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Making Soap Green

Asia Sweet

University of Southern Maine

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Making Soap Green

Asia Sweet, Caryn Prudenté Ph.D.
University of Southern Maine Department of Chemistry



Abstract

The One Gallon Soap Company (OGSC) recycles partially used bar soap from local Portland hotels and repurposes it as liquid hand soap. The preliminary formulations originally prepared by the OGSC produced a smooth, homogeneous liquid soap with good foaming action. However, over short and often variable time periods, the soap would separate into two layers: a watery bottom layer with little foaming action and an oily top layer. The OGSC asked the USM Chemistry Department to investigate the formulation process in an effort to provide a more stable product – one that would maintain a constant consistency over several months.

Introduction/Background

Each day in the US, over 2 million bars of soap are thrown away. Soap is manufactured from caustic materials. The OGSC's mission is to reduce the use of these materials and to minimize byproducts from disposed soap entering ecosystems by recycling partially used soap. Soaps high pH values can disrupt the natural pH of ecosystems. During the pilot manufacturing stage, the OGSC was unable to produce a liquid soap product that had consistent viscosity or foaming action, and the stability of the liquid soap product was variable. Since the OGSC sells their product by the gallon and it is used in soap dispensers, providing a product that maintains a homogeneous suspension over long periods of time was critical.

Objective

By working in small batches, our aim was to explore the variables contributing to the undesired separation of the soap, and to modify the conditions to yield a liquid soap product that did not separate into two layers over time.



Figure 1. Soap Examination

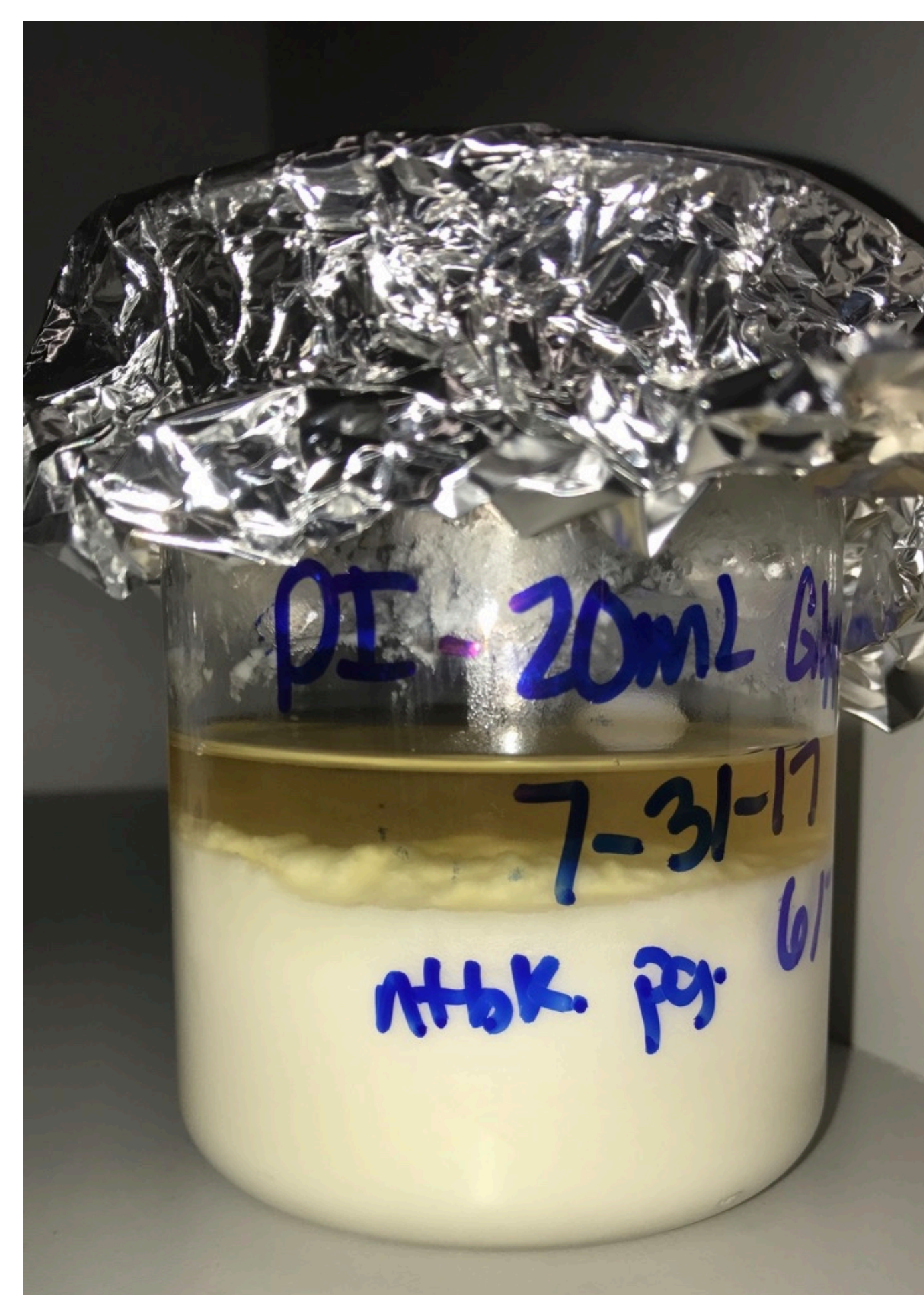


Figure 2. Glycerol Separation from Soap



Figure 3. Successful soap with polysorbate-60

Methods

General Procedure:

- Soap prep – grind soap into fine flakes and autoclave to sterilize
- Dissolve soap in boiling water and add emulsifier
- Stir while heating 5-10 mins, filter, and cool
- Observe soap foaming action, viscosity, and stability over time

Variables Studied:

- Tap water vs DI H₂O
- Volumetric ratio (water : soap)
- Cooling time and stirring vs standing cooling
- Filtration and filtration method
- Additives/emulsifiers – various concentrations of hydrolyzed lipids, glycerol, and polysorbate-60

Results

- Figure 1 demonstrates the analysis of soap viscosity and foaming action.
- The significance of using DI H₂O vs tap water did not impact soap consistency.
- It is important to maintain a consistent water to soap volumetric ratio throughout experiment.
- Glycerol and hydrolyzed lipids separated over time (Figure 2). Various consistencies were produced by these emulsifiers.
- Polysorbate-60 at 10% of the total volume remained consistent over time (Figure 3).
- Soap can cool overtime and should be stirred once, when cooled.
- For best results, soap should be filtered once during cooling process.

Discussion/Next Steps

The OGSC is currently working on scaling up production. In conclusion, polysorbate-60 at 10% total volume should be used to maintain a homogenous suspension. In the future, the OSGC plans to use soaps from various sources and will investigate how the consistency and stability will be affected.

Acknowledgements

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References

1. <https://www.theonegallonsoapcompany.com>