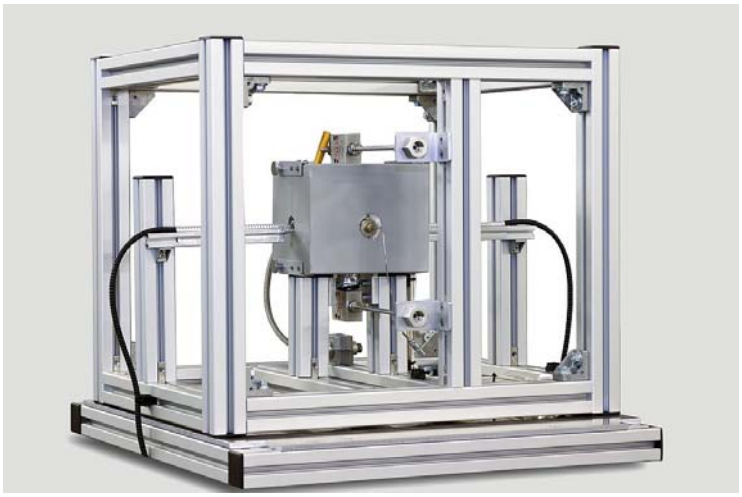
# Measurement Cell Saves Energy

**Used for the Extraction of Natural Substances and Cleaning – Technology Transfer Project with Swiss Company**



*With the help of infrared light, the cell measures when the optimum result is reached. (Photo by: Martin Lober)*

**When extracting natural substances for food, cosmetics, and pharmaceutical industries as well as for cleaning processes with carbon dioxide ($CO_2$), it has been impossible so far to directly observed these energy-intensive processes. Hence, the duration of extraction in the past was often longer than required for an optimum result. Using a mobile module developed by Forschungszentrum Karlsruhe, such processes can now be monitored in-line and completed at the right point in time. As a result, a considerable amount of energy is saved.**

Possible applications include the decaffeination of coffee and tea and the extraction of hops, spices, and rape seed oil for food industry. In addition, the module can be used to produce essential oils for flavors and cosmetics or pharmaceutical agents or for the degreasing of cocoa, the cleaning of cork, the removal of pesticides from rice, and the cleaning of components. These processes require increased temperatures and high pressures.

The NIR module developed determines the exact state of the cleaning or extraction process with CO2 by means of near-infrared spec-


*KIT Energy Center: Having future in mind*

**Dr. Elisabeth Zuber-Knost**
**Press Officer**

Kaiserstraße 12
76131 Karlsruhe, Germany
Phone: +49 721 608-2089
Fax: +49 721 608-3658

**For further information, please contact:**

Monika Landgraf
Press Office
Phone: +49 721 608 8126
Fax: +49 721 608 3658
E-mail: Monika.Landgraf@kit.edu

troscopy, i.e. with infrared light. In this way, natural substances are exposed to high temperatures and pressures only as long as required to produce the extract.

“Extraction and cleaning as well as reaction processes can now be controlled in an optimum manner”, says Dr. Gabriele Wiegand from the KIT Institute for Technical Chemistry (ITC-CPV), who has developed this instrument. “Attempts made by this branch in this field have been unsuccessful for many years, but now, we are succeeding in saving daily operation costs of thousands of Euros for the processes at a large plant. As the runtimes of the machines are shorter, far less energy is needed.“ Within the framework of a technology transfer project supported by the KIT Innovation Department, the module has been developed ready for the market together with the Swiss company of SITEC Sieber Engineering AG. “First companies are already using the measurement cell in their extraction plants”, underlines Dr. Manuella Werp from the Innovation Department. To meet additional specific requirements of industry, the scientists of ITC-CPV are presently developing applications.

The mobile module can be integrated easily in existing extraction plants. Extraction and cleaning are closed-cycle processes, during which liquid $CO_2$ is compressed and evaporated and, thus, transferred to a supercritical state. Supercritical carbon dioxide is an environmentally friendly solvent for natural substances, fats, and oils and replaces the toxic organic substances used so far. Upon the completion of the extraction or cleaning cycle, it evaporates without any residues contrary to organic solvents. The extract itself is collected in a container by pressure relief, $CO_2$ gas is converted into its original liquid state again and, thus, the cycle is closed.

The measurement cells available so far are designed for either high temperatures at low pressures (300°C at 25 bar) or for low temperatures at high pressures (50°C at 300 bar). The NIR measurement cell now succeeds in working at a maximum of 180°C and 1000 bar at the same time. “Apart from saving energy, the measurement cell has other advantages”, underlines Wiegand. “Due to the shorter operation time for the individual processes, it is possible to run more extractions per day than before and to increase production.”

**The Karlsruhe Institute of Technology (KIT) is one of Europe’s leading energy research establishments: The KIT Energy Center pools fundamental research with applied research into all rele-**

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**The Karlsruhe Institute of Technology is the merger of the Forschungszentrum Karlsruhe, member of the Helmholtz Association, and the Universität Karlsruhe. This merger will give rise to an institution of internationally excellent research and teaching in natural and engineering sciences. In total, the KIT has 8000 employees and an annual budget of 700 million Euros. The KIT focuses on the knowledge triangle of research – teaching – innovation. It sets new standards in the promotion of young scientists and attracts top scientists from all over the world. Moreover, KIT is a leading innovation partner of industry.**

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