

Absorbing Ammonia



Introduction

A **zeolite** is a type of mineral that is made up of a framework of silicon, aluminum, and oxygen. This framework acts as a cage and traps other molecules inside of the zeolite. There are many types of zeolites, and each type has a different type of cage structure. The different types of cages will trap different types of molecules.

In this activity, you will be working with a natural zeolite (one that is mined out of the ground instead of produced in a lab) called **clinoptilolite**. This zeolite is often used as an ammonia **absorber**, meaning the cages in the zeolite trap ammonia molecules.

If you have a fish tank with a filter, you have probably seen clinoptilolite—it looks like small white rocks which go into the filter. (It is also sometimes mixed with black rocks called activated carbon which also filter water.) Clinoptilolite is used in fish tanks to remove ammonia because ammonia can damage the fishes' gills. In this activity, you will see how clinoptilolite can take ammonia out of water, and you can experiment if clinoptilolite will remove anything else from water.

In this activity we will:

- Use a natural zeolite called clinoptilolite to absorb (take out) ammonia from distilled water. You can also experiment with other materials to see if the zeolite will absorb them too.

Materials

- Zeolite granules which can be purchased from a store that sells fish supplies. The zeolite can be found in the filter section under ammonia filters.
- Disposable cups (12 – 16 oz or larger)
- Coffee filter (white paper can be used)
- Water
- Ammonia
- Disposable spoons
- Pen or pencil
- Scissors



Safety

Parents, please note that ammonia can be very dangerous! Ammonia can be very dangerous to one's eyes or if it is swallowed. If ammonia gets on your skin, wash it off immediately with lots of water. If ammonia gets into your eyes, immediately flush your eyes with water and call poison control. This activity should be performed under parental supervision.

Preparation

An ammonia solution should be made by an adult by adding about one spoonful (use the disposable spoon) of ammonia to one to two cups of water. Stir the ammonia into the water. The scent of ammonia should be noticeable, but not overpowering. If the ammonia solution seems too strong, pour off some of the solution down the drain (remember to flush with lots of water), add water to the remaining solution, and stir again.

Pre-Activity

Show children the zeolite. You can examine it under a magnifying glass if you have one, or simply look at it closely. What does it look like? It looks very similar to gravel, but it has tiny holes all through it which allow it to absorb (or trap) tiny molecules. Can you think of an object that has holes which trap other things?

Activity

The job of zeolites in a fish tank is to filter ammonia from the water. In this activity, you will investigate how that happens.

- First you are going to make the cup that holds the zeolites. Turn one of the disposable cups upside down and punch a small hole in the bottom of it with your pencil or pen. Then cut the coffee filter so that it fits on the bottom of the cup. This cup acts like a funnel.
- Place zeolite granules into the funnel cup. The zeolite should fill at least half of the cup.
- Observe the ammonia solution. What color is it? How does it smell? Predict what could happen to the ammonia solution after it is poured over the zeolites.
- Pour about $\frac{1}{4}$ cup of the ammonia solution over the zeolites. Make sure that you are holding the funnel over another cup!
- After the ammonia solution goes over the zeolites, observe the solution that is in the bottom cup.
- What color is it? How does it smell? It should be less smelly than the original ammonia solution.
- What do you think happened?
- You can try pouring the solution from the bottom cup back through the zeolites. Does the ammonia come out again?

Conclusions

The zeolites filtered out the ammonia from the ammonia solution. The ammonia is now trapped inside the zeolites! That is why the remaining solution does not smell as

much. Once the ammonia is in the zeolites, it does not want to leave, though it will slowly leach out over time. You can see this happening in the *Using Zeolites as Fertilizer* activity. To clean up, use the used zeolites in the *Using Zeolites as Fertilizer* activity, or throw them away. Wash any unused ammonia down the sink with plenty of water.

Extension

Do you think this zeolite could absorb other things? Try using things with different smells and colors. For example, you could make a perfume solution or a glass cleaner solution. What happens if you mix ammonia with things other than water? Predict what you think will happen, and then test it out on new zeolites!