

Detailed procedure for constructing a color chart/preparing color standards

The color standards can be prepared by the teacher prior to the activity or students can make their own set of standards as part of the activity. Having students participate in the creation of the standards will introduce them to the following concepts: concentration, dilution, density, and unit conversion. The following steps should be taken to create the standards:

1. Creation of a stock solution: Add 2 mL of red dye to a large container. Add 498 mL of water and shake.
2. Conduct serial dilutions. Less concentrated standards are obtained by diluting the stock solution in a series of dilutions, with each solution used to prepare the next. Instructions are in the table below:

Color standard preparation.

Solution number	Directions*
1	This is the stock solution; no dilution.
2	Mix 20 mL of solution 1 with 20 mL of water.
3	Mix 20 mL of solution 2 with 20 mL of water.
4	Mix 20 mL of solution 3 with 20 mL of water.
5	Mix 20 mL of solution 4 with 20 mL of water.
6	Mix 20 mL of solution 5 with 20 mL of water.
7	Mix 20 mL of solution 6 with 20 mL of water.
8	Mix 20 mL of solution 7 with 20 mL of water.
9	Mix 10 mL of solution 8 with 10 mL of water.

*These volumes and dilutions can be modified.

3. Calculate the solution concentrations following this procedure:
 - a. Determine the concentration of dye in solution number 1 (also referred to as the stock solution):

$$\text{Dye concentration} = \frac{(\text{volume of dye in mL}) \times (\text{density of dye in g/mL})}{(\text{volume of water in mL}) + (\text{volume of dye in mL})} \times \frac{1000 \text{ mg}}{1 \text{ g}} \times \frac{1000 \text{ mL}}{1 \text{ L}}$$

where dye concentration is in mg/L and the density of dye is 1 g/mL.

- b. Determine the concentration of each solution. With each dilution, the concentration decreases by a factor of 2. The following table contains a listing of the final concentrations when following the dilution procedure outlined in the table above.

_____ Standard concentrations _____

Standard number	Standard concentration (mg/L)
1	4,000
2	2,000
3	1,000
4	500
5	250
6	125
7	62.5
8	31.25
9	15.625

4. After students have collected the effluent from their filter, they can visually compare their sample color to the color of the standards and estimate the dye concentration in their sample. Pictures can also be taken of the vials and a chart constructed for comparison (similar to Figure 1). For comparison, a vial containing water should also be filled. Below is a picture of the vials containing the standards prepared using this procedure:

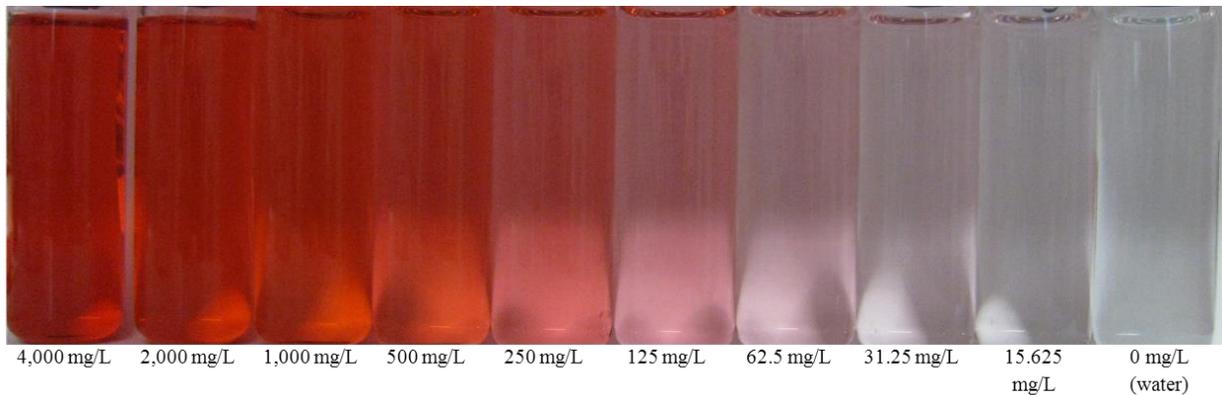


Figure 1 Example color chart to estimate the concentration of influent and effluent dye.