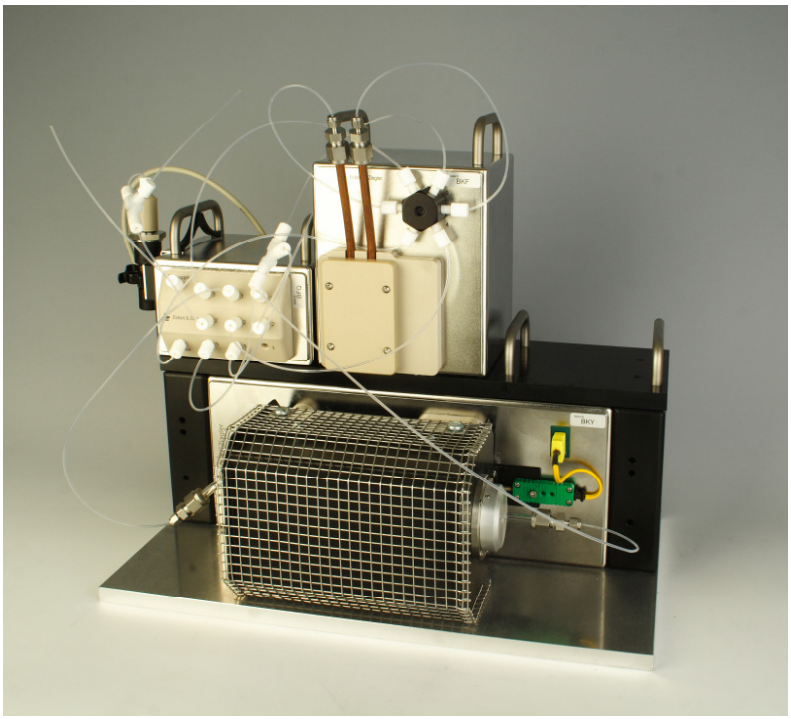
Modular-Lab

For heterogeneous catalysis – [^{11}C]CO-Converter



With the Modular-Lab technology you may now label tracers and radiopharmaceuticals by using a different synthesis approach – heterogeneous catalysis.

Application

Carbon-11 - characterized by its relatively short half life - has the advantage to be applicable for repeated PET studies while still allowing multi-step radiosynthesis sequences. [^{11}C]methyl iodide ([^{11}C]CH_3I) is the most important and frequently used secondary ^{11}C-labelling precursor. Despite its versatility the application of [^{11}C]CH_3I requires a position in the PET tracer molecule which can be methylated. Therefore, for certain radiopharmaceuticals other ^{11}C-based precursors are necessary requiring a different synthesis approach - heterogeneous catalysis. One precursor is [^{11}C]CO which can be used to synthesize PET tracers which are not accessible by the application of [^{11}C]CH_3I or [^{11}C]CO_2.

Technology

[^{11}C]CO can be easily produced with the automated synthesis device Modular-Lab* resulting in high radiochemical yields and high specific radioactivity. The Modular-Lab technology for the production of [^{11}C]CO is based on the reduction of [^{11}C]CO_2 on a molybdenum surface.
Instead of using liquid nitrogen for [^{11}C]CO_2 trapping, the cyclotron produced [^{11}C]CO_2 is reversibly adsorbed to molecular sieves (using the CTM module) or Carbosphere™ material (using the CCTM module). After controlled release by heating the molecular sieves or Carbosphere™, [^{11}C]CO_2 is converted into [^{11}C]CO by contact with a hot molybdenum surface. The produced [^{11}C]CO is then available for tracer synthesis. If desired more modules can be easily included into the system. The products can be purified by SPE or, if necessary, an HPLC can be easily integrated into the system.

Standard Regulatory Compliance

The Modular-Lab Software combines easy programming via a self-explanatory graphical user interface with the highest standards compliant with GMP, GAMP 4/5 and 21 CFR part 11 regulations. Access control with four defined security levels meets all demands for the security of the process data and the application-specific setup. The logging of all system and user operations runs fully automatically in Audit Trails.

*patent pending

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Key Features

- Fully automated synthesis process, no user intervention necessary
- Fully automated cleaning routine after each process to ensure a minimum of chemical or bacterial contamination of the system
- Plug & play system setup through integrated bus-system
- Traceability of the complete process, including documentation of all process parameters and functions
- Upgradeable for further applications

Modular-Lab Components

Tube Oven Module (TOM) (Single Tube Oven, vertical setup)	Dimensions: 130 x 130 x 314 mm The Tube Oven Module (TOM) is a used for continuous flow reactions of gases on hot surfaces. The oven has an inner diameter of 15 mm and a heated zone of the length of 100 mm. The reaction takes place in a quartz glass tube (OD = 13 mm) within the TOM. The quartz glass tube is connected with a Teflon ferrule - using Swagelok™ connectors - to a standard 1/16" tube and fixed by two holders. It can be filled with different catalysts or other filling material which are kept in place by a frit. The frit can be delivered with different pore sizes. The TOM can be operated up to 900°C. Active cooling is not possible.
Cooled Carbon Trapping Unit (CCTM)	Dimensions: 130 x 130 x 156 mm The Cooled Carbon Trapping Module (CCTM) is used for reversible adsorption of radioactive gases. It is directly connected to target and gas supply. [^{11}C]CO_2 from a cyclotron is trapped inside a copper U-tube filled with carbosphere™ for adsorbing gases. The U-tube is equipped with Swagelok™ connectors that can be easily connected to Teflon, FEP or PEEK tubing material. The trapped [^{11}C]CO_2 can be separated from the target gas by a flow of inert gas through the U-tube. By heating the U-tube [^{11}C]CO_2 is released from the carbosphere™ and can be swept out of the U-tube with gas suitable for further processing. Heating and cooling is achieved with integrated Peltier elements.
Flow Controller Module (FCM)	Dimensions: 130 x 130 x 78 mm A flow controller module (FCM) is used to control a flow of a certain gas in a limited range. This module contains a mass flow controller and three 3/2 way valves.

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