



TECHNICAL INFORMATION SHEET

MFG-WI-88-rev1 Issue Date: 04/23/2018

SUSPENSION OF HYDROPHOBIC PARTICLES IN AQUEOUS SOLUTION

PURPOSE

This document describes the process for preparing suspensions of hydrophobic particles in an aqueous solution by using a surfactant.

INTRODUCTION

Many materials are hydrophobic (water-fearing) in nature. Due to their non-polar chemical structure, hydrophobic particles want to minimize contact with polar (water) molecules and, as a result, tend to aggregate on the surface of the water and resist going into suspension. This presents a challenge to scientists and engineers who would like to be able to work with hydrophobic particles suspended in aqueous solution.

Examples of the applications are using fluorescent polyethylene microspheres for flow visualization in aqueous systems, creating density gradients, filtration and contamination control studies.

Fortunately, there is a simple way to overcome the hydrophobic effect. It is called a surfactant, a detergent, or simply "soap." Surfactant is a magical molecule that has both hydrophobic and hydrophilic properties, which coats the particles and helps them mix into water. The same mechanism applies when we use soap to wash greasy dishes or stained clothes.

Selection of the surfactant depends purely on your process and product requirements. Dishwashing liquid works great, so does Simple Green. For scientists working on biological applications we recommend the use of Tween surfactants. Tween is the commercial name for Polysorbate non-ionic surfactants, which are stable, nontoxic, and often used in pharmacological, cosmetic, and food applications. Non-ionic detergents are considered to be "mild" detergents because they are less likely than ionic detergents to denature proteins. By not separating protein-protein bonds, non-ionic detergents allow the protein to retain its native structure and functionality.

Tween 20 and Tween 80 are frequently used. Both surfactants are yellowish, water-soluble viscous liquids. Primary difference between the two is viscosity. Tween 20 has lower viscosity and is easier to work with.

SAFETY

- Gloves and eye protection to be worn at all times during solution preparation and use.
- Care should be taken when handling hot objects/liquids and immersion blender.
- Centrifuge should be properly balanced and allowed to come to a full stop before opening.

SUSPENSION PROCESS

There are many ways to suspend the particles (e.g. put a few drops of dish detergent into water and shake with the particles).

The process below is specific for using the minimum amount of Tween for biologically sensitive applications.

- ✓ We recommend using distilled water to minimize impurities.
- ✓ We recommend boiling the water to sterilize and to make it easier to disperse a small amount of surfactant uniformly. This also increases shelf-life of prepared solutions and suspensions.
- ✓ We use an immersion blender to disperse the surfactant in water quickly and effectively.

PREPARING TWEEN SOLUTION.

- Fill a heatproof container with distilled water.



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- Ensure the water level is high enough to cover the immersion blender.
- Heat water to boiling and leave boiling for 5 minutes.
- Weigh out 0.1g of Tween per 100ml of water used (creating 0.1% solution).
- Slowly add Tween to boiled water while mixing with immersion mixer (~30 seconds).
- Some bubbles will form during mixing.
- Bubbles will dissipate on cooling and solution will appear clear.

SUSPENDING PARTICLES IN TWEEN SOLUTION.

- Place the desired amount of particles into a container.
- Dispense prepared Tween solution on top of particles.
- We recommend at least five times greater volume of solution to the volume of particles.
- Cover tightly and place containers into a centrifuge.
- Centrifuge on highest setting for at least 5 minutes.
- If some particles are still floating on the surface of water, more centrifuging may be necessary.
- A small quantity of particles may accumulate on the top surface and not enter solution despite additional centrifugation. Typically, these particles will go into suspension over time (hours).

OTHER CONSIDERATIONS

- A greater length of centrifuging or larger volume of Tween solution may be necessary to suspend certain materials and particle sizes.
- As a 0.1% Tween solution is sufficient for most applications, concentration levels could be raised to support particles that are more resistant to entering solution.
- Once the particles are suspended, solution can may be diluted further to increase the volume.
- Particles can be recycled and reused as necessary. The suspension might need to be repeated.
- If no centrifuge is available, it is possible to shake the container by hand (up and down, upside down) to achieve the same result.

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