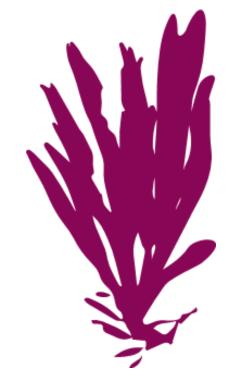


Seaweed Aquaculture in the Classroom – Hollarsmith, et al. Appendix A. Tumble Culture Resources



Tumble Culture Assembly Manual and Materials List

Growing Seaweed in the Classroom



k'áach (dulse, red ribbon seaweed)

Tumble Culture Assembly Manual

Components of the Tumble Culture

- A. Tumbler
- B. Chiller and pump
- C. Hanging light structure
- D. Miscellaneous
 - * These are instructions to build a one action packer, 3 bucket unit. Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

A. Tumbler

- 1. Cut 3 5-ft sections of 1/8" inch clear vinyl tubing
- 2. Poke holes, spaced 2 inches apart, on half of the 1/8" clear vinyl tubing sections
- 3. Use 8" zip ties to attach adhesive backed mounting bases to the half of the $\frac{1}{8}$ " clear vinyl tubing sections that have holes poked through
- 4. Stick the mounting bases with the ½" clear vinyl tubing sections attached to the base of 5 gallon buckets in a swirl, starting from the center and moving outward toward the bucket wall (One ½" clear vinyl tubing section per bucket)
- 5. Place 3 buckets in one Action Packer tote
- 6. Prop the air pump between the two Action Packer totes where the $\frac{1}{8}$ " clear vinyl tubing sections can reach it
- 7. Attach the section of ½ clear vinyl tubing section without holes to the air pump
- 8. Fill 5 gallon buckets with 3-4 gallons of sea water or mix artificial seawater (e.g. Instant Ocean) and add nutrients according to package instructions
- 9. Fill action packer ²/₃ full with freshwater
- 10. Optional: secure an Onset HOBO logger to one of the buckets to monitor temperature in the bucket

B. Chiller and pump

- 1. If water pump does not come with an grounding plug, wire a grounding plug to the electrical wires of the pump
- 2. Attach the 1" x 1" Fitting Pipe Size coupling, Female NPT x Female NPT to the intake and the outtake of the water pump
- 3. Use two 1" MPT X 1" Barbed Insert Adaptor to screw into the couplings on the water pump
- 4. Use two 1" MPT X 1" Barbed Insert Adaptor to screw into the intake and outtake on the water chiller
- 5. Use a wrench to tighten all adaptors and couplings
- 6. Use pipe thread to wrap all of the barbed insert adaptors (4 total)
- 7. Cut the 1" clear vinyl tubing into two 4-ft sections and one 3-ft section
- 8. Place the end of the 4-ft section into the freshwater in the Action Packer and secure the other end to the intake of the water pump/adaptor
- 9. Secure the end of the 3-ft section to the outtake of the water pump and secure the other end to the intake of the water chiller
- 10. Secure the end of the remaining 4-ft section to the outtake of the water chiller and place the other end in the freshwater in the Action Packer
- 11. Use hose clamps to secure 1" clear vinyl tubing around adaptors

C) Hanging light structure

- 1. Cut PVC piping in sections to build two hanging light structures that a rectangular cube with 4' x 2' x' 1.5' dimensions (this structure is meant to go around the action packer totes so the dimensions need to be the length x width x height of the action packer tote + wiggle room)
- 2. Assemble the PVC sections with the PVC tees and elbows into the cube
- 3. The top section of the cube (where the light is secured to) needs to have a PVC pole running down the length of the cube in the middle (see photo)
- 4. Secure hanging attachment to grow light
- 5. Hang grow light from top middle PVC pipe
- 6. Program the timer for 16 hours of light and 8 hours of dark
- 7. Attach the timer to the power strip and plug the light in

D) Miscellaneous

- 1. Read instruction manual for water chiller and set temperature range to 48-52 degrees F
- 2. Connect water chiller to a power source separate from the rest (to an outlet not used by anything else is best)
- 3. Use a power strip and extension cord to organize and supply power to the air pump, water pump, and lights.
- 4. Turn on air pump, water chiller, water pump, and lights
- 5. Check every 24 hours to ensure that everything is working properly and secured for the first week

Tumble Culture Materials List

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Item	Number	Cost per unit	Total Cost	Vendor	Purpose
Coupling: 1 in x 1 in fitting pipe size, female NPT x female NPT	2	\$1	\$2.00	Grainger	Adaptor for chiller intake and outtake, and water pump intake and outtake. Needs to fit the size of the intake and outtake of the chiller and water pump.
4) Growth Media					
F/2 nutrient solution and F/2 trace metal solution	1	\$30	\$30.00	Algae Research and Supply	Mix in 5 gallon buckets weekly. Recurring charge for as long as tumble culture is running, one quart will last one school year.
Salt water kit (Instant Ocean)	1	\$60	\$60.00	Petco	Change water in 5 gallon buckets weekly. Recurring charge for as long as tumble culture is running, one 60 lb bucket will last one school year.
5) Miscellaneous					
PVC pipe cutter	1			Home Depot	General use.
Scissors	1			Amazon	General use.
Wrench	1			Home Depot	General use. Big enough to secure one inch intakes and outtake adaptors.
Extension cord	2			Home Depot	Depending on proximity to outlets.
Saw	1			Home Depot	General use.
Power strip	2			Home Depot	For various plugins. May be helpful to attach velcro to mount to a nearby wall.
Photometer	1			Amazon	Test light for kelp. Light from grow lights should emit at least 200-400 μ mol photons m-2s-1 at the top of the 5 gallon buckets.
Pipe thread	1			Home Depot	Secure attachment of large width vinyl tubing around intakes and outtakes