**Nylon rope trick (1 hr)**

**Summary:** This lab demonstrates a common industrial process, interfacial polymerization, on a small scale. Depending on time, potentially follow up on this activity the following day once the fibers have dried to test them- it will depend on available timing.

**ILOs:**

1. Describe the concept of interfacial polymerization
2. Create nylon fibers and compare their material properties to commercially produced nylons

**Equipment list:**

* Sebacoyl chloride (500 mL of liquid SC)
* Dichloromethane (DCM)  (2-3 L)
* Hexamethylene diamine (HMDA)  (200 g pure solid)
* Sodium carbonate (200g of pure solid)
* Distilled water
* Yellow food dye
* 10 sets of Chopsticks
* 10 Glass cup/ beaker (important that it is clear in order to be able to watch the process)
* 10 sets of Tweezers
* 10 Calipers (or rulers)
* 10 force gauges

**Intro:**

Nylon was first produced in 1931 and became commercially available in 1941. Today it is a $31.1 billion market and used for many different applications. There are many different ways of producing polymers, but one of the most curious one is the one in which the polymer is synthesized in the interphase between two immiscible liquids. This experiment shows that in a very fun way

**Procedure:**

The solutions will be prepared beforehand so the students can conduct the experiment

1. Pour 50 ml of the organic phase to a 250 ml beaker in the hood. Then, with the beaker tilted at an angle, slowly pour 50 ml of aqueous solution down the side of the glass wall so that it will be sitting on top of the organic phase. Carefully tilt the beaker back to an upright position.
2. "Catch" the membrane that has formed at the interface with a chopstick. Draw it up and out, and attach the top end to another chopstick. Keep rotating the chopstick as you pull the fiber out and withdraw the Nylon fiber from the interface, spinning it onto the chopsticks.
3. Unwind the collapsed membrane into a large (1 to 2 liter) vessel of water to rinse away any soluble components (salts, mainly).
4. Separate the membrane into 1-2-foot-long portions. Leave half of these wet for tensile testing. Dry the other portion in the 70 °C air oven for weight measurement.

**Analysis:**

1. Using the calipers, estimate the thickness of the wet fiber (D). Then measure the length of the Nylon fiber with a ruler.

1. Have one end of the wet rope held by your lab partner, and attach the other end to the force gauge. Pull the rope taught, but don’t pull hard yet. Measure the length of the wet film (L) and record the corresponding force (F) in your notebook, as well as the length. Keep extending the wet rope by having one of the members step back slightly until it breaks, and try to get at least 6 measurements. Repeat this procedure for at least two wet ropes produced from each recipe to establish how closely the data agree.

**Discussion questions/debrief:**

What have you heard about nylon? Based on what you heard, what applications would it be suitable for?

**Lab handout needed?**

Yes

**Questions/concerns:**

We don’t know if we will have time to dry the fibers, so we might need to do the tests on the wet ones

Safety for the students (should not be dangerous if we do it in a fume hood, and some introduction to lab safety should be good for the safety of all)

Transporting chemicals