

## WARNING NOTICE

The experiments described in these materials are potentially hazardous. Among other things, the experiments should include the following safety measures: a high level of safety training, special facilities and equipment, the use of proper personal protective equipment, and supervision by appropriate individuals. You bear the sole responsibility, liability, and risk for the implementation of such safety procedures and measures. MIT and Dow shall have no responsibility, liability, or risk for the content or implementation of any of the material presented. [Legal Notice](#)

### Toxic Compounds from Cooking “Cracking” Bacon Fat

#### Abstract

A ration of bacon is heated with a Bunsen burner until it sizzles. The ration of hot bacon is tossed into a 2L Erlenmeyer flask filled with red-brown Bromine vapor. After briefly shaking the stoppered flask with the bacon, the red-brown bromine color disappears indicating the presence of double bonds in the sizzling bacon.

#### Materials

Package of bacon	Portable butane burner or Lab burner
Bromine	Matches
Tongs	2 Liter Erlenmeyer flask
Laboratory Fume Hood	Long Glass Pasteur pipette with bulb

#### Safety

Wear safety goggles and disposable gloves. Bromine is toxic if inhaled. The vapor is an eye and skin irritant and can burn you. Bromine is difficult to work with and tends not to stay inside of the transfer pipette due to its high density and vapor pressure. Because it leaks readily from the transfer pipette, the receiver flask must be close at hand to avoid any spill. Always work with bromine in a laboratory fume hood.

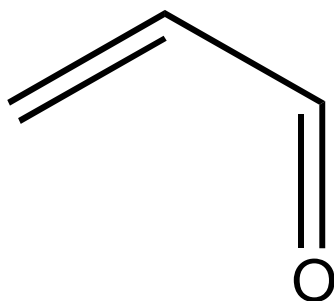
#### Procedure

Prior to the demonstration prepare a 2L Erlenmeyer flask with bromine vapor. Working in a laboratory fume hood, open a bottle of bromine and transfer several drops to the 2L Erlenmeyer flask. Immediately stopper the flask. Shake gently to vaporize all of the bromine. The flask immediately fills with the red-brown color of bromine vapor. If necessary, add a couple more drops to darken the color until it's visible for the audience.

When it's time to perform the demonstration, pick up about a ½ ration of bacon with tongs and heat it with a portable butane burner or lab Bunsen burner until it is sizzling. Then immediately in a very quick action unstopper the 2 L flask with the bromine vapor and toss in the sizzling bacon. Re-stopper the red-brown bromine vapor filled flask and shake several times. After a brief time, the red-brown color of the bromine disappears and the flask becomes clear.

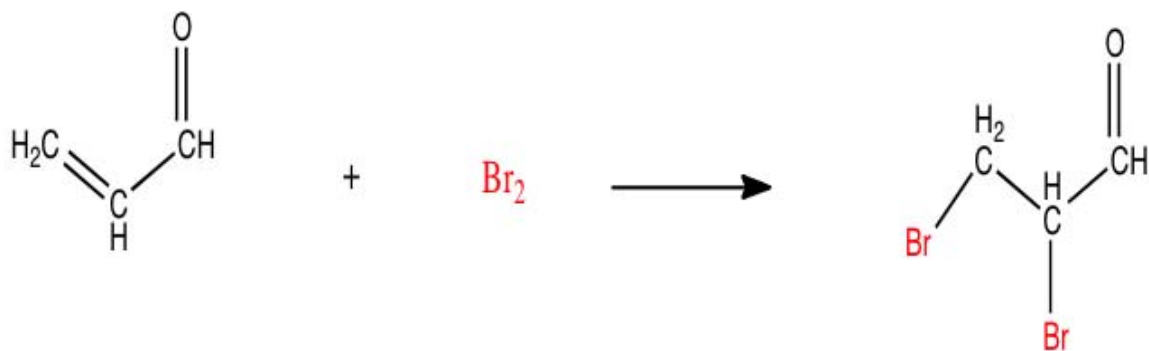
### Discussion

Heating the bacon to sizzling cracks the bacon fat, producing an unsaturated acrolein ( $\text{CH}_2=\text{CH}-\text{CHO}$ ), and some other unsaturated fats:



Acrolein

The acrolein is toxic and represents the simplest unsaturated aldehyde that we could make. It is extremely reactive due to the presence of the double bond. It is one of a number of compounds that is highly recognizable from their acrid odor that resembles burning fat. By tossing the sizzling bacon into the flask containing the bromine vapor, we are able to see a classic reaction in Organic Chemistry: the addition of bromine across a double bond. Bromine adds across the double bonds in unsaturated molecules according to the following reaction:



The color of the bromine in the flask disappears because it's used up adding across the double bonds in the unsaturated molecules that are present from "cracking" bacon fat.

### Disposal

The bacon can be discarded. The flask can be washed out and rinsed with soap and water. Dispose of following all local, state and federal regulations for disposal.

### References

Hubert N. Alyea, *J. Chem. Educ.*, **1969**, Volume 46(9) p. A633

Ted Lister, *Classic Chemistry Demonstrations: Unsaturated Compounds in Foods*; Royal Society of Chemistry, **1995**, Experiment 50, p. 126.

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