DIY PVC Biofilter

3/27/2011 v.1.0 By RMCG@THCFarmer

After reading several threads on the dreaded 'slime' that can afflict RDWC, I decided to whip up a 'biofilter' to create a habitat to breed and house beneficial bacteria that is useful for prevention of the algae. It will allow me to disconnect the unit from the reservoir to flush and refill it or isolate it to sterilize my reservoir (if necessary) without killing the established beneficial colony. They will be healthy and ready to 'reseed' the reservoir as soon as it's hooked back up and flowing. This unit contains about 45 sq. ft of 'surface area' for the bacteria to colonize in a very small footprint (5"x5"). You could scale this up to 4" pipe, as long as you can find the proper reducers or you could make this 6' tall. Taller makes for better filtration.

The cost is ~$45 (excluding pump) and takes 30 minutes to make.

Parts List:

All PVC is 'precut' from Home Depot. No cutting or drilling necessary. If you have the PVC available in lengths, feel free to cut it to any length you need.

- 2' x 3" PVC
- 2' x ¾" PVC
- 3" x 2" x 3" 'Sanitary' Tee
- 3" x 2" End Cap/Reducer
- 3" Toilet Flange
- 3" 'Tom Kap' threaded drain end cap
- 10' of black ½" OD tubing
- ¾" slip to ½" threaded elbow
- 2" to 1" reducer (slip)
- 1 ½" to 1" reducer (threaded)
- 1" to ½" reducer (threaded)
- (3) Watts ½" CPT(compression) x ½" Threaded connectors
- 4" Rubber gasket (from toilet repair section of HD)
- 6 bags of kitchen scrubbies (6 per bag) from dollar store
- 3 bags of stainless steel scrubbies (2 per bag) from dollar store
- Teflon Tape

Use your PVC cement and glue the sanitary Tee to your 3” PVC pipe, make sure the Tee is ‘sloped’ on the pipe side.

Glue in the reducer into the open end of the sanitary Tee.

Now take the reducer that fits in that reducer and your ¾" slip x ½" threaded elbow and glue the ¾" side into your reducer. This isn't a 'perfect' fit, but it doesn't need to be. Just shove it down in there deep.

Now glue your ¾” PVC tube through the reducer, into the ¾” slip elbow you just glued into the reducer. 

Take your Teflon tape and wrap your threaded reducer and one of the Watts ½” CPT x ½” MIP connectors, install them like so:

Wrap your other Watts connector threads and install it into the ½” threaded elbow:

Glue in the reducer in to the sanitary Tee only. Do NOT glue in the ‘top’ reducer(with down pipe), as we might need to open it up for maintenance/cleaning. Shove it in hard and it will stay put.

Install/glue the 3" 'Tom – Kap' drain fitting on the bottom of your 3" PVC. When you are sourcing parts, look for one that fits 'snug' in the tube you will be using. Mine was slightly loose and leaked initially. Worst case, glue your rubber gasket between the pipe end the tom kap lip. Trim gasket as needed.

Start shoving your scrubbies down the pipe. Alternating them so you don't create 'path' for the water, either up the center or along the pipe side. I put in a few layers of plastic ones, then did all the stainless

steel ones, then went back to plastic. The stainless steel scrubbies have MORE surface area than the plastic ones do (~420 ft2 vs 370 ft2 per cubic foot of media) but I wanted to keep the cost down.

Note: Here you can 'pre-seed' your biofilter with store bought beneficials (SubCulture, ZHO, etc.) by sprinkling them in.

Keep shoving them down the pipe, packing them as much as you can. I used a second piece of ¾" PVC to shove them down and a rubber spatula from the kitchen line them up/move them around within the pipe. I also used a long screwdriver inside the ¾" pipe to move it side to side to allow me to get a scrubbie down the sides evenly.

Once you pass the ¾" pipe (it's about 5" shorter than the 3" shell), you can start stacking scrubbies like this:

Use your Teflon tape to wrap the threads of your ‘Tom Kap’ threaded drain insert:

Insert the bottom of your biofilter into your toilet flange. This will be your ‘stand’. Do not glue it as you may need to use the ‘access cap’ of the Tom Kap to clean the unit.

Put it in the sink, fill it with water and ‘leak test’ your fittings, especially the bottom.

Don’t tip it upside down, as the ‘down pipe’ is not glued/sealed.

All good?

Install your hose, cut to length and attach to your pump. The top hose goes to the pump. Bottom hose just goes back to the reservoir.

I am utilizing a small pump (285gph) with a ½" threaded outlet, so I utilized the last Watts ½" CPT x ½" MIP connector on that hose. I will be adding a small T in there for an airline hookup for some venturi air injection off of my air manifold, as well as some ½" OD John Guest valves (my HD didn't have them in stock) on the inlet/outlet hoses to allow me to block it off or disconnect as needed. Do NOT let your colony dry out or be without water flow/oxygen for any length of time as you will kill them or worse, breed a colony of ANAEROBIC bacteria.

It will take several weeks for the beneficials to colonize the biofilter completely, but once it's done, the unit will be 'loaded'.

- Do not run chlorinated water or other sterilizers through this system. It will kill everything.
- Do flip the hoses around periodically to 'break up' any water channels that form in the 'mulm'.

Types of Biomedia, surface area and cost:

Type of Bio-Media	Surface Area/cu.ft.	Approx. Cost/cu.ft.
Lava Rock, Clinkers 	16	$ 5.00
Bio Barrels 	26, 33, 44, 64	$ 31.00
Biological Media Balls	96	$ 59.95
Spring Flow Pvc Shavings 	60	$ 14.00
Open Cell Foam or Japanese Mats 	120	$ 22.50
Bio-Pin Balls	130	$ 30.00
1/2" River Gravel	90	$ 5.00
Corallife Bio Balls 	160	$ 56.00
Bio-Bale	250	$ 32.00
Nylon Pot Scrubber 	370	$ 10.00-12.00
Stainless Steel Scrubbers 	420	
Polyethylene Beads 	400	$ 90.00
Matala  Black Green Blue White	 62 96 124 171	$ 30.00 cu/ft. average
Fine Sand	156 Sq. Meters/Gram	$ 5.00
Activated Carbon/Lignite 	30,000 Sq. Yds./Oz.	$ 4.00/lb treats 1K Gal.

Formula used to determine surface area of biomedia:
(r2 x pi x L) of shell MINUS (r2 x pi x L) of 'down pipe'

212 in^3 – 19 in^3 = 193 in^3
Convert to cubic feet:
193 in^3 = 0.111689 ft^3

Multiply cubic feet times an 'average' of sq. ft/ ft^3 based on the biomedia chart above.
0.111689 ft^3 x 400 = 44.6 ft sq. of biomedia surface area