

The ABS Water Filter

Duncan Kunz

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Okay, enough of the lawyer talk. Build your filter!

1. Introduction

Lack of good drinking water kills more children (especially in the Third World) than almost anything else. Micro-organisms in a water supply can cause dysentery, which can lead to diarrhea and fatal dehydration. If you're faced with the need of potable water – in the absence of a municipal water supply – you and your family could be faced with this problem as well. Fortunately, we can purify water with bleach, and/or build inexpensive solar-powered distillation units, or stills, and pasteurization ponds which provide people with all the fresh water they need.

But the water coming from the pasteurization pond or from storage after it's been purified with bleach can taste bad. Even though pasteurization or purification has killed most of the pathogens, you could be left with a chlorine- or metallic-tasting drink. That's where a good filter comes in: it will remove many remaining pathogens, as well as particulates, dissolved metals, and chlorine to make your water taste good.

This article shows you how to build a filter that uses activated charcoal available at aquarium stores to improve the taste of your water. The filter allows you to easily change the charcoal when necessary, as well.

2. Materials

There are two plastics commonly used in making pipes: poly-vinyl-chloride (PVC); and acrylonitrile-butadiene-styrene (ABS). Both of these formulations are completely safe when used to carry or store water. PVC is the (usually) thin-walled white plastic used in water delivery systems; ABS is the usually thick-walled black plastic used a lot in sewage connections.

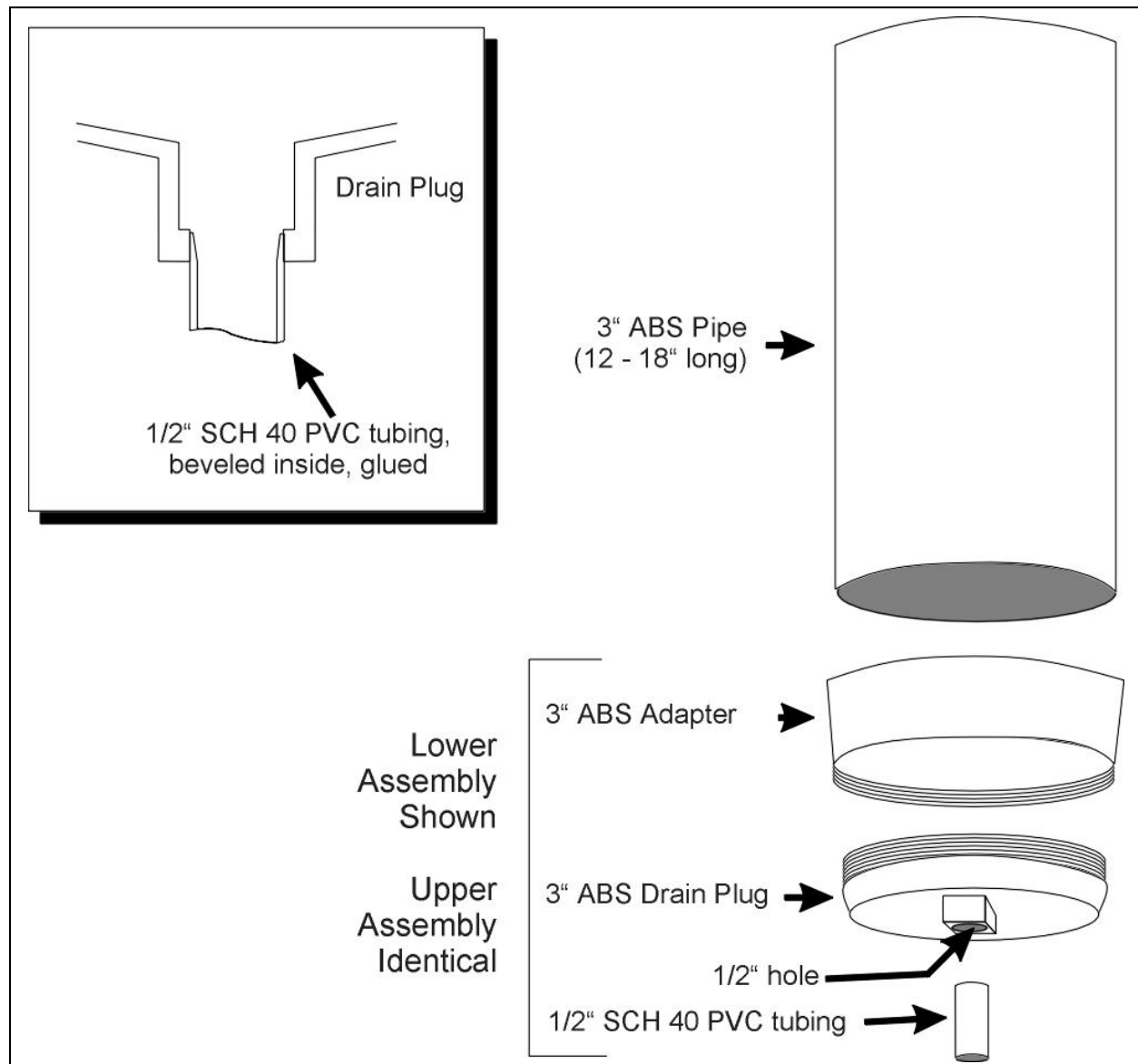
The reason we're using ABS is that it's easier to get a threaded end-cap (in this case, a three-inch drain plug). Since we want to be able to take the filter apart to clean or replace the activated charcoal, we need these screw caps on both ends. You can make the filter as large as you want, but our size is based on three-inch ABS pipes. The end-cap, pipe adapter, and pipe itself can commonly be found in the three-inch size.

Here are the parts and tools you'll need to build the filter.

<i>Quantity</i>	<i>Item</i>
1	ABS pipe, 3" outside diameter, between 12 and 18 inches long
2	3" ABS drain plugs (used for the end caps)
2	3" ABS adapters (used to connect the drain plug to the pipe)
2	½" outside diameter PVC schedule 40 tubing, 4 inches long
2	3"-diameter fine mesh brass or stainless steel screening
1	4-lb bag fine activated charcoal
1	Paper coffee filter
1	PVC cement
1	ABS cement
1	Drill with ½" bit
1	Fine sandpaper

3. Construction

Refer to the drawing while you're assembling the filter.



3.1 End-Cap Assemblies

Notice that the bottom of the drain plug has a hollow square protuberance or “knob” – this allows you to use a wrench to tighten the drain plug. Drill a half inch hole through the bottom of the knob. The hole should be just big enough for the 4-inch-long, ½-inch diameter PVC tube to fit in. Using the sandpaper, bevel the inside of one end of the PVC pipe, then lightly sand the outside of the pipe.

Carefully wipe out the hole you just drilled, then coat the outside of the beveled end of the PVC pipe with a thin coat of PVC cement. Insert the pipe in the hole about a half-inch, give it a quarter-twist to spread the PVC cement, then set aside. Do the same with the other drain plug and PVC pipe.

Now take one of the brass or stainless steel screens and place it in the inside of the drain plug. If necessary, trim it so it will fit. Using a few drops of the ABS cement, glue the rim of the screen in place. Do the same with the other screen and end cap assembly.

3.2 *Adapters and ABS Tube Assembly*

Carefully clean and dry the inside and outside of the two adapters and the 3-inch ABS tube. Spread a small amount of ABS cement around the outside of one end of the tube. Insert the tube into one of the adapters and give it a quarter-twist to spread the ABS cement, then do the same with the other end of the ABS tube and the other adapter.

3.3 *Final Assembly*

Now screw in the two end-cap assemblies into the ends of the tube and adapters, checking for a secure fit. Mark one of the end caps “TOP” and the other “BOTTOM”. Take off the top end cap and fill the filter with the activated charcoal to the top of the tube. Screw the top end-cap assembly on and, holding the filter upright, slowly run several gallons of clean water through the filter. This will remove the charcoal dust that was mixed in with the charcoal granules.

When the charcoal dust has been removed and the outflow is running clear, remove the top end cap and place a coffee paper filter on top of the charcoal granules. If necessary, trim it so it will fit. Replace the upper end cap.

Filter Assembly is now complete. The filter is ready for use.

4. **Operations and Maintenance**

4.1 *Operations*

Using whatever adapters are required for your own water system, run the water to be filtered through the filter from top to bottom, keeping the filter upright. We have found that a flow rate is about one gallon per minute gives the best results.

Bear in mind that this filter is not designed to remove all pathogens and contaminants, although it will remove most of them. Our team designed and uses this filter to be the final step in water delivery for water that has already been chemically purified by sodium hypochlorate 5.5% solution (unscented chlorine bleach). We found that the filter, when used in this way, removed almost all of the solids and bleach taste. In addition to removing the bleach taste, the filter also aerated the water to some extent. For most of us, the result tasted like bottled water.

4.2 *Maintenance*

How often you change the activated charcoal depends on the level of bleach, particulates, and other chemicals/metals in the water. Four of these filters have treated one hundred gallons, and one of them has treated over three hundred gallons, with no apparent degradation in the way the filter aerates and removes the chemical taste from the treated water.

The coffee filter placed at the top is used as a ‘pre-filter’ to trap any large particulates, and it also helps to keep the charcoal granules in place. You can probably go through five or six paper filter changes before you need to change the charcoal.

There are some studies that claim backwashing the charcoal, then heating it at a low (~150 deg F) temperature will allow you to recycle the charcoal and extend its life. We have not tested that.