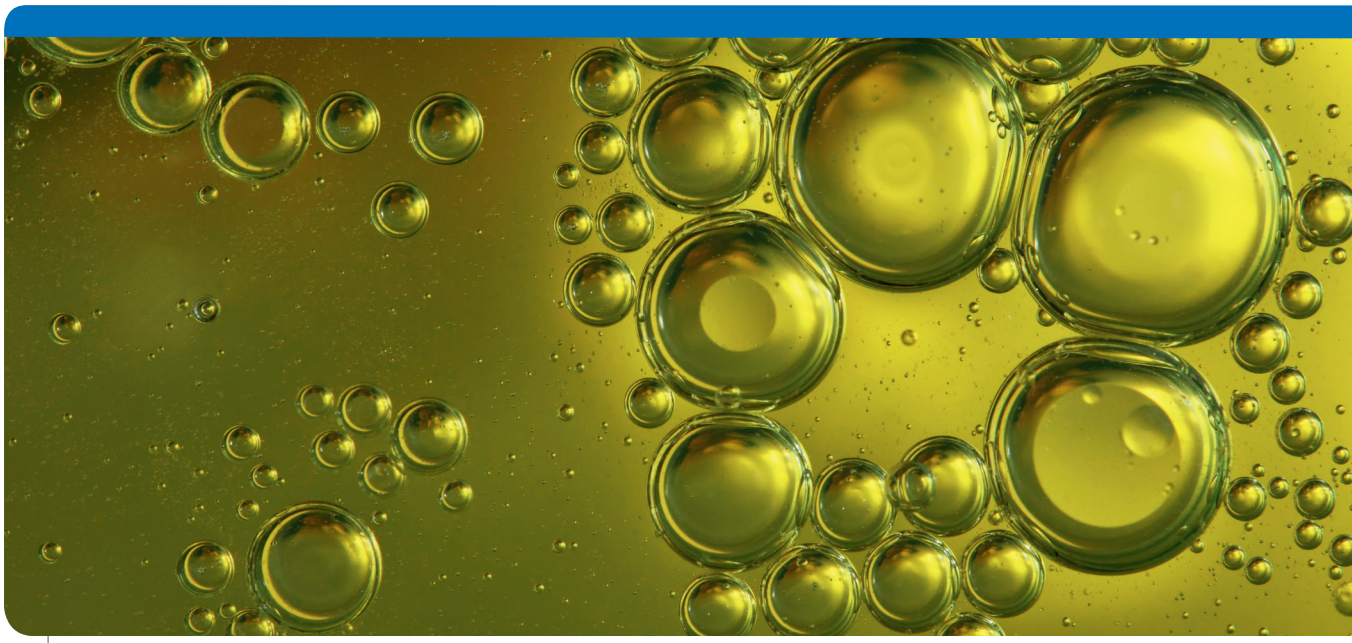


Droplet Size Distribution in Food Emulsions

- New G-Var Method with Significantly Improved Speed and Lower Measurement Limit of Dispersed Phase Than Former D-Var Method

Water-in-oil (W/O) and oil-in-water (O/W) emulsions are found in everyday meals, mainly as margarine, low fat spread, and butter (W/O) or, as mayonnaise, salad dressing, and soft cheese (O/W). The droplet size distribution in these emulsions influences their taste, smell, and appearance, as well as their shelf life and spread behavior. Bruker's minispec allows a fast, non-invasive, and accurate analysis of the droplet size distribution in these products. It is based on a Time Domain (TD) NMR technique which is equally applicable to free and to flocculated droplets. Moreover, it has the ability to assess individual droplet sizes rather than cluster sizes.

Unlike conventional techniques as light microscopy, laser light scattering or electric sensing, TD-NMR requires minimum sample preparation and no dilution. Samples remain unaltered.

It is much faster than light microscopy, has not the restriction to only O/W emulsions as laser light scattering and is much more precise than electrical sensing. And it has the lowest cost-of-ownership per measurement among all competing methods!

Range of Application

Water Droplet Size in W/O Emulsions including:

- Margarine
- Low fat spread
- Butter
- Other W/O emulsions

Oil Droplet Size in O/W Emulsions including:

- Mayonnaise
- Salad dressing
- Soft cheese
- Other O/W emulsions

Features and Benefits

- Minimum sample preparation with no sample alteration or dilution;
- Able to measure both, W/O and O/W droplets
- Similar or better precision compared to other analytical techniques such as microscopy, laser diffraction, and electric sensing
- NMR measures droplet size and not cluster size
- Unilever's standard method for droplet size distribution measurements in spreads and dressings
- Very fast method
- Has lowest cost-of-ownership per measurement of all methods

Application Method

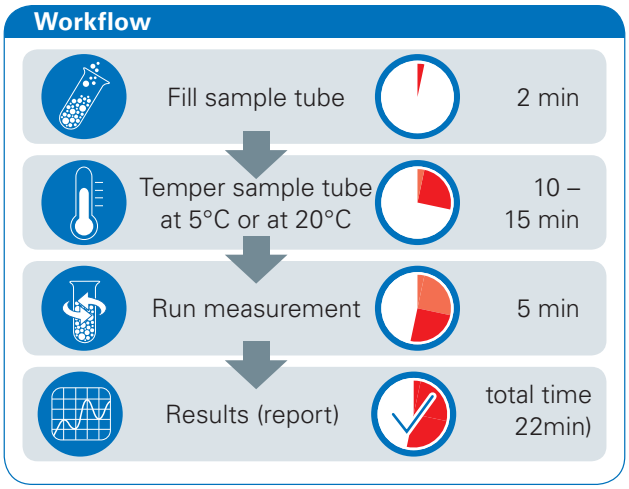
The Time Domain (TD) NMR method is based on the physical laws of restricted diffusion of oil or water molecules in droplet particles. By means of special gradient sequences, the oil and water signals are discriminated. Thus, the droplets phase can be investigated selectively and a series of gradient experiments is performed under variation of certain pulse sequence parameters.
The resulting datasets include the information of the droplet size distribution. Parameters of distribution functions are automatically determined by the software; in this case by the parameters of a log-Gaussian distribution.

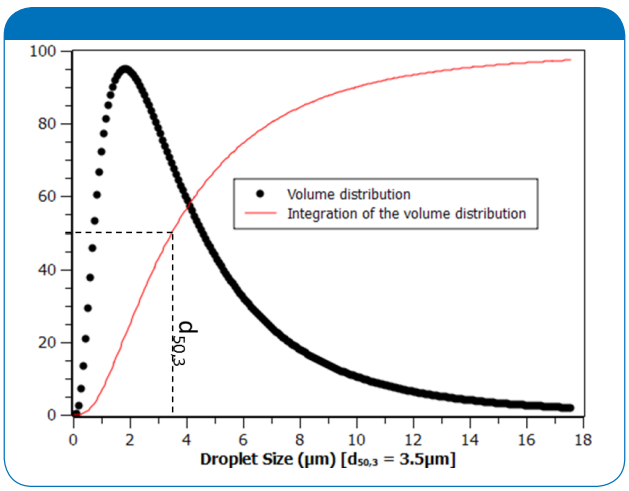
Advantages of New G-Var Method in Comparison to Former D-Var Method

- 3-4 times faster
- Cuts total-cost-of-ownership into half
- Higher sensitivity: Can measure down to 2% volume dispersed phase versus 10%, before

Data Analysis and Fittings

Assuming spherical droplets and a unimodal log-Gaussian distribution, Marquardt or Simplex algorithms are used for the fit of the diffusion decay curve. The resulting volume weighted mean droplet diameter $D_{50,3}$ and the corresponding standard deviation σ of the Gaussian distribution are automatically mathematically determined. Thus, the full information about the droplet size distribution of the emulsion is presented (see curves below).





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info@bruker.com
www.bruker.com