The "Stain Stick"

Syringe-Cast Agarose with Citrate-Based Stain Reduction Solution

SUPPLIES

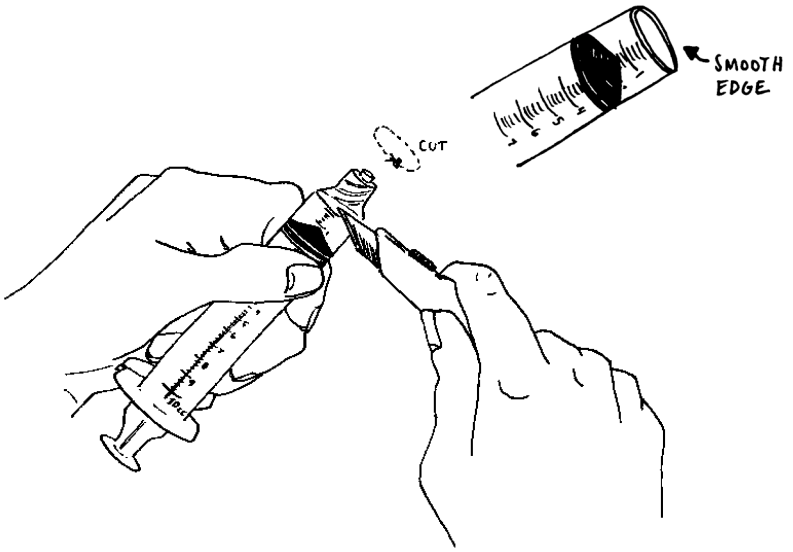
- Disposable plastic syringe (choose volume)
- Utility knife
- Digital scale
- Distilled/deionized water
- Agarose powder
- Sodium citrate* powder
- Glass or silicone beaker
- Watch glass or plastic wrap
- Glass stir stick or small whisk
- Microwave

**tri-sodium citrate is an inexpensive food-grade product that is safer for down-the-drain disposal than tri-ammonium citrate, according to some SDSs*

INSTRUCTIONS

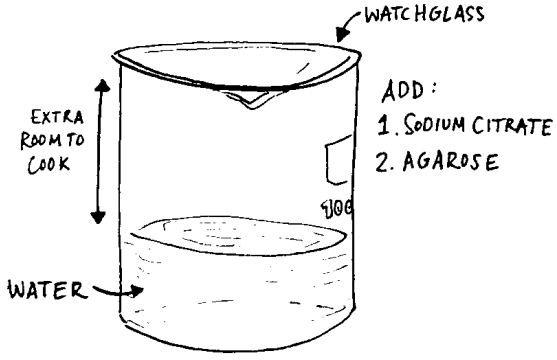
1. PREPARE THE SYRINGE

Using the utility knife, carefully cut off the tip of the syringe (the end opposite the plunger), ensuring the cut yields a flat and level opening for the cylinder of the syringe. This will be where the gel comes out when in use, so the edge should not have any burrs that could jeopardize the surface of an object during treatment.



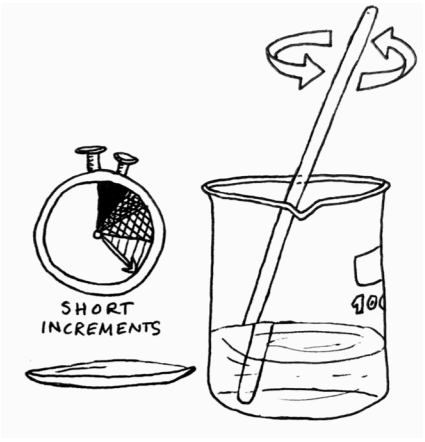
2. PREPARE THE SOLUTION

Use a scale that is capable of accurately measuring small amounts, on the scale of 0.001g. Some amounts necessary for making these syringe gels can be quite small! You may need to make an excess of gel and cast into multiple forms if your scale (or beakers) cannot accommodate such small quantities. Measure out the water first, followed by sodium citrate. Dissolve the sodium citrate into the water. Measure the agarose powder in a separate container and slowly stir it into the solution, ensuring there are no lumps.

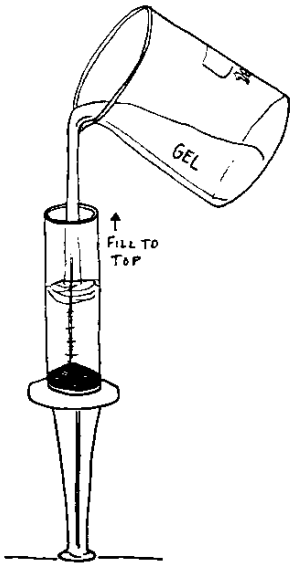


3. COOK THE GEL

Cover the beaker with a watch glass or plastic wrap to prevent evaporation of the water. Cook the gel in the microwave in brief increments of 5-20 seconds, with stirring in between, as with cooking wheat starch paste. The power of the microwave and the quantity of gel being cooked will dictate how long each cooking interval should take: large batches will take longer, small batches or a powerful microwave will need shorter cooking times.



Cook the gel until it goes clear and begins to boil – avoid boiling over, which can happen suddenly.

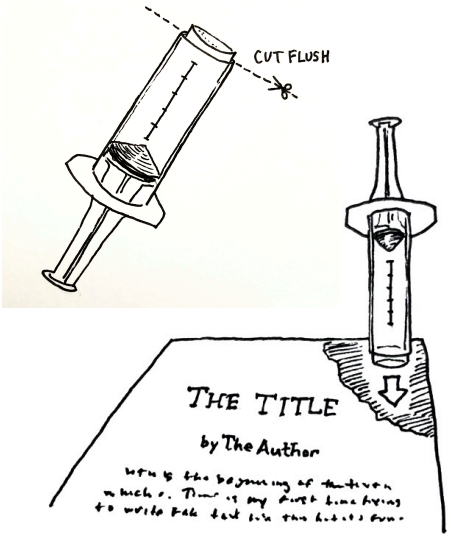


4. CAST THE GEL

While the gel is still hot and liquid, pour it carefully into the cut open end of the syringe. Standing the syringe on the end of the plunger is usually stable – if it is not, have a partner hold it for you. Pour excess gel into other prepared syringes or into a flat, heat-proof container for use as a cast gel. The syringes take longer to set than cast gels because they retain heat longer in their cylindrical shape! Leave the gel for at least thirty minutes to ensure it is fully set. The agarose will appear slightly hazy and blue when set.

5. USE THE GEL

Push the plunger down slightly to expose the gel. With a clean blade, cut the gel flush with the plastic syringe to trim off the meniscus of the gel. The "Stain Stick" is now ready to use! Lightly pounce on your object where necessary; longer dwell time or more pressure will release more water. Try cutting the tip of the gel into a chisel or point for detailed work! Avoid vigorous rubbing across the object's surface, which can cause crumbling of the gel and abrasion of the object's surface. As the end of the gel becomes stained with imbibed discoloration products, trim it off with a clean blade. Store the gel in a plastic bag and in the refrigerator for up to two or three weeks.



SUPPLY SOURCES

SYRINGES

Syringes with many different volumes can be found at Amazon.com and other online retailers. Particularly useful sizes include 10ml (glue stick diameter), 3ml (gel pen diameter), and 1ml (thinner than a pencil diameter). Note: many syringes have volumes listed in “cc” (cubic centimeter), which is the same as mL.

SODIUM CITRATE

Sodium citrate tribasic dihydrate is available from scientific chemical supply companies like Sigma and Fisher, but as a food additive it can also be purchased from high-end food retailers or Amazon. The purity may be different between the two retailers, although your budget and ordering capabilities may dictate where to purchase.

AGAROSE

As with the sodium citrate, low EEO agarose gel can be purchased in a range of purities/prices from different chemical supply companies. A more expensive option is Sigma (product number A0576, $320 for 100g), while a more economical option can be purchased at Benchmark Scientific (product number A1701, $104 for 100g). Avoid purchasing food-grade agar agar, which is unrefined and still contains agaropectin.

FURTHER READING

Cremonesi, P. 2016. “Surface cleaning? Yes, freshly grated Agar gel, please.” Studies in Conservation, Volume 61 Number 6 (pg. 362-367).

Dwan, A. 2015. “Ammonium Citrates for Stain Removal in Paper.” WAAC Newsletter, Volume 37 Number 3 (pg. 10-12).

Stavroudis, C. 2015. “A Tale of Two Citrates.” WAAC Newsletter, Volume 37 Number 2 (pg. 15)

Brockman, M. 2020. “Accelerated Aging Study of Papers Treated with Citrate Solutions.” WAAC Newsletter, Volume 42 Number 1 (pg. 11)