

## The Unadulterated History of Food Dyes



## By Harold T. McKone

ChemSumer

e worry about too much sugar. We worry about too many grams of fat. We worry about too much salt. But a look at some food history reveals that we have a lot less to worry about than people in the past!

Today, we assume that the foods we eat are free of toxic substances. We certainly assume they are free of mercury, arsenic, and lead! The U.S. Food and Drug Administration (FDA) acts to ensure the food safety of modern consumers. Yet, the degree of safety that we now take for granted was not always the case. The history of coloring foods, with a variety of questionable ingredients, goes back to antiquity.

In ancient Greece and Rome, wine was often artificially colored, and inspectors were appointed by the government to monitor this practice. In Europe in the middle ages, even butter and bread were often *adulterated*, a practice by which inferior or even dangerous materials were added to the ingredient list. Butter was often colored with flowers, and lime, chalk, and crushed bones sometimes went into the bread. In England, punishment for selling adulterated bread was severe. "If any default be found in the bread of a baker of the city, the first time, let him be drawn upon a hurdle from the Guildhall to his own house, through the greatest streets, where there are most people assembled, and through the streets which are most dirty, the false loaf hanging from his neck."

At the end of the 18th century, there was a marked increase in the addition of colorants to foods. Handbooks that contained "secret recipes" for coloring foods were widely available. Modern chemistry, marking its beginning during this period, suggested even more ingredients that could add to the visual appeal of foods.

In 1820, the English chemist Frederick Accum not only described in great detail the harmful effects of foods containing poisonous colorants, but also provided names and addresses of merchants selling these products. The following example from Accum's work shows the extent of food adulteration in England during the first half of the 19th century:



"Vegetable substances, preserved in a state called pickles. whose sale frequently depends greatly upon a fine lively green color. are sometimes intentionally colored by means of copper. A young lady amused herself by eating pickles impregnated with copper. She soon complained of a pain in the stomach. In nine days after eating the pickle. death relieved her of her suffering."

Accum prophetically warned against using toxic colorants and provided a list of foods most commonly adulterated with these poisons. For example, candy was almost always contaminated with one or more of the following: red sulfuret (mercury(II)sulfide, HgS), verdigris (copper(II) acetate, Cu(C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>)<sub>2</sub>), blue vit*riol* (copper(II)sulfate, CuSO<sub>4</sub>), sugar of lead (lead(II)acetate,  $Pb(C_2H_3O_2)_2)$ , white lead (lead(II)carbonate, PbCO<sub>3</sub>) and Scheele's green (copper(II) arsenite,  $Cu(AsO_3)_2$ ). In spite of Accum's plea,

Parliament made no laws to regulate food preparation. In 1850,

Dr. Arthur Hill Hassall wrote the following bleak account of the plight of the British people:

"From morning to night (the Englishman) is the subject of perpetual fraud... he drinks chicory and beans in his coffee. water in his milk. and organic matter of the vilest kinds...in the water itself. He is unsuspicious that he is eating lard in his butter, alum in his bread, disgusting parasites, flour and gypsum in his sugar, meal in his mustard, turmeric in his ginger, sulfuric acid in his vinegar, lead in his cayenne, copper in his pickles ... and many mineral poisons in bonbons and confectionery, or that his potted meats may be made of horseflesh, his tea of leaves revamped, his cigar falsified, and his cocoa adulterated with meal and flour."

The human toxicity of these colors was well known at the time, making their presence in food even less excusable. Hassall voiced a particularly strong concern that poisonous candy was consumed primarily by children. Hassall describes a candy bird cake decoration as follows:

"The pigments employed for colouring the pigeon are light yellow for the beak, red for the eyes, and orange-yellow for the base or stand. The yellow color consists of the light kind of chromate of lead or pale chrome; for the eyes, bisulfuret of mercury, or vermilion, and for the stand, the deeper variety of chromate of lead or orange chrome."





What's coating our favorite candy snacks today? Find out how many different pigments are found in our safe, modern food colorings with a seperation technique called paper chromatography. The directions that you can use to try this at home or in class are on page 8.

Likewise, in the United States, there appears to have been little organized opposition to the adulteration of foods and beverages until after the Civil War. Until this time in the United States, it was virtually impossible to find any food, drink, or medicine that had escaped extensive contamination. For example, cod liver oil was adulterated, almost to substitution, with train oil mixed with iodine. Yellow tinged milk, colored with lead(II)chromate (PbCrO<sub>4</sub>), was so common that people refused to purchase white milk, thinking that the latter had been doctored. In 1856, the English chemist, William Perkin (1838–1907) prepared the first synthetic organic dye, "aniline purple" or "mauve". Within a few years, a variety of these potentially safer organic dyes began to replace mineral pigments as food colorants. However, in the United States, toxic colored metal salts of arsenic, mercury, lead, chromium, and copper continued to be used as food colorants until the beginning of the 20th century. In the United States, it was common to color pickles and canned vegetables with copper sulfate until about 1905.

Laws prohibiting the coloration of foods and beverages with toxic metal salts were enacted in 1906 when the Pure Food and Drug Act was signed into law by President Theodore Roosevelt. This law was the foundation for the Federal Food Drug and Cosmetic Act of 1938, which required the testing and the safety certification of the 15 aniline-based organic food colors that were in use at that time. Presently, in the United States, there are six certified artificial colors that are allowed in foods and beverages. These are all derived from carbon compounds rather than from inorganic minerals.

The safety of food additives—food colors in particular—continues to interest the health-conscious public. We might not approve of every ingredient we read on a food label. But we have come a long way from the times when lead, copper, mercury, chromium, and arsenic salts were routine ingredients in almost every food and beverage in the marketplace.

*Harold T. McKone* is a professor of chemistry at Saint Joseph College, West Hartford, CT.

## REFERENCES

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