# Activity 3.9: Synthesis of bio-fibres

## A) Synthesis of calcium alginate threads35

### Apparatus and materials

* sodium alginate sol (ρ = 20 g/l)
* calcium chloride solution (c = 1 mol/l)
* deionized water
* beaker (250 ml)
* reaction tube (diameter: 2 cm, length: 25 cm)
* measuring cylinder (100 ml)
* rubber stopper to fit the reaction tube
* heatable magnetic stirrer and magnetic stirring bar
* glass rod
* syringe (2 ml) with injection needles (diameter: 0.45 mm, length: 12 mm)
* tweezers
* paper towels
* scale
* sieve

### Procedure

* For preparing 100 ml of the sodium alginate sol, warm 80 ml of deionised water in the beaker to 70°C. Turn of the heat and increase stirring speed to a maximum so that a vortex forms. Sift 2 g of sodium alginale to the upper vortex wall and keep stirring until the sodium alginate dissolves (help out with a glass rod if needed, after turning off the stirrer).
* After the sol has cooled to room temperature, remove the stirring bar and clean it and the glass rod with deionised water over the beaker. Add deionised water to yield 100 ml and mix stir the sol again with the glass rod.
* Mount the reaction tube vertically, close the bottom with a rubber stopper and add 50 ml of calcium chloride solution.
* Fill the syringe (without needle) with 1 ml of the sodium alginate sol and clean the outside of the syringe with a paper towel. Let air bubbles in the sol rise to the tip of the syringe and then attach the needle.
* Pierce the rubber stopper of the reaction tube carefully and dress the sol into the calcium chloride solution carefully and evenly. After the syringe is empty, it is removed with the needle. Refill the syringe and repeat the above-described process of attaching a **NEW** needle.
* The thread will rise to the top and can be removed after 1 minute from the solution. Hang it up to dry and weigh the gained fibre.

### Disposal

* Pour the calcium chloride solution and any remaining sodium alginate sol down the sink. Put the calcium alginate threads in the waste bin.

### Further ideas

* Research what calcium alginate threads are used for.

35 Source of experiment:

Marburger, A. (2002). Alginate in der Medizin: Anwendung in Wundauflagen, Dentalabdruckmassen und Medikamenten gegen Sodbrennen. *Praxis der Naturwissenschaften - Chemie in der Schule*, 51(5), 27-35.

## B) Synthesis of polylactic acid fibres36

### Apparatus and materials

* test tube
* test tube stand
* gas burner
* plastic weighing dishes (chilled)
* tin(II) chloride
* lactic acid
* beaker (small)
* anhydrous copper sulfate
* boiling chips
* pipette (5 ml)
* tweezers
* glass rod

### Procedure

* Fill 3 ml of lactic acid, several crystals of tin(II) chloride and some boiling chips into a test tube.
* Heat for 10 minutes while constantly agitating it gently.
* During the heating, hold a small beaker over the test tube to collect the emitted steam. Test for water using the anhydrous copper sulfate.
* As soon as the content in the test tube turns orange to brownish, pour the hot and liquid contents onto a chilled plastic weighing dish.
* At the transition from liquid to solid, use the tweezers and glass rod to pull threads from the material.

### Disposal

* Put the threads in the waste bin.

### Further ideas

* Research what polylactic acid threads are used for.

36 Source of experiment:

Huntemann, H., Parchmann, I. (2000). Biologisch abbaubare Kunststoffe: Einordnung in ein neues Konzept für den Chemieunterricht. *CHEMKON*, 7(1), 15-21.