Establishing safe and sustainable pharmaceutical life cycles by design

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#Be greener, be... ETERNAL

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ETERNAL

Research and innovation contributing to sustainable future access to medicines through full life cycle approaches covering pharmaceutical design, manufacture, use, and disposal

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Ongoing access to safe, high quality and effective medicines for citizens and animals is a vital part of fulfilled, equitable living. At the same time, we must avoid any undue impact of pharmaceutical residues on the environment. Indeed, our health and well-being strongly depend on a healthy environment.

About ETERNAL

Boosting reduced environmental impacts of pharmaceutical products throughout their entire life cycle, the ETERNAL project is a four-year HORIZON Research and Innovation Action running until August 2026. It brings together sixteen partners from across Europe united by the motivation to contribute to sustainable development of pharmaceutical manufacture, use and disposal.

Our industry-research-compliance partnership is mobilizing to:

- co-design application-industry oriented R&D and scale-up in six industrial case studies focused on Green Chemistry, Mechanochemistry, and Digitalization as key enabling technologies
- assess the regulatory implications of adopting the innovations to ensure a pathway to compliance
- generate new scientific knowledge on the environmental fate and eco-toxicological effects of pharmaceuticals; and
- catalyze behavioural change, participation and social innovation for reducing the environmental impacts of pharmaceuticals in terms of safe use and disposal.

Green Manufacturing

- Continuous manufacturing technologies for API and medicines
- Mechanochemistry and Biosynthesis application
- Solvent reduction and recycling
- Removal of carcinogenic impurities
- Energy savings

Digital Transformation

- Workflow digitization for efficient chemical process data transfer with CDMOs
- PAT for Quality by Design and Continuous Manufacturing
- AI and Digital Twins for competitive and scalable production methods

Safe Use and Disposal

- Intrinsically less environmentally harmful products (Safety by Design)
- Ecotoxicity studies of current and new pharmaceuticals
- New technologies to capture carcinogenic impurities in water treatment plants

Social Awareness

- Regulatory compliance and outreach to public authorities
- Change Labs for business investment, policy 'pull', practitioners as influencers, and responsible disposal by citizens
- Engagement with water treatment

Innovation enabling...

- Reduced use of solvents
- Application of greener solvents
- Optimized solvent recycle/recovery options for processes with potentially carcinogenic impurities like nitrosamines
- Application of mechanochemistry (Holt Melt Extrusion) in the production of pharmaceutical products
- More eco-efficient purification/capture routes for solvents and wastewater with biobased products
- Innovative workflow digitalization, PAT and Digital Twin solutions to enable Quality by Design and Continuous Manufacturing for competitive and scalable methods of production

Project Partners

The ETERNAL consortium brings together complementary knowledge and expertise from academic and specialist research institutes, leading businesses in the pharmaceutical industry, and innovative SME businesses in whole process design, technology/digitalization, environmental engineering, innovation services, and international scientific and regulatory affairs.