

## Measurement of Color on Oranges

Colors are sometimes added to foods to enhance the natural color of the food or to change the color. The Food and Drug Administration (FDA) regulates use of color additives in foods and does not allow unsafe color additives to be used. Color additives also may not be used to conceal spoilage or inferior products. Color additives are classified as either "certifiable" or "exempt from certification." Certifiable color additives are man-made and each batch is tested by both the manufacturer and FDA. There are 9 certified colors approved for use in foods in the United States. Each of those colors is known as FD&C color number, for example, FD&C Yellow No. 6, and are allowed only on specific foods and only in specific amounts. Color additives that are exempt from certification include pigments made from natural sources such as vegetables, minerals or animals, and man-made counterparts of natural derivatives.

Whether a color additive is certifiable or exempt from certification has no bearing on its overall safety. Both types of color additives are subject to rigorous standards of safety prior to their approval for use in foods.

Oranges do not always change from green to orange color when they ripen. However, consumers prefer to buy oranges which are orange instead of green.

Food scientists can either use ethylene gas to cause the oranges to change to orange color or they can use a color additive. The Food and Drug Administration allows the use of Citrus Red No. 2 color on ripe and otherwise acceptable quality oranges. The amount used must be within safe tolerance limits.

In this experiment, the use of this color on oranges will be determined.

### Materials

- Oranges stamped "color added"
- Oranges not stamped "color added"
- 125-milliliter Erlenmeyer flasks
- funnels
- graduated cylinders
- scale or balance
- hot plate
- glass rods
- chloroform

### Procedures

1. Obtain a tare weight for the Erlenmeyer flasks.
2. Place funnels on top of Erlenmeyer flasks and suspend an orange on glass rods above the funnel.
3. Measure 25 milliliters of chloroform and slowly pour over the orange. The chloroform should collect in the

bottom of the Erlenmeyer flask.

4. Remove the funnel and orange from the Erlenmeyer flask. Weigh the flask again.
5. Repeat for all oranges.
6. Place the Erlenmeyer flasks on a hot plate turned to a very low heat. Allow the chloroform to evaporate. This will take at least overnight.
7. Weigh the flasks again.
8. Calculate the weight of the colors of the oranges. The flasks containing pigments from oranges with color added should weigh more than those from oranges with no color added.

### Caution

- Chloroform is a potentially toxic solvent. This experiment should be performed in a fume hood while students are wearing eye protection and gloves. The oranges used should be discarded safely so that they cannot be eaten.

