

Making, deploying, and extracting resin bags

Anion Exchange Resin: Amberlite reg IRA 400(Cl)

VWR Catalog AA17246-36

Cation Exchange Resin: Amberlite reg IR 120 Plus

VWR Catalog AA42833-A1

Mixed Bed Resin: Dowex Marathon MR-3

Sigma-Aldrich Catalog 428736

Some people believe that using a mixed bed resin leads to interference with ion uptake. However, this has not been tested to my knowledge. Also, there may be differences among resin types in ion uptake and selectivity, but again there is not much evidence for which particular resin is better.

Making bags:

- Many people use nylon stocking material, but I've heard that other fabrics are easier to work with. I recommend nylon/lycra swimsuit liner material, available at fabric stores. It's thicker than stocking material and holds its shape much better.
- Cut material into 4 inch squares (for 5 g resin).
- Weigh out 5 g resin onto each square. I find it easiest to put the fabric in a weigh boat and weigh resin directly onto the fabric.
- Alternatively, measure the resin by volume (i.e. 1 level tablespoon) and determine the weight of that volume. This method is much faster and sufficiently accurate.
- Bundle up corners and edges of fabric and tie off with a zip tie. Use 4 inch zip ties that you have started to close to form a loop. Also, tie a 14 inch piece of tough nylon thread to the loop. You can color code the zip ties or the thread for anions versus cations.
- Once the zip tie is over the fabric edges and not squeezing a lot of resin, pull it tight with your fingers or pliers and cut off the end. Bags are ready for leaching.
- Prepare enough volume of 0.5 M HCl to soak all the bags well. Place bags in 0.5 M HCl for 20 minutes. Remove bags and rinse in DI water.
- Prepare a large volume of 2 M NaCl and soak bags until the pH of the solution stabilizes. This will take longer for cation bags, as you are exchanging off all the H⁺ you put on in the acid wash. 4-5 changes over an 8 hour period should do it.
- Rinse bags again in DI water and they are ready for use.

Deploying bags:

- Using their attached threads, tie 4-5 bags together at the ends of the threads.
- Use a trowel to make 4-5 slits in the soil to 5-10 cm depth. Slits should be close enough that all the bags can reach them.
- Push each bag into a slit, and push down on the soil surface to close the opening.
- Mark the location so you can find it again. You may also want to attach the threads to the marker.
- Leave bags out for an appropriate period of time (1-2 mo in the boreal forest).

Extracting bags:

- Rinse each bag in DI water and place in a labeled, acid washed 250 ml Erlenmeyer flask.
- Add 100 ml 0.1 M HCl/2.0 M NaCl to each flask and shake for 1 h at medium speed.
- Pour resin extract into labeled, acid washed storage container.

Warning: this method is not effective for extracting PO_4^{3-} from resin bags; use a bicarbonate extraction for this.

Extraction solution: 0.1 M HCl/2.0 M NaCl in DI water

Make in acid-washed containers

Per liter:

8.4 ml concentrated hydrochloric acid (or dilute a 1 M stock solution)

116.88 g NaCl

Wash solution 1: 0.5 M HCl in DI water

42 ml concentrated hydrochloric acid for every 1 L of solution. Always add acid to water.

Wash solution 2: 2.0 M NaCl in DI water

116.88 g NaCl per liter of DI water