

Industrial Applications of Emulsion Technology

Jonathan O'Sullivan^{a,b}, Ian Norton^a, Richard Greenwood^a, John O'Connell^b

^a. School of Chemical Engineering, University of Birmingham, Edgbaston B15 2TT.

^b. Kerry Ingredients, Tralee Road, Listowel, Co. Kerry, Ireland.

Emulsions are found in all aspects of life and an understanding of how to control and optimise their properties is essential for the production of high quality product. Quality can be defined as fitness for purpose. As a result the manufacturing process for an emulsion in one industry can vary greatly from another industry. These variations can include the components being used, the method of emulsification, the conditions of processing and many more.

The objective of this project is to investigate the mechanisms and determine rate-limiting steps in the formation of protein-coated nano-emulsions for food applications. Once this has been achieved the next stage will involve the development of an emulsification process. This allows the controlled formation of nano sized droplets with efficient use of the protein which are stable for application in food products.

Other fields of industry in which emulsion technology is heavily used includes the pharmaceutical industry, the agrochemical industry and the cosmetics industry to mention but a few.

The early stages of the project involve the development of a method for the consistent formation of nano emulsions. There are numerous methods by which emulsions can be produced and these include some of the following pieces of equipment:

- Homogenisation
- Impinging jets.
- Membranes.
- Microfluidisers.

Once a method for emulsification has been established the characterisation of the produced emulsion is necessary. Characterisation includes mean droplet size, droplet size distribution (DSD) and protein coverage of the emulsion that is produced.

Initial work has been conducted to produce simple oil-in-water (O/W) emulsions using both a high shear mixer and a homogeniser. Properties of the emulsion are to be analysed include the viscosity, the mean droplet size and the DSD. Visualisation of samples was conducted by means of an optical microscope (see *Figure 1* below).

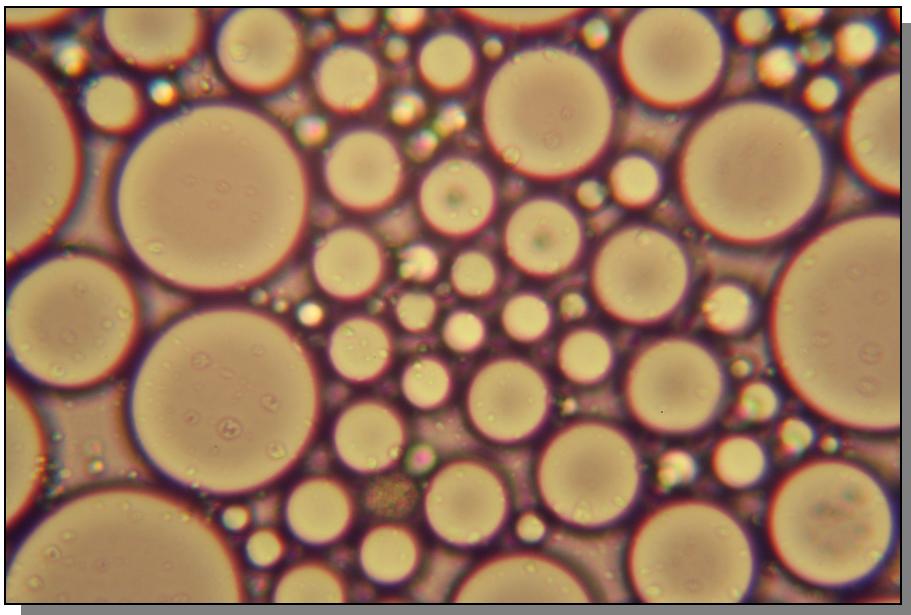


Figure 1 – O/W emulsion, where the oil used was sunflower oil and the emulsion was stabilised with Tween

The overall goal of research in this field is to determine the key processing parameters for the emulsification system which offers the most promise and from this to determine how they influence the properties of the produced emulsion. These properties include the average droplet size and the droplet size distribution. Then it is necessary to analyse properties of the emulsion and see how these influence the quality of the product, such as the texture, the performance, the rheology, etc.

References

- 1) McClements, D.J. Food Emulsions: Principles, Practises, and Techniques, 2nd Edition, 1, 1 – 26, 2004.
- 2) McClements, D.J. Modern Biopolymer Science: Bridging the Divide between Fundamental Treatise and Industrial Application, Biopolymers in Food Emulsions, 4, 129 – 166, 2009.