Simple Medium based on BOD test solutions
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If you would like a very simple medium to use in an MFC, you can prepare one based on the biochemical oxygen demand (BOD) test used at wastewater treatment plants around the world. To make things even simpler, you can buy pre-made ingredients sold by different companies. For this example medium, we will used BOD pillows sold by Hach. These pre-made packages contain most nutrients (nitrogen, phosphorus and metals) needed by microorganisms. The only thing you need to add is additional buffer to the solution. We call the final medium a buffered reactor medium (BFM). You then add a fuel (for example sodium acetate or acetic acid) to the solution. Here is a recipe for making 2 liters of BFM, and feeding instructions.

BFM- 2 L Feed Preparation (no fuel)
1. Water. Stir or aerate water overnight to removed chlorine from tap water; or use bottled water (still water). Do not use carbonated water. Distilled water or water prepared by reverse osmosis (RO) is OK, but these processes do remove some trace metals that the bacteria can use. To stir, you need a magnetic stirrer and a stir plate. If you aerate, then just use a fish pump and aeration stone (available in a pet store).
2. Add (2) BOD pillows to 2 liters of water with stirring, or add and then just mix it by shaking by hand for about half a minute. This is less water than Hach uses for BOD tests as a higher concentration of nutrients is desired here.
3. Add additional buffer. Add 1 teaspoon each of NaH2PO4 and Na2HPO4 with stirring (or shaking).
4. Your medium is now ready to use! Store at room temperature (hopefully around 20 °C) until feeding. If you store it for longer than a few days, keep it in the fridge and then let it warm to room temperature before adding to a reactor.

Feeding Instructions
1. "Feed" the reactor when the voltage drops to low levels. The specific voltage for your microbial fuel cell (MFC) will vary. Cycle times can vary from every day to a couple of weeks depending on reactor volume, amount of electrodes and the voltage and current produced. Two approaches can be used to add substrate: just add “fuel”; or replace all of the solution.
2. Before feeding, it is best to disconnect the circuit.
3. Adding fuel by replacing solution. The best way to add fuel is to add it to fresh medium. Pour out the old medium, add your fuel to fresh medium. Check the pH is okay. If okay, then pour this medium and fuel into the MFC.
4. Adding fuel only. The main thing to avoid when adding fuel is low pH. Always avoid pH decreases below about pH=6. Higher pH values are okay, but if the pH gets above 9.5 there could be problems, and you can get some salt precipitation at higher pH values (mostly calcium carbonate). Drain some liquid out of the reactor to make room for the fuel. Add your fuel to the same amount of liquid, then pour it back in. If you add acetic acid, then this will...
decrease the pH to levels that could harm anode bacteria when you add the solution back in. To avoid this, pour out the solution, add the fuel, then pour it back into the reactor. This addition of fuel works for a few cycles, but over time the microorganisms will deplete some nutrients (especially nitrogen) in your medium and pH may change to levels not good for the microorganisms. If you add fuel that has salt in it, for example sodium acetate instead of acetic acid, you have to be careful solution conductivity does not change. See notes below

5. pH. Check pH before and after each cycle. Simple pH paper available in the spa or pool center at a local store will probably work for this purpose.

6. Conductivity. A conductivity above 20 mS/cm should be avoided (unless you are trying to acclimate the biofilm to these levels over time). To measure conductivity you need a special conductivity probe, which you probably could get from your school.

7. Air in the reactor. You need to avoid air getting into your reactor. If water is evaporating through the cathode, air can leak into the reactor and be seen to form a headspace above the solution. This can reduce power production. To avoid this, we fill a syringe (20 mL for a liter or more reactor size, but smaller for smaller reactors) with distilled water (so as not to add salt), attach it to needle (careful!), and then pierce a septum or stopper on the top of the reactor so that the needle sticks into the water. As water is lost in the reactor, water will be drawn in through the syringe. To see an example of this, see the syringes on top of our MFC webcam that runs a fan. Refill the feed syringes with water or media as needed to maintain volume and avoid getting any air pulled into the reactor through the syringes.

8. Discard used MFC medium in a toilet and flush.

Notes on using Acetic acid.
1. If you cannot buy sodium acetate or obtain pure acetic acid, you can use dilute household vinegar. Check the percentage, and make sure it is only vinegar (no oil!). If it is 5% acetic acid (typical in the USA), you would use 30 mL (that is, 1.5 mL of 100% vinegar = 30 mL of 5% vinegar). If it is 40%, then add 3.75 mL.
2. Try not to add too much vinegar at once to water. It is okay to dilute it out more.

Items
Hach BOD pillows, sold in packages of 50, Product #: 1486166, for $32.95 (December 2012).