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1 *Packing materials coated with adsorber particles.*

SEPARATION OF MINOR COMPONENTS FROM SEED OILS

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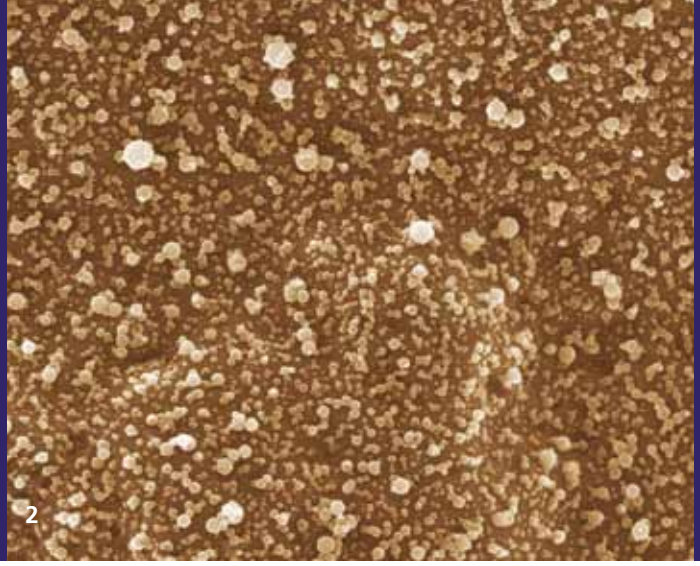
Minor components

Renewable resources used in the production of biofuel are increasingly gaining importance. The plant or seed oils involved, for example from rape seed or soy, contain various minor components (valuable materials and contaminants). On the one hand, biodiesel contains contaminants which can negatively affect the quality of the fuel. On the other hand, smaller amounts of important valuable materials such as bioactive vitamin E (α-tocopherol) can also be found. To date, when biodiesel is burned, these valuable materials are normally burned along with it.

New adsorptive process

For the separation of minor components a new patented adsorptive process was developed. With this process valuable bioactive minor components could be extracted for example as additional, value-added products in plant processing. To this purpose, we included polymeric nanoscale adsorber particles in a new process concept for the separation of substances. These specific polymeric adsorber particles were then attached to polymeric packing materials and fixed into place. The coated packing materials were integrated into a technical process and a testing plant is located at the Fraunhofer IGB.



Adsorption columns packed with NANOCYTES® adsorber particles

For the separation of minor components from vegetable oils nanoscopic polymeric particles with free binding sites on the particle surfaces were developed. In the patented NANOCYTES® process from the Fraunhofer IGB suitable monomers are mixed with so-called crosslinkers. By using the miniemulsion polymerization process nanoscopic polymeric adsorber particles ranging from 200 to 300 nanometers are obtained in one step. Through the addition of suitable molecules and the subsequent extraction of these molecules out of the polymeric network, specific particle surfaces are created. In order to enlarge the adsorption surface, the polymeric adsorber particles are then attached to polymeric packing materials as carrier structures and integrated into an adsorption column. For the optimal adsorption of for example tocopherol onto the polymeric particles, their concentration in the column should be in the area up to 30 µg/mL. By contrast, untreated packing materials displayed only very limited adsorption capacities. By changing the solvent, the tocopherol can be completely separated from the adsorber column via extraction. The columns are then again available for further cycles.

One example – gaining tocopherol

Due to its antioxidant properties tocopherol plays an important role in the human body in that it protects cells from the damaging effects of oxygen. Natural tocopherol-containing extracts are separated from the seeds of oil-containing plants, especially from wheat, corn, soy, cotton and rice, and then enriched. However, such extracts are often only found in low concentrations. On an industrial scale, synthetic vitamin E is produced as a racemic mixture. Since synthetic tocopherol is relatively unstable, it is normally connected to an acetyl group. Through this process it loses all antioxidant properties. Up to 50 percent of the absorbed synthetic tocopherol can, however, be converted to natural vitamin E by the body.

We were successful in producing polymeric adsorber particles for the separation of α-tocopherol from vegetable oils. To this purpose we optimized the polymer composition of the adsorber particles to achieve the maximum adsorption of α-tocopherol. Up to 24 µg of tocopherol adsorb onto 1 mg of specific particle material.

Our services

A testing plant is available for R&D projects focusing on the separation of various minor components from seed or plant oils, plant-extracts and biodiesel. The plant or seed can be utilized directly on site at the oil mill, in the plant-processing industry or by biofuel producers. By adapting the polymeric adsorber material, the testing plant developed for the separation of valuable materials and contaminants from vegetable oils can be applied to other separation tasks for bio-based oils and plant-extracts. In order to increase the adsorption surface, packing materials with low packing densities and thus low free volumes can also be used in the future.

Features

Obtaining valuable materials

- Extraction of value-added products
- Integration in existing plants
- On-site extraction

Removal of contaminants

- Better product qualities
- Going below a limit
- Applicable in oil and water

Patents granted

DE 10 2007 061 436
DE 100 31 859

2 *SEM image of polymeric adsorber particles on packing materials.*

3 *Trial plant for the separation of minor components from vegetable oil.*