Flow Chemistry

Enhancing speed, safety, and reproducibility

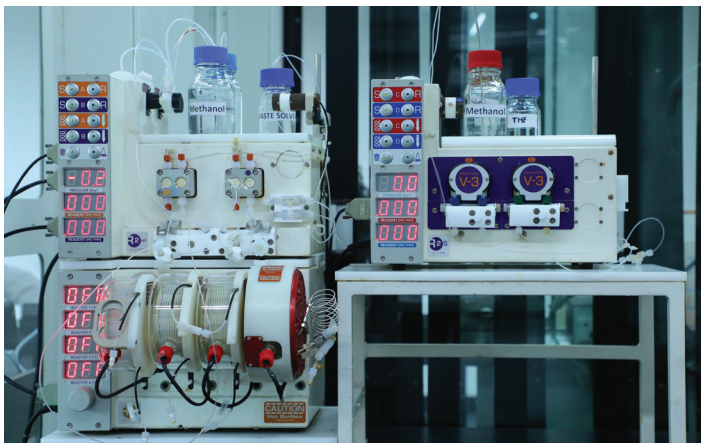
Sai Make it better together

Flow chemistry, also known as continuous flow chemistry, involves conducting chemical reactions in a continuous stream of reactants. This approach offers significant advantages, including improved process efficiency, reduced by-product formation, higher reaction yields, and enhanced safety profiles. Additionally, flow chemistry provides a highly controlled environment, crucial for managing hazardous reactions by minimizing the inventory of reactive chemicals and thereby reducing risks. The continuous flow design also facilitates efficient heat transfer and mass transfer, which are key factors in optimizing reaction rates, temperature control, and the uniform distribution of reactants. At Sai Life Sciences, our experienced and specialized flow chemistry team works in tandem with the development facility to deliver a comprehensive suite of services.

Our state-of-the-art, customized technology platform is designed to handle a wide range of applications, with scalable capabilities that support process optimization and seamless scale-up for commercial production.

Highlights

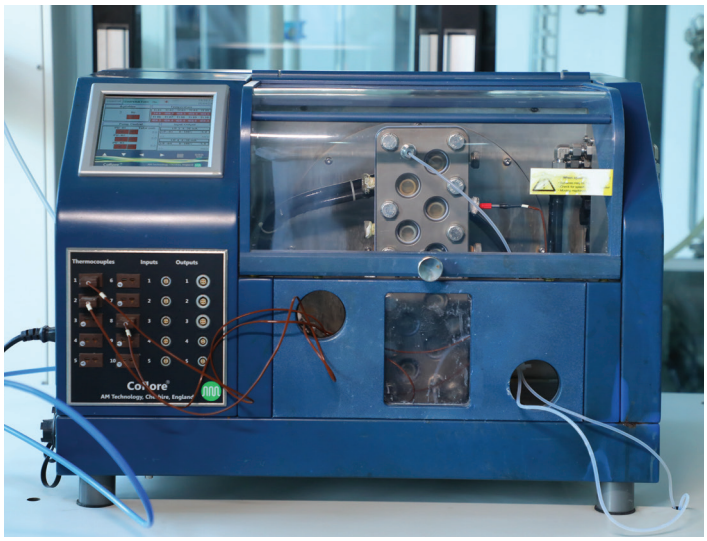
- Completed Proof-of-Concept for over 30 chemical processes across diverse project portfolios, demonstrating feasibility and route selection.
- Conducted optimization of more than 15 chemical processes at lab scale (up to 50g), improving yield, selectivity, and reaction time.
- Scaled up 4 chemical processes to kilogram scale, ensuring process robustness and reproducibility at increased volumes.
- Delivered 500g of a final compound involving the synthesis of a tetrazole ring followed by azide formation using sodium azide as a reagent.
- Delivered 1 Kg of a final compound involving the synthesis of a pyrimidine ring using Eaton's reagent.
- Successfully converted 10 kg of material using photocatalysis, employing advanced photocatalytic methods to drive the chemical transformation.
- Successfully performed aromatic ring bromination of 8 kg of material using DBDMH in flow mode.
- Optimized Grignard reactions followed by cyclization reactions, scaling successfully up to 250g in the laboratory.
- Enhanced conversion rates and selectivity in a Debenzylation reaction using 1M BCl3, with optimized conditions scaled up to 10kg.
- Executed photo-bromination followed by lactone synthesis using monochromatic LED in the visible spectrum. Both Proof-of-Concept (POC) and process optimization have been successfully carried out, demonstrating efficient photochemical activation and reaction control.
- Improved ATFE (Agitated Thin Film Evaporator,) distillation processes by reducing residence time, optimizing solvent recovery and throughput.
- Refined Liquid-Liquid Extraction (LLE) processes for dichloromethane, reducing extraction time and minimizing water usage.
- Extensive experience in a wide range of chemical transformations, including nucleophilic substitution, oxidation, cyclization, aldehyde synthesis, debenzylation, tetrazole formation, azide formation, methylation, Grignard reactions, Heck reactions, bromination, and more.
- Proficient in the safe handling of sensitive reagents and chemicals such as n-BuLi, i-PrMgCl, LiCl, BCl3, Br-CN, NaN3, and TBAA, ensuring safety and operational efficiency.



For more information contact: **contact@sailife.com**

Comprehensive Capabilities

- Expertise across Lab, Pilot, and Plant scales, ensuring seamless transition from bench-scale to early phase production.
- Equipped with a state-of-the-art technology platform, designed for scalability and capable of accommodating significant capacity expansion.
- Infrastructure supports process development, optimization, and early-phase material supply, enabling rapid and efficient scale-up.
- Development capabilities are integrated with flow chemistry operations, supported by a diverse array of complementary equipment designed for continuous unit operations, ensuring optimal reaction conditions and process consistency throughout all phases.



Infrastructure

- Vapourtec Flow Reactors: Standard tubular reactors (2 mL to 10 mL) in PFA, HC-276, and SS, along with a 5 mL column reactor, and cryogenic reactors (2 mL and 8 mL), enabling precise control over reaction conditions.
- Static Mixer Reactors: 20 mL capacity for efficient mixing in continuous flow processes.
- Agitated Cell Reactor (ACR): 100 mL volume Coflore ACR from AM Technology for efficient mixing and temperature control in heterogeneous reactions.
- Pinched Tubular Reactor: 100 mL volume (SS & HC-276), designed for enhanced heat transfer and efficient flow dynamics.
- Indigenous Coiled Reactors: Ranging from 5 mL to 500 mL, offering flexible design for varied reaction scales and precise flow control.
- Flow Photochemical Reactor: Available in 2 mL, 10 mL, 50 mL & 200 mL capacities, equipped with varying sources of light (UV & Visible spectrum).
- Pumping Systems: High-precision HPLC pumps, peristaltic pumps and diaphragm pumps providing flow rates from 0.01 mL/min to 100 mL/min for accurate dosing and fluid handling.
- Scale-up Reactors: 2L and 4L Hastelloy reactors equipped with static mixers, automated system with necessary accessories for smooth scale-up from laboratory to commercial scale.
- Short-Path Distillation: For efficient separation and purification of volatile compounds.
- Agitated Thin Film Evaporator (ATFE): For efficient solvent removal and concentration of reaction mixtures under controlled conditions.
- Liquid-Liquid Extractor (LLE): For selective separation and purification in liquid-liquid phase systems.
- Process Analytical Technology (PAT): Integrated REACT-IR for real-time monitoring of reaction parameters (temperature, pressure, concentration) and in-situ reaction analysis.

Talent Pool

The talent pool for flow chemistry at Sai consists of highly skilled scientists and engineers with deep expertise in continuous flow processes, reaction optimization, and process intensification. Our team excels in designing and operating advanced flow reactors, utilizing state-of-the-art technologies to ensure precise control over reaction parameters. With a strong focus on scalability, we are proficient in translating lab-based reactions to commercial-scale production, ensuring seamless integration into industrial settings.