

## Ion-exchange Resin Bags

Resin bags are constructed using the nylon fabric wrapped around a 5.7" zip tie that is performed in the shape of a loop. The zip-tie makes gives the resin bag a little more rigidity and allows for greater surface area. The fabric is stretched around the zip-tie loop and resin and then is secured with an addition smaller 4.3" tie. Bags are pretreated in HCl for ~30 minutes and then are rinsed with Nano-Pure DI water until the pH of the rinse water is neutral and stable. Before deploying resins, tie a nylon string on to the bag.

### Materials:

Powder free gloves

Anion Exchange Resin: Amberlite IRA 400 (Sigma Aldrich Cat# 10326)

Mixed Bed Exchange Resin: Amberlite MB-150 (Sigma Aldrich Cat# A5710-1KG )

Swimming Suit Liner material (~4"x4" square/bag)

4.3" and 5.7" zip-ties (for Mixed Bed Resin Bags Use White/Clear Cable Ties and for Anion Resin Bags Use Black Cable Ties)

Colored nylon

string 0.5 M HCl

Scissor

Fabric Roller-Cutter and Fabric Roller-Cutter Pad

Ziploc Bags

Tablespoon (15 mL)

Sharpie Marker

Salad Spinner

pH test paper

Two Different Colors of Synthetic Fiber String (use different colors to identify the type of resin bag: mixed bed or anion)

### Making bags:

1. Using the rotary fabric cutter and cutting mat, cut 4"x4" fabric squares, one for each resin bag.
2. Onto the center of each fabric square scoop on table spoon of resin. It works pretty well to use a standard sized scoop now and then get an exact weight on the resins after they are extracted. Scoops should be ~5grams.
3. Position the pre-formed 5.7" zip-tie in the fabric with the resin scoop , gather fabric tightly and secure with the second 4.3" zip-tie. You can color code the zip-ties to indicate the type of resin in the bag. We use black zip-ties for anion resin and white zip-ties for mixed bed resin.
4. When the zip tie is secure, pull fabric tight and trim the excess fabric and zip tie end.
5. Store resin bags in labeled Ziploc bags in the refrigerator until they are ready for leaching. (Store the types of resin bags separately.)
6. To leach the bags, prepare enough volume of 0.5 M HCl to soak all the bags well. Place bags in 0.5 M HCl for 30 minutes. Remove bags and rinse in DI water.
7. Rinse multiple times in nano-pure D.I. water until litmus paper indicates the rinse water is neutral or at least the same pH as the water supply. Between and after rinses, spin the resin bags in the salad spinner.
8. Cut the synthetic string into ~12 in pieces.
9. Tie a piece of string to the end of each resin bag. (Make sure the color of the string and the type of resin bag correspond correctly.)

10. Store the rinsed resin bags in labeled Ziploc bags in the refrigerator. (Again, store the types of resin bags separately.)

#### **Deploying bags:**

1. Typically in sandy soils it is difficult to excavate a hole in the soil profile, so it is best to make a slit in the soil with a putty knife and lift the soil. Use a large putty knife to dig in and lift up soil to ~ 5 cm depth. Place resin bag in slit and gently remove the putty knife, making sure that the bag is well covered. This should be done in a way that minimizes disturbance overlying soil.
2. A pin flag should be placed in the vicinity of the resin bag so that it is easy to find them during collection.
3. Leave bags out for an appropriate period of time

#### **Collecting bags:**

1. Resin bags should be placed individually in whirlpak sample bags and labeled.
2. In the field, store resin bags on ice and in coolers.
3. In the lab, resin bags should be stored in the refrigerator prior to extraction.

#### **Extracting bags:**

1. Remove nylon string and rinse each bag in Nano-Pure DI water remove soil/litter/debris from the outside of the bag.
2. Place each bag in an acid washed 50ml centrifuge tube or acid washed 250 ml Erlenmeyer flask.

#### **For Anion Exchange Bags:**

1. Add 20 ml 0.5 M HCl to each flask and shake for 1 h at medium speed. If concentrations are low in sandy and low nutrient soil, use 10 ml instead of 20 ml during each extraction.
2. Pour off HCl into an additional labeled centrifuge tube and add and repeat extraction step #2.
3. Combine both of the 20mL extracts into the original tube with the resin bag and allow to sit over night in refrigerator.

#### **For Mixed Bed Resin Bags:**

1. Add 20ml of 2M KCl to each flask and shake for 1 h at medium speed. If concentrations are low in sandy and low nutrient soil, use 10 ml instead of 20 ml during each extraction.
2. Pour off KCl into an additional labeled centrifuge tube and add and repeat extraction step #2.
3. Combine both of the 20mL extracts into the original tube with the resin bag and allow to sit over night in refrigerator.

#### **For Both types of Resin:**

1. The next morning, shake the centrifuge tubes for about one hour.
2. Gravity filter the 40mL extract through a Whatman #1 paper filter. Collect extract into a labeled scint vial or nalgene sample bottle. Place samples in freezer or analyze immediately.
3. Line funnels with filter paper and pre-leach with KCl.
4. Gravity filter the solutions into labeled 60 mL Nalgene bottles.
5. If a resin bag is broken and resin beads fall into the filter, remove the filter paper with resin beads, place into a labeled weigh boat, and put the weigh boat in a drying oven.
6. Freeze the bottles until they are ready to be analyzed. Do not fill the bottles to the top they will break in the freezer.

7. Rinse resin bags in the centrifuge tubes with D.I. water.
8. Remove resin bags from the centrifuge tubes and put into a labeled weigh boat.
9. Dry resin bags completely in a drying-oven at 60°C.
10. Cut each resin bag open and weigh the dry resin and record resin mass in spreadsheet.

### **Solution Recipes:**

Make all solutions in acid-washed containers with Nano-Pure DI water. Acid solutions should be made while wearing gloves, goggles and a lab coat.

Wash solution for Anion and Mixed Bed Resins: 0.5 M HCl

***Always add acid to water.*** 42 ml of concentrated hydrochloric acid (12N or 38%) for every 1L of solution. Fill a beaker with 900 ml of water add 42 ml of acid and fill to 1L mark with water.

Anion Resin Extraction solution: 0.5M HCl

***Always add acid to water.*** 42 ml of concentrated hydrochloric acid (12N or 38%) for every 1L of solution. Fill a beaker with 900 ml of water add 42 ml of acid and fill to 1L mark with water.

Mixed Bed Resin Extraction solution: 2M KCl 149.1g  
of KCl granular form for every 1L of solution.

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