

THE ART OF SOAP MAKING
INTRODUCTION

Description

These open-ended problems involve students in multi-week explorations. Students have access to Emery's Analytical Procedures¹ and Technical Bulletin 140A, Processes and Facilities.² The students will use at least one analytical testing procedure to solve the problems stated in the scenarios.

Goals for the Experiment

In this exercise the students will:

- search literature prepared by Industry to develop an analytical procedure to solve a problem.
- develop a plan to address real-world industrial problems in the soap making industry.
- use standard methods to perform analytical tests.

Recommended Placement in the Curriculum

This lab is intended as a capstone experience at the end of the second semester.

THE ART OF SOAP MAKING

BACKGROUND

Soap making is an art as well as a science. These scenarios are not meant to be explorations in the art of soap making. (Solvent choices, salting out the soap and effects of additives like glycerin and fragrances are beyond the scope of this introductory laboratory.) However, soap making ingredients like fatty acids and fats and oils (lard, tallow and cottonseed oil) are described by chemical properties and tests. Using an appropriate chemical property or test to evaluate the soap making materials (fatty acids or lard, tallow and cottonseed oil) is essential to success with these problems.

LARD SOAP MATERIALS SCENARIO

A company producing small batch, old fashioned soaps has just discovered a very cheap source of cottonseed oil. The preferred soap recipes of the company are all very similar to “lard soap” recipes. Can the cheap cottonseed oil be mixed with another soap raw material to produce soaps similar to their existing “lard soaps?” What raw material(s) might be mixed with cottonseed oil to produce soaps similar to “lard soaps?” Finally, how similar would your cottonseed oil plus other ingredient(s) soap be to “lard soap?”

STEARIC ACID SOAP SCENARIO

A friend in the small specialty soap business wonders whether more “pure” soaps might be made if your company began with fatty acids rather than lard or tallow. The friend even offers some Lily[®] Stearic Acid for trials. The sample soaps from Lily[®] Stearic Acid don’t formulate correctly and contain excess alkali. Why aren’t the soaps formulating correctly (for stearic acid)?

PROCEDURE

Read the memo from The Aroma of Spring Soap Company before proceeding with any tests.

MATERIALS

Determine the materials that are needed for the lab and provide a list to your instructor in advance.

SAFETY, HANDLING, AND DISPOSAL

Obtain the MSDS for any chemicals you use. List the safety, handling, and disposal recommendations (which can be found in the Flinn Catalog) in your lab notebook.

The Aroma of Spring Soap Company

Inter-Office Memorandum

July 23, 1998

From: The Management

To: All laboratory employees

RE: Regulatory Compliance

This memorandum is to alert you to the new Soap Testing Industrial Policy on collection and handling of data chemical properties on soap systems. The newest Industrial Standard found in yesterday's *Soap Business News Report* has increased the minimum number of trials needed when characterizing any chemical property of prepared soap from 4 to 6 and placed a multiple person requirement stating "that the 6 trials are to be conducted by at least two persons on the testing team."

This change was not unexpected. As you already know, this 6 sample/multi-persons testing procedure has been used by our company for over a year now. We have been among the pioneers of this method and have played an important role in its adoption by the Industry as a whole.

Thank you for your prompt compliance.

PLANS FOR YOUR SOAP MAKING INVESTIGATIONS

GROUP MEMBERS:

SCENARIO PERFORMING:

I. Write a statement of the purpose of your particular investigation.

II.

A. Identify the following:

1. the variable whose values you will manipulate
2. the units in which the variable values will be expressed
3. probable sample sizes you expect to try

B. Identify the following:

1. the responding variable whose values you will measure
2. the units in which the variable values will be expressed

C. Identify the other variables of your procedure whose values you must keep constant.

III. List the expected steps of your investigative procedure.

YOU MUST TURN IN THIS PROCEDURE REVIEW AND PLAN OF ACTION TO YOUR INSTRUCTOR AT THE BEGINNING OF THE LABORATORY PERIOD TO GAIN PERMISSION TO WORK IN THE LABORATORY. Feel free to talk with your instructor before class meets about your plan.

GROUP MATERIALS REQUEST FOR A SCENARIO

Please note: These plans must be returned to the instructor for processing in advance of the time you need the equipment so that lab personnel can do the work needed for all students. For students in a Tuesday laboratory, these plans must be returned by Thursday noon of the week before the experiment is to be performed. You will not be permitted to enter the laboratory if this form is not completed and turned in on time.

Name of group members:

Scenario:

Special Equipment and Materials needed (other than what is in your lab desks):

Reagents and/or solutions needed (please state minimum quantity needed):

THE ART OF SOAP MAKING
INSTRUCTOR NOTES

Time Required

A minimum of one 3-hour lab will be necessary in order to complete the analytical testing. (We recommend two lab periods be provided.) The students will need to spend at least three hours in advance of the lab, preparing their plan of action.

Group Size

Students should work in groups of 2.

Materials

per class:

- stearic acid
- palmitic acid
- Lily[®] stearic acid
- sodium hydroxide
- ethanol 95%
- phenolphthalein indicator
- 0.5 M hydrochloric acid
- potassium hydroxide
- 250-mL Erlenmeyer flasks
- 500-mL Erlenmeyer flask
- air condenser (minimum 650 mm long)
- 50-mL volumetric pipet

Safety, Disposal, and Special Handling

Review the Material Safety Data Sheets of any chemical used in the experiment for information regarding safety and handling. Dispose of waste according to your local ordinances.

Points to Cover in the Pre-Lab Discussion

Introduce Henkel Corporation by showing videotapes produced by the Henkel Corporation.

Likely Play-Out of Lab

Students look up soap and the fatty acid composition of various fat and oil sources.² Students suggest a mixture of fat(s) and/or oil(s) plus cottonseed oil that approximates the fatty acid composition of lard. The lard, cottonseed oil, and cottonseed oil plus fat(s) and/or oil(s) are saponified (reacted with sodium hydroxide) and titrated allowing students to compare the fatty acid values. (This problem is also related to other composition of matter problems like percent composition of an element in a compound problems and isotope percent abundance and the atomic weight of elements problems.)

Students look up fatty acids and acid value. Lily[®] Stearic Acid is actually a mixture of stearic and palmitic acids, a fact unknown to the novice soapmakers in the soap scenario.

Students can access the internet to determine saponification values and lye to fat ratios.^{3,4}

Students have access to Emery's Analytical Procedures (on reserve in the library) and will have been introduced to Emery via video tapes which provide some background prior to going to the library to look up aspects of the problems.

Extensions and Variations

Students can access the internet to find soap recipes. They can select one of these recipes and make the soap in lab.

References

1. "Emery Analytical Testing Procedures." Henkel Corporation, Emery Group, Cincinnati, OH, October **1989**.
2. "Processes and Facilities, Technical Bulletin 140A." Henkel Corporation, Emery Group, Cincinnati, OH, January **1990**, pp. 5.
3. "Rainbow Meadow." <http://www.rainbowmeadow.com/soapsap.html>
4. "Lye to Fat Ratio Table." <http://www.lis.ab.ca/walton/old/soap/soaptabl.html>