

## Shallot mashed potatoes and the potato starch test

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Adapted for CHM 182: Kitchen Chemistry by Keri Colabroy

Cookwise reading: pg 348-351

### Kitchen equipment

Medium and Large mixing bowl	Saucepan
Digital thermometer	Hot gloves/oven mitts
Potato peeler	Whisk
Potato masher	Rubber spoonula
Wire mesh strainer	Waring single burner
Santoku knife	Cutting board
Cuisinart food processor	Wire mesh strainer

### Part I - Potato Starch Test

The density of a potato is largely determined by its starch content. The more starch a potato contains, the more *dense* it will be. We will prepare a brine solution (i.e. a concentrated solution of salt in water) and determine the different densities of different types of potatoes as a means of predicting starch content. The high-starch potatoes are great for baked potatoes, fries and mashed potatoes. The low-starch (i.e. “waxy”) potatoes are good for boiled potatoes. The more starch a potato has, the more water it can absorb and the easier it will break apart. A low-starch potato will absorb less water and can hold its shape after boiling.

### Ingredients/Materials for potato starch test

Different types of potatoes (Idaho Russet, Yukon gold, red potatoes, white potatoes)
Graduated cylinder (one for the class) <i>Since this will come from the chemistry lab, all of this material is not for consumption</i>
1 gallon pitcher (one for the class)
Salt (not for consumption!)
Water from the tap (not for consumption!)

### Instructions for the Potato Starch Test

1. Each group chooses a type of potato
2. Make a table on the chalkboard for your data

*Split the following work up among the class*

3. Measure out 1 cup of salt (chem stockroom salt), and 11 cups of room temperature tap water.

4. Dissolve 1 cup salt in the 11 cups of water in the 1 gallon pitcher. This salt water solution is called *brine*.
5. Carefully pour the brine into the tall, graduated cylinder, but leave a few inches of room at the top.
6. (*one group at a time*) Gently drop a potato into the brine. Record how far it sinks (in your notebook and on the chalkboard). The more starch a potato has, the more dense it will be and the farther it will sink. To retrieve the potato and re-use the brine solution (for the next group), carefully pour the brine and potato back into the one gallon pitcher. Use a clean hand to retrieve the potato from the pitcher. The used potato can be washed with soap and water, and then thrown away or composted.
7. The next group can take the brine and start again at step 5. *When you have completed your turn or you are waiting for your turn, assemble your equipment for part II*
8. Repeat until all groups have tested their potato. Record all the data on the chalkboard and rank the potato types by starch content. Which types have the most starch and would therefore make the best mashed potatoes? Choose a high starch potato to carry forward into the next half of the lab.

## Part II – Shallot mashed potatoes with Garlic

### Kitchen equipment for Mashed Potatoes

Medium and Large mixing bowl	2 qt saucepan
Digital thermometer	Hot gloves/oven mitts
Potato peeler	Whisk
Potato masher	Rubber spoonula
Waring single burner	Cuisinart food processor with steel blade
Santoku knife	Cutting board
Liquid measuring cup	Wire mesh strainer

### Ingredients for Shallot Mashed potatoes with Garlic

*Makes 2-3 servings (half of the original recipe)*

2-3 medium high-starch potatoes, peeled and sliced about ½ inch thick	⅛ teaspoon of white pepper
2 medium shallots <i>crushed</i> , 2 shallots <i>finely minced</i> A shallot is a mild onion	½ cup heavy cream
1 clove garlic <i>crushed</i> , 1 clove garlic <i>finely minced</i>	¼ cup of milk or half and half
2 teaspoons of salt	2 tablespoons butter
¼ teaspoon of cider vinegar	

*We want to use high-starch potatoes, because the large quantity of starch granules absorbs water, the starch granules swell and separate from each other. High starch potatoes break apart easily when cooked.*

## Instructions

1. Place the potatoes on your cutting board. Peel your potatoes, wash them briefly in cool water to remove any dirt, dry them in a clean kitchen towel and slice them in  $\sim\frac{1}{8}$  inch thick discs. Collect the sliced potatoes in your large mixing bowl.
2. Take ALL 4 shallots and do the following: Smashing one shallot at a time by placing it on your cutting board, covering the shallot with a clean kitchen towel and smashing it with the bottom of your saucepan (this really does not require much force – don't over-smash it ☺). The crushed pieces should be large and easy to handle. Remove the layers of thin, papery, purplish skin and discard. The peeled shallot will have a smooth, waxy purple skin. You may need to slice off the top of the shallot to make it easier to peel. Slice off the hard parts where the shallot was attached to the plant. Add 2 (TWO!) of the peeled, crushed shallots to the potatoes in your large mixing bowl. Reserve 2 (TWO!) of the peeled, crushed shallots to your medium mixing bowl – you will use them later.
3. Fill your 2 quart saucepan with about 3-4 cups of water. Set your Waring single burner in a clean area away from any flammable material. Place the saucepan of water on the burner and start heating to 175°F. BEWARE OF BURN HAZARDS! Start with a setting of 4 and monitor the rate of temperature increase. Adjust as necessary.
4. While waiting for the water to heat, crush the 2 (TWO!) garlic cloves in the same way you crushed the shallots (gently!) and remove the thin layer of papery white skin – discard the skin. Cut off the hard nub where the clove was attached to the head. Add 1 (ONE!) crushed garlic clove to the potatoes and shallots. Reserve 1 (ONE!) crushed garlic clove with the reserved shallots in your medium mixing bowl.
5. When the water has reached 175°F, turn the heat down to low (1-2) and immediately add the potato slices, crushed shallot, crushed garlic, 1 tsp salt and  $\frac{1}{4}$  tsp cider vinegar to water. The potatoes will cool the water down to  $\sim 160^\circ\text{F}$ . Cook at  $\sim 160^\circ\text{F}$  (just below a simmer) for about 20 minutes (add cold water or turn up the heat a little to maintain the temperature).

*You must be ready for the next several steps involving the draining of the potatoes – read through all the steps before attempting them.*

6. Fill your large mixing bowl with  $\sim 3$  cups of water and 1 cup ice.
7. Empty and relocate the 1 gallon pitcher from part 1 to an easily accessible central location in the room. Put the pitcher on top of a clean kitchen towel.
8. Drain the potato/shallot/garlic mixture by setting your wire mesh strainer on top of the one gallon pitcher and pouring the hot water into the pitcher. Beware of splashing hot water, and beware of where you set your hot pot.
9. Take the wire mesh strainer containing the potatoes/shallots/garlic mixture back to your station and carefully submerge the contents in the ice water in your large mixing bowl. If water is not at least room temperature (after you have added the hot potato mixture), add more ice. The potatoes need to *stand* for about 30 minutes.

*We have boiled the potatoes, the starch granules have swollen with the absorbed water and the starch has gelled. Now, with standing, the starch polymers cool down and firm up or crystallize (amylose*

*crystallizes more readily than amylopectin) a process chef and food scientists call retrogradation. The firmed starch is now a large matrix that is very insoluble in water and will not form a gluey mess.*

10. During the 30 minute wait, mince (*chop very small*) the reserved shallots and garlic by placing them in the Cuisinart food processor with the steel blade. If the quantity of shallots and garlic is too small for the processor to mince effectively, then combine with another group and split the minced shallot/garlic mixture.
11. Heat 2 tablespoons of butter on medium heat (burn hazard!) in your clean 2 qt saucepan until they melt (beware of overheating!), add the minced shallot and garlic and *sauté* just until soft (the shallot and garlic should sizzle slightly when you add them). This means – push the shallots and garlic around the saucepan with your spoonula until the mixture become slightly translucent and soft. Then stir in 1 teaspoon of salt and the white pepper. Add the cream and milk (or half and half) and gently heat through. Pour the cream/shallot/garlic mixture into your medium mixing bowl, cover with aluminum foil and set aside.
12. Return the potatoes to the saucepan (after at least 30 min of standing). Cover them with cool water (you can use the same water the potatoes cooled in – just add more if you need to), then bring to a boil and simmer for ~5 min or until fork tender. Turn off the heat. Drain the potato mixture again (over the 1 gallon pitcher as before). Remove and discard the shallots and garlic pieces. Return the wet potatoes to the hot pot and set them on the still hot (but off!) burner for 1 minute to dry out.
13. Gently mash the potatoes with your potato masher – mash gently so as to separate cells of potato rather than smash the cells – and transfer the mashed potatoes to a mixing bowl. Cover with aluminum foil. (*while one partner is doing this step, the other can do step 14*)
14. Remove the foil from the shallot/garlic/cream mixture and microwave in 30 second intervals until hot, then add the cream mixture to the potatoes by stirring with your spoonula. Add the cream mixture in portions to the consistency you desire.

### Analysis

In your report, explain...

1. Why was the starch content of the potato important to this recipe?
2. Why was cooling the potatoes (the 30 minute *standing*) important to this recipe. What did it accomplish?
3. Did your mashed potatoes turn out as you expected? Why or why not?
4. Compare your potatoes to another group that used a different potato type. How are the two products different? Can this be explain by starch content of the potatoes?