

Equipment and Chemical Preparation

Experiment 7: Synthesis of Soap (Saponification)

Experiment Summary

In this two week experiment, students will work in pairs to prepare soap. Soap will be prepared through saponification (ester hydrolysis) of triacylglycerols derived from vegetable shortening (i.e., Crisco). Reaction of triacylglycerols with sodium hydroxide in de-ionized water will promote saponification to generate the soap, which is a mixture of carboxylate salts of fatty acids and glycerol. Workup requires precipitation of the soap from cold saline solution. The soap product will be evaluated for hardness/softness, feel, and its ability to emulsify oils.

Chemicals, Supplies and Equipment

Each student pair will make approximately 10g of soap.

For an individual student pair:

Chemicals & Solutions	Equipment	
10g vegetable shortening	100ml Beaker	250ml Vacuum flask w/vacuum hose
40 ml ethanol	250ml round-bottomed flask (24/40 joint size)	Buchner funnel w/ filter paper
40 ml of 20% NaOH	Reflux condenser (24/40 joint size) w/ hoses	Large Powder funnel w/ filter paper
150 ml 28% NaCl	250 ml Heating mantle w/cord	400ml beaker
200 ml de-ionized water	Variac	100ml beaker
500µl soap scent	500 ml Erlenmeyer	2 Weigh boats
2-3ml 1% Calcium chloride	6 13 x 100mm Test tubes	
2-3 ml 1% Magnesium chloride	Test tube rack	
2-3 ml 1% Ferric Chloride		
2-3ml Mineral or other oil		
3-5 ml 0.5% detergent solution		
3-5 ml 9% Sodium phosphate tribasic solution		

Total Needed for ~160 students

Chemicals	Total Quantity	Prep
Vegetable Shortening	4 containers (1.36 kg size)	Separate into six containers of ~200g each
Ethanol	5 liters	6 1 liter bottles, One bottle at each bench.
25% NaOH in water	5 liters	6 1 liter bottles (Should be plastic not glass), one at each bench
28% NaCl	14 liters	6 1 liter bottles, one at each bench
De-ionized water	20 liters	Can be stored in a carboy in lab
1% Calcium chloride	600ml	6 100ml bottles at each bench
1% Magnesium chloride	600ml	6 100ml bottles at each bench
1% Ferric Chloride	600ml	6 100ml bottles at each bench
Mineral or other oil	1 liter	6 100ml bottles at each bench
0.5% Detergent solution	2 liters	6 100ml bottles at each bench (dish detergent is fine)
9% Sodium phosphate tribasic	2 liters	6 100ml bottles at each bench

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250ml 24/40 round bottomed flasks	12 +2 extra for breakage	2 at each bench
24/40 reflux condensers w/ hoses	12 + 2 extra for breakage	2 at each bench
250ml Heating mantles w/cords	12 +2 in case of failure	These heating mantles are larger than what the students typically use. Two of these should be placed at each bench.
Variacs	12	Located in the student's common hood cabinet.
500ml Erlenmeyer flasks	12 + 2 for breakage	2 at each bench
Powder Funnels (10cm diameter)	12 + 2	These large powder funnels should be provided, two at each bench. The ones typically used for other experiments are too small.
Large filter paper (15cm or greater)	12 boxes/packs of ten	One box/pack at each bench
250ml Vacuum flask w/ vacuum hoses	12 + 2 for breakage	2 at each bench
Buchner Funnels (6cm diameter or larger) with adapters to fit 250ml vacuum flasks	12 + 2	These should be in the student's filtration drawers. Adapters need to be provided to fit the 250ml vacuum flask.
Filter paper (to fit Buchner funnels)	12 boxes of 20	One box at each bench
100 and 400ml beakers	14 each	Students already have these in their lab drawers
Fragrances (total of ~60ml)	3 or 4 varieties, 12 bottles	Place one bottle at each bench
Weigh boats for soap molds (8 x 8 cm)	200	Place ~20 at each bench

Instructions

- Set up six reagent bins, one for each bench, containing each of the following items.

Chemical and Supplies Bins	
1 container of shortening	1 pack of 15cm filter paper
1 1 liter bottle of ethanol	1 bottle of fragrance
1 1 liter bottle of 25% NaOH	~20-30 weigh boats
1 1 liter bottle of 28% NaCl	
1 box of 6cm filter paper	

- Set up six equipment bins, one for each bench, containing each of the following items.

Equipment Bins	
2 250 ml rb flasks (24/40 joints)	2 Large Powder funnels
2 condensers w/ hoses (24/40 joints)	2 250ml Vacuum flasks w hoses
2 250 ml heating mantles w/ cords	2 500ml Erlenmeyer flasks

- Check bins, solutions, chemicals, supplies throughout the week and refill as needed.