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ASIA EDITION

Advancing Sustainable Pharmaceutical Manufacturing with Flow Chemistry

August 27, 2025 | News

Apeloa's approach to sustainable and safer drug manufacturing with flow chemistry for improved reaction safety, scalability & production efficiency



Sustainable drug manufacturing is becoming increasingly vital in the global pharmaceutical industry, as drugmakers seek to improve climate conditions, production yields, and reaction safety. Flow chemistry is gaining momentum worldwide as the preferred option to replace explosive or hazardous chemistries in batch processing, while also reducing energy use, lowering emissions, and increasing resource efficiency.

Apeloa Pharmaceutical is recognized for its expertise in flow chemistry, demonstrating capabilities across the entire lifecycle of drug development, from early-stage research to commercial production.

Over the past decades, flow chemistry gained remarkable attention offering advantages to tackle process challenges such as improved reaction safety & scalability & selectivity, increased production efficiency, enhanced mass & heat transfer, reduced PMI in the pharmaceutical industry.

Apeloa has developed a flow chemistry technology platform supported by over a decade of experience, a network of manufacturing, development, and analytical facilities, and a team of skilled scientists. Apeloa state-of-the-art facilities is a quick and economical viable solutions to tackle process challenges under conventional batch mode, with services from feasibility, process development and optimization (PD&O), scale-up to commercial production.

Green Chemistry – Flow Chemistry

- "Green" chemistry is an approach focused on minimizing or eliminating pollution by using sustainable chemicals and processes with minimal environmental hazards. "Green" Flow Chemistry, in particular, emphasizes energy efficiency and environmentally friendly technologies.
- "Green" Flow Chemistry processes and technologies are designed to be safe for both animals and humans, ensuring that they are non-toxic and environmentally friendly.

- "Green" Flow Chemistry provides safe and sustainable practices that lead to reduced pollution and waste, lower production costs, and minimized floor space requirements in manufacturing plants. It also enables continuous work-up and purification processes, achieving high efficiency for manufacturers.

Internationally, the flow chemistry market is projected to grow at a 10% CAGR, reaching USD 2.9 billion by 2028, driven by regulatory support and scientific advancements. The field is expected to expand significantly due to the commercialization of innovative drugs and the rise of AI/automation, particularly in factories with minimal human intervention.

Apeloa Flow Chemistry Technology Platform For Greener Chemistry Initiatives in Commercial Manufacturing:

Apeloa's comprehensive flow chemistry expertise covers the entire lifecycle, from early development to manufacturing of intermediates and active pharmaceutical ingredients (APIs).

- Feasibility study (FTE/FFS for early-stage development)
- Process development & optimization (PD&O)
- Scale-up and Proof of Concept Study
- Commercial equipment design
- Variable scale sample preparation
- Non-GMP and cGMP commercial manufacturing

Flow chemistry can be an ideal approach for synthesis routes involving high-risk conditions, such as highly exothermic, explosive, light-activated, or highly complex multi-step synthesis routes. Apeloa has demonstrated scientific excellence with a wide range of flow chemistry reactions.

With 3 R&D centers and 8 manufacturing sites worldwide, Apeloa leverages 8 technical platforms, including Flow Chemistry, Synthetic Biology & Biocatalysis, and Peptide Development, advancing lab discoveries to commercial production. Its trusted quality system is certified by global regulators and has been inspected by the US FDA 19 times since 2006.

Apeloa Pharmaceutical has presence in China, the USA, Germany, and Japan, providing services that support clients in delivering affordable medications. With over USD 20 million invested in its flow chemistry platform and further investments planned, Apeloa is a subsidiary of the multinational conglomerate Hengdian Group. The Boston site focuses on early-stage flow chemistry, while the Shanghai and Hengdian locations provide samples ranging from grams to kilograms.