

A Cosmetics Module for Women in Engineering Programs

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Abstract

Rowan University hosts a week-long workshop titled *AWE: Attracting Women into Engineering* during the summer. This workshop is targeted for female students from the 7th and 8th grades to expose them to the challenges and excitement of engineering. Novel hands-on experiments in the various fields of engineering with state of the art technology are used to boost the participants' interest in engineering. These experiments require collaborative learning through teamwork. The program consists of a two week on-campus session at Rowan University wherein students interact with departmental faculty, undergraduate engineering students and representatives from local industry. Programs specifically focus on hands-on engineering laboratory experiments, field trips, workshops on engineering ethics, and computer training sessions.

A cosmetics module was recently added to the workshop. Girls at this age are interested in various cosmetics such as lipsticks, eye shadow and lip gloss. However, few recognize that engineers are vital to the cosmetics industry. The cosmetics module introduces the participants to the ingredients in lipstick and their physical properties, as well as the production process of lip gloss and lipstick. Participants work in teams to formulate lip products of different consistencies and colors. Each team creates its own line of cosmetics, and presents the finished products to faculty and other participants at the end of the module.

It is expected that the workshop will encourage young women to consider engineering as a course of study and/or a career, thereby attracting new and more diverse engineering talent to the workforce.

Introduction

Just sitting in front of the television for an hour or looking at magazine displays in grocery stores, one realizes that a significant portion of the cosmetics industry is targeted to young women in their early teens. Specialized product lines that rely on nontraditional color palettes for cosmetics such nail polish, lip gloss, and eye shadow are designed to appeal to young women in this age group. The relatively recent marketing focus on

consumers of this age group inspired us to develop a workshop that moves these young women from the designation of consumer to participant, and even engineer. With the assistance of two undergraduate women at Rowan University, we designed a workshop that appeals to girls who are interested in cosmetics, with the goal of stimulating curiosity and excitement about engineering.

Some of the goals for this workshop include the following:

- Show the connection of engineering to everyday products that are interesting to teen women.
- Demonstrate that engineering is a career that requires creativity.
- Emphasize the cooperative nature of engineering work (teamwork).
- Have each participant leave with a product that they made, thus encouraging them to share their experience with family and friends.
- Introduce girls to the various roles that an engineer might play in the manufacture of a product.

Workshop overview

The workshop can be completed in one hour for less than \$50. Cosmetic-grade pigments and other supplies can be easily obtained from a drugstore and over the internet from various suppliers^{1,2}. The equipment and supplies needed for the experiment include:

- Hot plates
- Large, shallow pots
- Small, deep heat resistant glass bowls for heating and mixing
- Tongs and oven mitts for handling hot bowls
- Lip gloss tins
- Pigments (cosmetic grade)
- Beeswax (cosmetic grade)
- Castor oil
- Mineral oil
- Flavorings
- Stickers and decorations for tins

Several undergraduates were recruited as assistants for this experiment since there were some safety considerations (hot surfaces and hot waxes and oils). For each team of three participants, a faculty member or undergraduate student was available to assist with pouring.

Prior to the experiment, we developed several formulations of various consistencies based on recipes we found at supplier's website¹. These lip gloss samples were available (and color-coded with catchy names) for the girls to sample and use to determine what recipes to use to achieve a desired consistency of their products (from slippery lip gloss to more waxy lipstick).

The girls were given a handout (Figure 1) that helped lead them through the activity. The faculty member first led a discussion of cosmetics manufacturing and the role of engineers and scientists in developing cosmetics such as perfumes, lotions, and lipsticks that don't smear³⁻⁶. Several small group experiments and demos such as determining the melting point of wax and determining which oil (castor, mineral, or almond oil) is the best carrier for the pigment were incorporated into the discussion to keep the girls actively involved.

During the experiment, two teams shared a hot plate station. Before teams began the experiment, the undergraduate assistants set up a water bath at each station by placing 2-3 inches of water in each pot and turning on the hot plate. Since each hot plate is different, testing the hot plates to determine the proper settings prior to the lab is recommended. Water should be hot (steaming) but not boiling (the melting point of beeswax is approximately 147 F).

Teams were asked to develop a line of cosmetics (one color per team member) and work as a team to come up with a theme that tied together their 3-4 colors. Teams were also given the prices for each component of their lip gloss and were asked to calculate a price per unit. Once all teams were finished, each team made a small informal presentation in which they modeled and "advertised" their lip gloss line. Other faculty and undergraduates were invited to come in and try out the lip gloss the teams made.

Figure 1: Handout for Participants

Introducing a new line of lip products . . . exclusively from the AWE corporation!

The scenario: Drs. Jahan and Hollar have decided they want to make a little money on the side in the summer, and what better way to make a buck than doing something fun like making lip gloss! But they need a little help, so they brought in 7 teams of consultants—you! Your job is to work in teams of 3 to formulate a line of lip products (lip gloss, lipstick, lip balm) that will appeal to consumers in the 12-20 age group. Before you get started, we need to answer some questions . . .

Product development: What are some things you need to decide on before you get started?

Making the lipstick:

- The ingredients
 - *Waxes* give the lipstick structural integrity, stiffness, and temperature stability.
 - *Oils* make application of the lipstick easier, give the product "slip," and provide moisturizing capability.
 - *Pigments* and *flavors* make the lipstick fun to wear!

- What are the physical characteristics of the different ingredients?
 - In what oils will the pigment dissolve better?
 - *Experiment:* As a group, we'll try out castor oil, mineral oil, and almond oil. Circle the one you think works the best.
 - In what order should the ingredients be mixed?
 - What is the best temperature to mix all the ingredients together?
 - *Experiment:* As a group, we'll measure the melting point of wax—the oil/pigment mixture should be heated up to that temperature before making your final product
 - What amount of each ingredient should we add?
 - *Experiment:* We have 4 top secret formulas developed in the Rowan labs. You'll try these out and decide how much of each component you'd like to add to achieve the desired products for your line.

The procedure:

- Caution! The hot plates are hot, and your mixture and utensils will be hot. Be very careful!
- You will repeat this procedure 3 times, making one color for each team member.
 1. Add a small amount (a pinch, it doesn't take much) of pigment to _____ tsp of _____ oil in your mixing glass (as determined from our previous experiments). Mix with stirrer until pigment is evenly dispersed.
 2. (Optional) Add pinch of mica or titanium dioxide (for lightening and sparkle).
 3. Add _____ tsp of _____ oil. Mix well.
 4. (Optional) Add _____ tsp of _____ oil. Mix well.
 5. Heat your mixture to the melting point of beeswax, _____ °F. **Be careful!** Your hot plates are **hot!** Only touch the Styrofoam holder on the glass.
 6. Bring your heated mixture to the beeswax pot at the front of the room. Heat up measuring spoon by dipping into water bath containing melted wax at front of room.
 7. Add _____ tsp of wax to oil mixture and stir until well-mixed with stirrer.
 8. Take out a small amount of your lip product mixture and allow it to cool. Check for consistency and color. Make any modifications necessary. If adding pigment, you must first disperse it in a small amount of oil (step 1), or your lipstick will be lumpy.
 9. Have Rowan students help you pour your finished lip product into the tins provided.

Marketing

Decide on a theme for your marketing plan.

How much will you have to charge for each container?

Make up cool names for your lip gloss, label the containers, and enjoy!

You can experiment with different formulas at home! Try adding Vitamin E, other moisturizing agents, vitamins, and flavors. Be careful to check out the safety of your additives first, though!

Interested in finding out more about lip products? Some cool websites:

Supplies:

<http://www.seedman.com/Rachel/lipbalm.htm>

<http://members.aol.com/pigmntlady/>

The story of lipstick from a Chemical Engineer's perspective:

<http://pubs.acs.org/cen/whatstuff/stuff/7728scit2.html>

Soybeans and lip balm? Some engineering students invent a new lip balm!

<http://ard.unl.edu/rn/0300/balm.html>

The story of a college student who developed her own line of cosmetics!

http://www.youngbiz.com/career_gears/Turning%20Pro/candy_girl.htm

Conclusions

This workshop was very popular with the participants (as well as the faculty and students!). The girls actively participated, and were very curious about how the various components of lipstick and other cosmetics were made. Incorporating the idea that each girl was a part of a team of consultants who were developing a line of lipsticks gave each group cohesiveness, yet did not allow one member to dominate, as each girl developed her own color within the parameters defined by the team.

Roughly half of the girls (10 of 21 responses) rated this workshop as their favorite activity during the week-long camp. The girls cited it as a favorite for varied reasons, from “I never knew you could make lip gloss with all the stuff we used” and “it was a lot of fun and very chemically involved” to “it was fun and different and we got to take the lip gloss home” and “my favorite part of that was ‘advertising’ them.” These comments indicate that we met many of the goals for this workshop—connecting engineering to products they use, inspiring discussions of engineering outside of the workshop, and demonstrating the various roles that engineers might play in product development.

REFERENCES

- (1) "Rachel's Potpourri Supply," <http://www.seedman.com/Rachel/lipbalm.htm>. Accessed June 11, 2001.

- (2) "The Coloration Station--cosmetic grade colorants," *Simple Pleasures*, <http://members.aol.com/pigmntlady/>. Accessed June 11, 2001.
- (3) Poucher, W. A. *Perfumes, Cosmetics, and Soaps*; Wiley: New York, 1974.
- (4) Williams, D. F.; Schmitt, W. H. *Chemistry and Technology of the Cosmetics and Toiletries Industry*; Blackie Academic & Professional: New York, 1996.
- (5) Klocksins, M.; "A slick idea--soybean-based lip balm," *University of Nebraska-Lincoln Agricultural Research Division*, <http://ard.unl.edu/rn/0300/balm.html>. Accessed February 23, 2002.
- (6) Johnson, R.; "What's that Stuff? Lipstick," *Chemical & Engineering News Online*, Volume 77, Number 28, <http://pubs.acs.org/cen/whatstuff/stuff/7728scit2.html>. Accessed June 11, 2001.

BIOGRAPHICAL INFORMATION

KATHRYN A. HOLLAR is an Assistant Professor of Chemical Engineering at Rowan University. She received her B.S. in Chemical Engineering and English at North Carolina State University in 1993, and her Ph.D. in 2001 from Cornell University.

MEGAN MORAN is a sophomore chemical engineering student at Rowan University. She is interested in pursuing a career in cosmetics manufacturing after receiving her degree in Chemical Engineering.

VICTORIA SCHEPIS is a sophomore mechanical engineering student at Rowan University.

KAUSER JAHAN is an Associate Professor of Civil and Environmental Engineering at Rowan University. She completed her Ph.D. studies in the Department of Civil and Environmental Engineering at the University of Minnesota, Minneapolis. She is also the Director for the Attracting Women into Engineering Program at Rowan University.