- University Birmingham
- Technische Universität Bergakademie Freiberg
- National Institute for Laser, Plasma and Radiation Physics
- Merck KG
- Universidad de Salamanca
- flt Biosystems GmbH
- University College Dublin
- KIMPT AG
- Swiss Federal Institute of Technology
- Technical University of Denmark
- Romanian Academy- Timisoara Branch
- Bühler AG
- INM – Cluj Napoca