Analytik Service Obernburg
Part of viridiusLAB AG

# STABILITY OF EMULSIONS

## TASK

In an emulsion, a liquid (e.g. oil) is mixed into another liquid (e.g. water) in the form of tiny droplets. Additives and special manufacturing conditions normally prevent the system from separating. Despite the same composition, batch B was unstable, i.e. the oil droplets increased in size and sank to the bottom as large droplets after a longer rest period of several days (Fig. 1). This segregation led to problems in further processing.

## SOLUTION

At Analytik Service Obernburg, the freshly prepared batches A and B were analyzed comparatively using a laser particle sizer (Fig. 2).

**Industries**
Chemicals
Paint manufacturer
Fiber manufacturer
Medical technology

**Analysis goals**
Process optimization
Failure analysis

**Materials**
Emulsions

**Analysis method**
Laser particle sizer

**Supplementary methods**
Light microscopy
IR spectroscopy
NMR spectroscopy

**Similar questions**
Particle size distribution

**SOLUTION**

The poor sample (B) shows a very broad distribution of droplet size as delivered (red curve) with a pronounced maximum at 20 µm. If this emulsion is measured with ultrasound switched on, the droplets can be reduced in size and form a stable distribution with a maximum at 2 µm (yellow curve). The good (stable) emulsion shows the same distribution with and without ultrasound (green curve). The majority of the droplets are distributed well below 1 µm with a small secondary maximum at 2 µm.

In a further step, various changes were made to the manufacturing process and the droplet size of the corresponding emulsions was measured using ultrasound. The results are shown in Fig. 3. A clear variation in the relative proportions of droplets larger than 1 µm can be seen.

If the different emulsions are stored for several days, separation and the associated formation of different layers can be seen (Fig. 4). The height of these layers corresponds to the expectations from the measurement results of the droplet size distribution.

**ADVANTAGE**

The method described allows the quality of an emulsion to be quantified long before segregation takes place. The method is also suitable for measuring the size distribution of particles in powders or dispersions.


Fig. 1: Emulsions of different stability

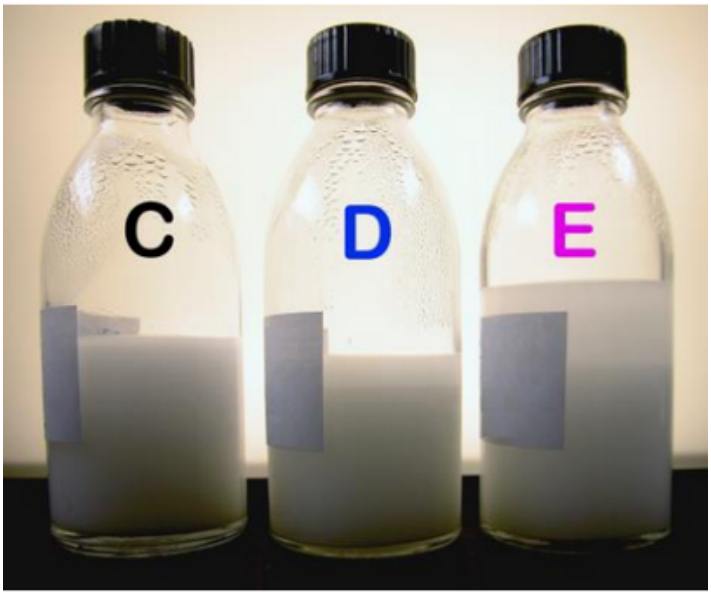


Fig. 4: Separation of different emulsions after storage

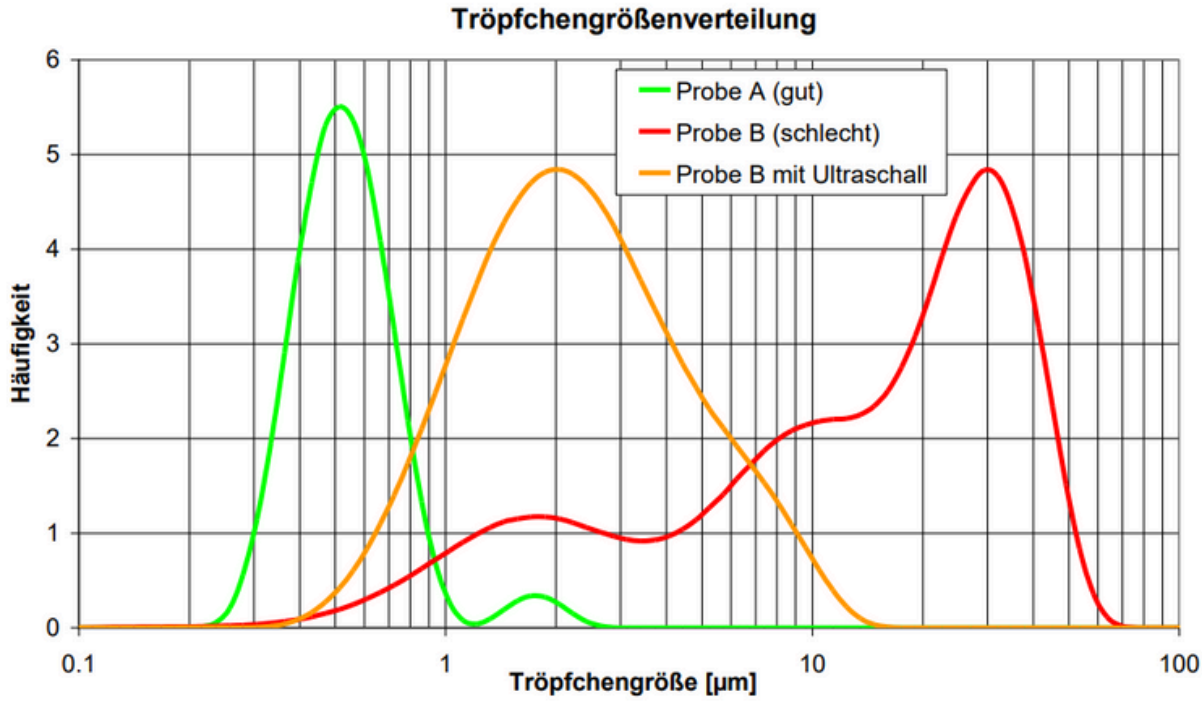


Fig. 2: Droplet size distribution of two emulsions.

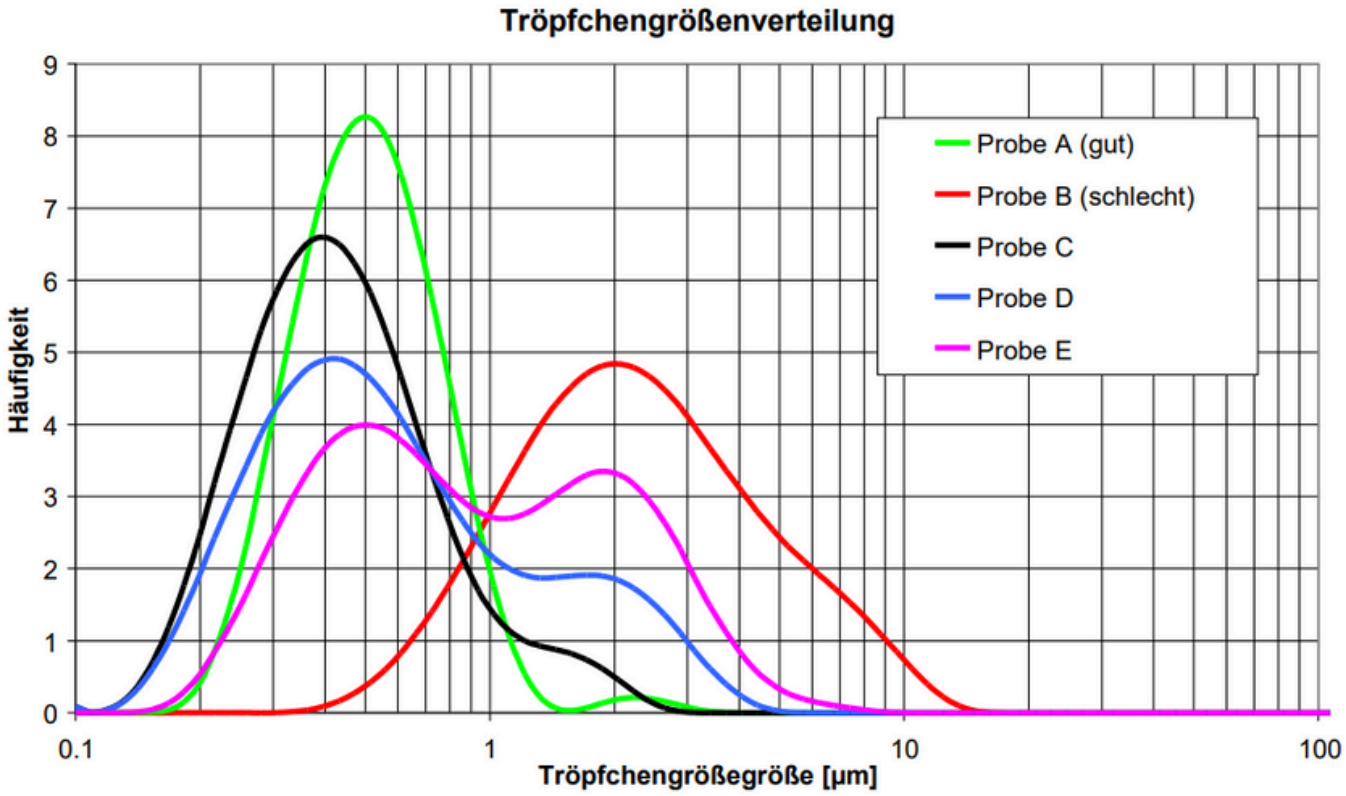


**Fig. 3: Droplet size distribution of different batches of the process optimization**