

Chemical Engineering and Cosmetics: Making the Connection Between Chemistry and Engineering Processes in Product Manufacturing

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Carnegie Mellon University**

Abstract--This workshop will provide an activity for middle school and high school educators and those involved in outreach projects to assist them in promoting engineering and science careers to youth. It will also provide an opportunity to bring industrial technology into the classroom using cosmetic and personal care products as a focus. Workshop participants will explore the processes involved in the manufacture of soap and the role of the chemical engineer. Each participant will manufacture their own personal care product. Using process symbols for chemical engineering unit operations, they will design a process flow sheet that accurately describes the steps taken to make their product. In any product, each ingredient has its own essential function in the product formulation. Ingredients determine the properties and effectiveness of the final product. A discussion of the ingredients in a sampling of popular consumer products will lead to the final activity, product testing. Product testing is a necessary and important part of product manufacturing. Specifically, we will consider product testing with regards to ingredients with a function important to skin care, pH adjusters. Participants will develop an awareness of the part played by the engineer and scientist in the formulation and processing of products that they use everyday.

Chemical engineers use science and mathematics to transform materials in nature into an amazing variety of products that we use every day. These products include cosmetics, medicine, clothing, food and toys, just to name a few. The chemical engineer develops a **PROCESS** which describes how you take the materials (chemicals) and combine them to form a **PRODUCT**. A **PROCESS** is an orderly description of each task that must be accomplished to make the product. You can think of following a recipe to make a cake as an example of a process. If you do not follow the directions properly, you will not get the best looking or best tasting cake.

The proper chemistry required to make a product is essential. It is here that scientists and engineers work together. Chemists provide the chemistry needed to make a product. The engineer takes the chemical recipe and forms it into a series of steps (the process) defined by equipment needed to perform each step. The chemistry defines the order of each step in the process and the engineer uses mathematics to determine how much product can be made, the quantity of initial ingredients needed and how fast the product can be made. This is of course very important, since a company wants to make a product that is affordable for people, as well as profitable.

In this paper we present an activity suitable for middle and high school students. The student makes a cosmetic product that they can keep. Once they have experienced the steps involved in

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