

SpringerBriefs in Molecular Science

Ultrasound and Sonochemistry

Series editors

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SpringerBriefs in Molecular Science: Ultrasound and Sonochemistry is a series of concise briefs that present those interested in this broad and multidisciplinary field with the most recent advances in a broad array of topics. Each volume compiles information that has thus far been scattered in many different sources into a single, concise title, making each edition a useful reference for industry professionals, researchers, and graduate students, especially those starting in a new topic of research.

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Ultrasonic Production of Nano-emulsions for Bioactive Delivery in Drug and Food Applications

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Preface

Emulsions are a semi-stable mixture of two immiscible liquids, one of which is dispersed as droplets within a continuous phase of the other. Emulsions serve an important role in enhancing the bioavailability of fats, lipids and nutrients in both aqueous and organic systems and hence are found across a wide range of products in food and pharmaceutical applications.

There is great interest in the use of ultrasound to produce emulsions. Ultrasound is a technology that can create emulsions relatively efficiently and effectively compared to other techniques such as rotor–stator mixing, high-pressure homogenization and microfluidization. The interaction of ultrasound with hydrocolloids and biopolymers that are often used to stabilize emulsions can offer advantages such as improved stability or greater control of the size distribution of droplets formed. This SpringerBrief will provide an overview of ultrasonic emulsification (Chap. 1), guide towards the most suitable parameters required for effective ultrasonic emulsion formation (Chap. 2) and showcase recent applications in which stable emulsions produced from ultrasound have been used to develop novel drug formulations and functional foods (Chap. 3).

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Contents

| | | |
|----------|---|-----------|
| 1 | Introduction | 1 |
| 1.1 | Emulsion Droplet Size | 3 |
| 1.2 | Emulsion Creation | 5 |
| 1.3 | Ultrasound | 5 |
| 1.4 | Mechanisms of Ultrasonic Emulsification | 7 |
| 1.5 | Emulsification Set-up and Conditions | 7 |
| 1.6 | Comparison of Ultrasonic Emulsification with Other High Shear Emulsification Methods | 9 |
| 1.7 | Theoretical Understanding of Emulsion Formation | 10 |
| 2 | Selection of Operating Parameters | 13 |
| 2.1 | Influence of Power and Processing Time | 13 |
| 2.2 | Influence of Gas Content | 15 |
| 2.3 | Influence of Ambient Pressure | 15 |
| 2.4 | Influence of Temperature | 16 |
| 2.5 | Emulsifier Selection and Concentration | 17 |
| 2.6 | Influence of Continuous Phase Viscosity | 18 |
| 2.7 | Ultrasonic Frequency | 19 |
| 2.8 | Issues to Consider | 19 |
| 2.8.1 | Effect of Ultrasonication on Product Quality | 19 |
| 2.8.2 | Formation of Metal Particulates | 20 |
| 3 | Applications of Ultrasonic Emulsification | 23 |
| 3.1 | Applications in Pharmaceuticals | 23 |
| 3.1.1 | Delivery of Anticancer Drugs | 23 |
| 3.1.2 | Controlled Delivery of Bioactives Using Double Emulsions | 25 |

| | | |
|-------------------|---|-----------|
| 3.2 | Applications in Food Processing | 26 |
| 3.2.1 | Emulsions for the Dairy Industry | 26 |
| 3.2.2 | Antimicrobial Efficacy of Essential Oil Nanoemulsions . . . | 27 |
| 3.3 | Future Trends and Outlook | 31 |
| References | | 33 |

Glossary of Key Terms

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| Emulsifier | An amphiphilic molecule that assembles at the interface of oil/water phase boundaries, reducing the surface tension, thereby resisting phase separation of the dispersed droplets. Additional mechanisms conferring stability are the provision of steric and/or electrostatic barriers to inter-droplet interaction. |
| Stabilizer | Surface active macromolecules that are added to increase the viscosity of the continuous phase of an emulsion in order to reduce the mobility of dispersed droplets, slowing down inter-droplet collisions that may lead to droplet coalescence. |
| Acoustic cavitation | The nucleation, growth and collapse of gas nuclei in fluids due to the application of an oscillating sound field. The collapse event is accompanied by the release of a large amount of energy in the form of pressure shock waves, fluid streaming and microjets as well as temperature hot spots. |
| Emulsion droplet size (EDS) | The characteristic size of the dispersed phase droplets of an emulsion. |
| Coalescence | The combination of two droplets to form a larger droplet. |
| Ostwald Ripening | The process by which molecules from small emulsion droplets diffuse through the continuous phase to larger droplets. |
| Continuous phase | The bulk phase of the emulsion. |
| Dispersed phase | The phase which is dispersed in the emulsion in the form of droplets. The droplets of the dispersed phase are stabilized with a coating of emulsifier. |

| | |
|---------------------------|---|
| Immiscible liquids | Two liquids that are not soluble, or barely soluble, within each other. For example, oil is barely soluble within water, and vice versa. |
| Micelle | A self-assembled aggregate of surface active molecules that are dispersed as a colloidal suspension. A typical structure in aqueous medium is a sphere with surfactant molecules aligned in such a way so that hydrophilic head groups point towards the solvent, while hydrophobic tail groups are pointed towards the centre. |