

Experiment 4: SPECTROPHOTOMETRIC DETERMINATION OF A FOOD DYE

The purpose of this experiment is to measure the concentration of a food dye, Allura Red, in a popular soft drink, Kool-Aid. This experiment will introduce spectrophotometry as a method for quantitative analysis.

Background

Coloring agents have been used as food additives for centuries. They help us to identify foods visually. For instance, lime and orange sherbets would be nearly indistinguishable based on appearance if not for the green and orange colors. Coloring agents add a festive appearance to foods – M&Ms candies would taste the same if they were all colored gray, but would certainly be less appealing. Food additives are also added to foods because we have strong expectations about what colors should be associated with certain foods. All else being equal, would you buy an orange with a bright orange color, or one that is a mottled brown-green?

Coloring agents have been added to foods for less legitimate reasons as well. At the beginning of the 20th century, when there was no regulation of color additives in this country, coloring agents were added to foods to mask inferior or spoiled foods, and some coloring agents marketed for inclusion in foods were indeed poisonous. Since passage of the Federal Food, Drug, and Cosmetic (FD&C) Act of 1938, color additives in the U.S. have been the responsibility of the Food and Drug Administration (FDA).

The FDA divides coloring agents into two categories: certifiable and exempt from certification. The former are derived primarily from petroleum, while the latter includes agents derived largely from mineral, plant, or animal sources. Certified colors are further broken down into water-soluble “dyes” and water-insoluble “lakes”, with most colors being available in both forms. At present, there are seven color additives certified for food use. One of these, FD&C Red No. 40, will be used in this experiment. Its structure is shown in Fig. 1.

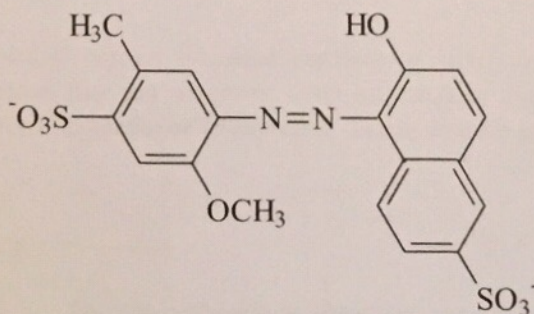


Figure 1. FD&C Red Dye No. 40 (Allura Red)

More information about color additives in foods, drugs, and cosmetics can be found at <http://vm.cfsan.fda.gov/~dms/cos-221.html>.

Red food dyes have a history of controversy. In 1960, additions to the FD&C Act of 1938 included the so-called Delaney amendment. This amendment prohibits the marketing of any coloring agent that has been found to cause cancer in humans or rats, regardless of the dose. For many years, FD&C Red No. 3 was the most important red dye used in foods. But, in 1938, a single study found that FD&C Red No. 3 could be associated with thyroid cancer in