

EXTRACTING IRON FROM CEREAL

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Materials Needed

Iron fortified breakfast cereal such as Total, Special K, etc..., instant breakfast cereal packets such as instant oatmeal. Read the list of ingredients on the label looking for *iron* or *reduced iron*. This procedure will not work unless iron is present in the cereal as a mineral supplement.

NOTE: Instant Cream of Wheat no longer contains reduced iron. As a result of this experiment, the manufacturers of Cream of Wheat received numerous telephone calls about the addition of reduced iron. They replaced the iron with iron phosphate.

water.

magnetic stir bar, Teflon coated, or a magnet painted white
beaker, 2000 mL or other large container (glass or clear plastic preferred)
magnetic stirrer or wood spoon
plastic bag (1 gallon size)

Safety

Wear safety goggles or glasses at all times in the laboratory.

There are no hazards associated with materials in this experiment.

Disposal

All materials in this experiment can be disposed of in the trash or down the drain.

Procedure

A. Iron in Processed Cereals

Place one to two cups of an iron enriched breakfast cereal, such as Total, Special K, etc..., in a plastic bag and crush the cereal.

Obtain a large beaker (about 2 Liters). Add between 1 and 1.5 liters of water to the beaker and place it on a magnetic stirrer.

Obtain a Teflon coated magnetic stirring bar (or a magnet painted white). Inspect the stirring bar to insure that it is clean. Place the stirring bar into the beaker of water and start the magnetic stirrer.

Slowly, pour the crushed cereal into the large beaker of water. Stir the mixture for about 15 minutes. (If the magnetic stirrer is not available, use a wood spoon.) If the mixture gets

too thick, the stirring bar will not operate. If that occurs, add additional water to the beaker and restart the stirrer.

Use a stir bar retriever or pour the solution into a second large beaker or into waste container, taking care not to pour out the stir bar, and retrieve the stir bar. Examine the stir bar. What do you observe?

If you tested several different breakfast cereals, did you get similar results?

Check the ingredients on the box or bag from the cereal. Do the ingredients support your findings?

B. Iron in Instant Cereal

Obtain a package of instant oatmeal or other instant breakfast cereal and a Teflon coated stir bar (or a magnet painted white).

Open the package of instant cereal and place the magnet into the cereal. Stir the cereal with the magnet or hold the top closed and shake the package. Retrieve the magnet. Examine the stir bar. What do you observe?

If you tested several different instant breakfast cereals, did you get similar results?

Check the ingredients on the box or bag from the instant cereal. Do the ingredients support your findings?

C. Additional Activities

Repeat this experiment using weighed amounts of different brands of cereals to compare iron content. For dry, baked cereals, allow at least 30 minutes of stirring to insure you collect as much iron as possible. You can evaluate your result visually or, if you have a balance with 0.01 g or better precision, you can carefully dry and weigh the magnets and determine the mass of iron.

For instant cereals, which normally consist of processed whole grains, provide sufficient stirring to pick up as much iron as possible. Use three packages of each instant cereal as these are not completely homogeneous mixtures.

Does the iron effectively dissolve in stomach acid? Place some of the iron extracted from the cereal into a beaker. Add some 0.1 M hydrochloric acid, HCl, cover with a watch glass, and let the mixture stand overnight. (You may want to run a control with a small iron nail in a separate beaker.) If iron dissolves, the solution will be a light green in color if the iron is in the form of iron(II) chloride and yellow if it is iron(III) chloride. What do you observe? (How long did you allow the mixture to stand?)

Based on your observations of the reaction between the iron and the hydrochloric acid, do you think that a significant amount of the metallic iron is metabolized and absorbed into your system?

EXPLANATION

Iron is often added to fortified cereals in the form of powdered iron (often listed as reduced iron in the ingredients). Powdered iron is easy to measure, has no stability problems, and does not affect the taste or color of the cereal in this form.

Upon ingesting the cereal, it is expected that some of the iron is dissolved in the stomach acid and will be absorbed into the system as it passes through the intestines. Not all the iron (as well as the other ingredients) will be absorbed. Remember, a single serving *contains* the daily adult requirement of vitamins and minerals.

Iron is added to the instant oatmeal or similar product packages along with the cereal. Since these are whole grains, it is not cooked or processed into the cereal mix. (Note: As a result of this experiment being published and inquiries being made to the manufacturers, some companies have replaced the metallic iron in their products with an iron compound such as iron(III) phosphate, also called ferric phosphate.)

Reference

Katz, David A., **CHEMECOLOGY**, 21, No. 2, 7, March 1992.

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