

Changing Business and Increasing Manufacturing Challenges

I love emulsions. I have made a career focused largely on developing emulsion-based cosmetic products and investigating problems related to their manufacture. Emulsions look elegant, provide nice skin feel, and offer versatile applications in a wide range of cosmetic preparations including many skin care, sun care, hair care and makeup products. Emulsions, however, are notoriously tricky to manufacture because many factors can affect product quality and shelf life. Not only must you worry about the quality and quantity of each ingredient in the formulation affecting the physical and chemical properties of the products, but even small changes in manufacturing conditions, or “process variables,” can often significantly affect its perceived quality or shelf life.

Process variables are often difficult to identify and control precisely. Sometimes, using a different kettle, mixing speed, cooling rate or even changing the order of ingredients added to a processing tank can make a difference in the quality of the product. In other words, how you put together an emulsion can be just as important as what you put into the formulation. This variability is a major headache and frequent inconvenience in emulsion manufacturing. But to me, the creativity and discipline employed in tracking down the cause (or causes) of the problem and devising a fix is the kind of intellectual challenge that makes working with emulsions so much fun. And, indeed, throughout my long career, I have encountered many challenging problems, and experienced plenty of anxiety and frustration, as well as the intoxicating joy of discovering solutions. I decided to write this book to share some of the knowledge and experience I have acquired over the last 50 years, hopefully stimulating research interest in the challenging area of emulsion science, and perhaps reducing the number of emulsion-related formulation and manufacturing headaches.

I believe it is important to pay special attention when formulating and manufacturing emulsion products in order to prevent unexpected manufacturing difficulties or even significant quality degradation during the product's shelf life. Understanding the often complex relationship between formulation and manufacturing is essential to the smooth production of cosmetic emulsions. As a consultant specializing in troubleshooting of manufacturing cosmetic emulsions, I have visited and worked in

cosmetic factories in different countries, talking to production managers, cosmetic chemists and engineers about all kinds of challenging manufacturing problems. From these conversations it is clear that the number of manufacturing problems in cosmetic factories continues to increase along with the costs of manufacturing failures.

One likely reason for this increase in manufacturing problems is globalization of business and the pressures of market competition. Whereas mega retailers like Wal-Mart and Costco purchase enormous quantities of goods from cosmetic companies today, they also demand good quality and low price. To reduce manufacturing costs, many US cosmetic factories have greatly increased their production batch size, and the standard 500-gallon batch of the 1960s for a cream or lotion has grown to 5000-gallon batches for a wide range of hair care and skin care products. Processing large batches and using high-speed filling machines allows many cosmetic products to be made quickly and relatively inexpensively. However, a compounding error in a 5000-gallon batch of antiaging skin cream containing expensive extracts can be very costly not only in terms of raw material expense but also the cost of disposal and lost time.

Larger Batches, More Costly Mistakes

Today, many companies are keeping very small inventories of raw materials and package components in their warehouses, and employ a “just in time” production strategy to keep production costs low. A manufacturing error involving just one 5000-gallon batch of a cream can deplete the inventory of certain raw materials needed to make a replacement batch immediately. The cost of the error is not just the cost of replacing the raw materials and remaking the batch, as missing a promised delivery date often results in a financial penalty. Worse still, if the error is not discovered by the manufacturing or quality control (QC) staff before the bulk product is packaged and shipped—say to retailers in foreign countries—the result may be a very expensive recall at a later date. This error is then likely to inflict an even greater damage due to its “time bomb” effect.

Larger batches can also mean larger risk in processing errors. Scaling-up of the manufacturing process for emulsion products or increasing batch sizes requires thorough understanding of important process variables that can affect emulsion quality or stability. Some formulations are sensitive to certain process variables such as mixing speed or cooling rate. Even if a product has been made for years in 500-gallon kettles without any problems, making the same formulation in a newly installed 5000-gallon kettle may cause quality degradation if key process variables are not identified and controlled. Depending on the formulation, the product may degrade during shipment to produce discoloration, bad odor or visible phase separation. A 20-ton batch of a cream filled in 20-gram containers represents about a million pieces of product.

You can see that a significant increase in risk goes along with larger production

batches. In theory, learning to manufacture 5000-gallon batches of a product consistently should not be much more difficult than learning to make 500-gallon batches. In practice, however, the cost and fear of a batch failure can often discourage the manufacturing staff to experiment and learn how to use the equipment correctly to process larger batches. The result can be a lack of experience or knowledge in using the new larger equipment. The ability to produce quality products consistently, without error or delay is essential for business survival in today's globalized, and highly competitive cosmetic market.

Changing Cosmetic Products and Changing Formulation Rules

Competition has not only forced cosmetic manufacturers to reduce production costs by making larger and larger batches in their factories, it has also created strong pressure for new product development. Formulation chemists are pressed to create a wider variety of new and unique products that will meet increasingly specific and specialized consumer needs, and they are being given less and less time in which to accomplish this goal. I believe that this pressure is changing the traditional rules for formulating emulsion products and has led to many of the manufacturing troubles and product quality problems cosmetic manufacturers are experiencing today.

Naturally, all products change with time. Some changes are forced by increased competition, while others occur because of a new invention or new technology, or are driven by the changing needs of consumers. Cosmetics products are no exception. Their formulations, use of ingredients, manufacturing methods, packaging and marketing are affected by many complex factors including new government regulations, changing fashion, consumer taste, economics, availability of new raw materials or technology and even by the heightened safety or ecology concerns of consumers.

Government-Imposed Rule Changes

In 1965, the safety of automobiles made in Detroit came under question, coinciding with the publishing of Ralph Nader's book, *Unsafe at Any Speed*. In response to the growing public concern, new auto safety laws were passed the following year, forcing important changes in the process of designing and manufacturing new automobiles.¹ The rise of consumerism in the 1960s also affected the cosmetic industry. Books critical of the cosmetic industry, such as Toni Stabile's *Cosmetics: Trick or Treat?* (published in 1966), raised awareness of the danger of ignoring consumer demands.² Despite strong industry opposition, the US Food and Drug Administration (FDA), in 1976, began requiring labeling of all ingredients in cosmetics, forcing manufacturers to disclose all ingredients in a given product. Although the main purpose of this new regulation was to protect consumers by providing them with the identity of ingredients in cosmetic products, it also had the unintended effect of significantly changing the ways chemists formulated products as cosmetics users became