Higher efficiency in processing oils and fats with IKA® inline machines
IKA® machines for processing of oils and fats

The IKA® rotor-stator-systems are increasing the efficiency of mixing processes, necessary e.g. for cleaning of vegetable oils. In order to remove impurities, vegetable oils have to be refined. For this purpose a small quantity of washing solution has to be brought into intensive contact with big quantities of oil. The impurities are transferred from the oil- to the water-phase and can then be separated together with the water.

The exchange of the substances over the phase limit can be influenced by the intensity of the mixing process. Using the IKA® rotor-stator-systems the mixing effect can be specifically adjusted to the respective requirements.

The most important process steps in processing vegetable oils are:

Degumming and neutralizing

Untreated vegetable oil has first to be „degummed“. During this process proteins and phosphatides, that cloud the oil and cause conglutination effects, are separated from the untreated oil. Furtheron free fatty acids, which on the one hand accelerate the destruction of the oil and on the other hand also disturb the transformation into biodiesel, are removed by neutralization.

For neutralization of the free fatty acids (FFA) the oil is intensively mixed with sodium hydroxide. The FFA are precipitating in form of soap and can be separated e.g. by centrifuging.

The DISPAX-REACTOR® DR 2000/.. as well as the single-stage dispersing machine ULTRA-TURRAX® UTL 2000/.. can be used for neutralization.

A part of the phosphatides in the untreated oil can be hydrated with water and can thus easily be separated. The non-hydratable part can be separated by adding an acid. The acid reacts with the phosphatides and thus enables an addition of water. The phosphatides can then be separated.

The three-stage IKA® DISPAX-REACTOR® is an excellent dispersing machine for this thorough mixing of acid and oil.
Biodiesel – a future market

Acc. to EC-regulations biodiesel has to be added to diesel made of fossil oils. Therefore the demand for biodiesel will increase also in the future. Moreover the already high and surely further increasing prices for fossil diesel fuel make biodiesel become a more and more attractive alternative.

Biodiesel is a vegetable oil methyl ester resp. a fatty acid methyl ester (FAME). For rapeseed oil methyl ester the abbreviation RME is used.

A high efficiency in production of biodiesel is of course also required, in order to minimize the environmental pollution.

The production consists of following steps:

<table>
<thead>
<tr>
<th>from untreated vegetable oil</th>
<th>degumming/ neutralization</th>
<th>refined vegetable oil</th>
<th>trans-esterification</th>
<th>raw biodiesel</th>
<th>washing</th>
<th>to biodiesel acc. to EN 14214 ASTM D 6751</th>
</tr>
</thead>
</table>

Transesterification

During transesterification the pre-heated and prepared oil is mixed with an alcohol, mostly methanol, and an alkaline catalyst. During this process glycerine is separated from the fat and replaced by 3 single alcohol molecules, thus resulting in biodiesel, a fatty acid alkyl ester, and glycerine.

In classical plants fats are transesterified in a two-step batch process. This is often done in two successive vessels.

Using a special IKA® inline dispersing machine type IKA® DISPAX-REACTOR® the transesterification can be done continuously in a single step with continuous dosing of the raw materials. The transesterification takes place in the highly energetic shear zone of the dispersing machine. The raw materials are dissolved into finest droplets, which enormously increases the specific surface and decisively intensifies the mass transfer. This noticeably accelerates the transesterification reaction and maximizes the output. The transesterification can be carried out almost completely in the first step.
Depending on the used raw materials a second transesterification step can even further increase the output. An automation is made easy by the considerably simplified structure of the process.

Advantages:
- Low operation costs
- Lower investment costs
- Considerably reduced space requirement
- More flexible production

Washing
The biodiesel resulting from the transesterification is either wet washed (on the basis of water) or dry washed (by absorption) e.g. with magnesium silicate. Washing is normally done in two steps, and adding of a weak acid may be advantageous.

Most processes in biodiesel production are liquid-liquid-reactions, that often take place in huge reaction vessels. For mass production the inline process offers essential advantages.

IKA® offers a wide range of inline mixing systems for fully continuous production.
These are the advantages:
- Fully continuous production
- Fully automatic production possible
- Extremely shortened reaction times
- The IKA® series 2000 offers full upscale possibility

Due to the homogeneous dispersion it is sometimes even possible to reduce the quantity of the reactives, having advantages regarding the process but also regarding the production costs.