TECHNOLOGY OFFER

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Open Source-Based Photometer for Applications in Flow Chemistry

With the increasing awareness in flow chemistry, there is growing interest in novel analytical tools for in-line analysis of reactions under flow conditions. This technology comprises the design of a flexible UV-vis photometer system from readily available electronic components enabling rapid and cost-efficient in-line concentration measurements and determination of segment lengths in segmented flow regimes.

BACKGROUND

Pharmaceutical companies and manufacturers increasingly convert batch to continuous processes. This transition requires novel process analytical technology tools for rapid and accurate real-time process analysis in order to ensure optimum product quality. UV-vis spectroscopy is often used for concentration measurements owing to a rather low level of interference from the matrix. In terms of flow chemistry UV-vis spectroscopy has been applied for monitoring photocatalytic reactions, esterifications, oxidations, nucleophilic aromatic substitutions, online analysis of nanoparticles generated under segmented flow conditions and often is the method of choice for the characterization of microreactors and micromixers in terms of their efficiency.

TECHNOLOGY

This technology comprises the construction of a low-cost and compact USB photometer based on open source hardware and software (Figure 1). It features a 1 ms sample acquisition time, utilizes a single interchangeable light emitting diode (LED) as a light source in combination with photodiode detectors and a Texas Instruments LaunchPad as the main control unit. A flow cell can be connected to a flow reactor made out of transparent polymeric material such as perfluoroalkoxy (PFA) tubing. The flow cell can be moved to different positions of the tube in order to take measurements at different residence times without having to disassemble the photometer or the flow reactor system. In the past the bespoke photometer was used to determine the residence time distribution (RTD) of various microreactors/micromixers, as well as for measuring the reaction rate constant for the base-induced hydrolysis of p-nitrophenol acetate in a biphasic segmented flow system. Due to the 1 ms sample acquisition time the lengths of individual segments can be measured in real time.

ADVANTAGES

- In-line monitoring of continuous chemical processes in real time
- Compact and inexpensive system

Market

- Pharmaceutical Industry
- Agrochemical Industry
- Specialty Chemicals Industry

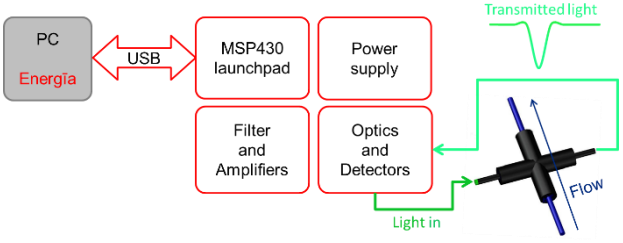

Figure 1. The main components of the photometer system.

KEYWORDS:
FLOW CHEMISTRY
IN-LINE ANALYSIS
REAL-TIME ANALYSIS
UV-VIS PHOTOMETER
MICROREACTOR
MICROMIXER

INVENTORS:
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COOPERATION OPTIONS:
LICENSE AGREEMENT
OWNERSHIP AGREEMENT
R&D AGREEMENT

DEVELOPMENT STATUS:
TRL 5 (VALIDATED IN RELEVANT ENVIRONMENT)
THE PHOTOMETER IS OPERATIONAL.

STATUS OF PATENTS:
PCT APPLICATION FILED (WO2019/206779)

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