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| **The Use of Color Comparison as a Low-Cost Alternative**  If a spectrophotometer is not available, a color comparison can be used as a low-cost alternative for completing this problem-solving experiment. First, the students will need to create dilutions using the 0.01 M stock solution of tartrazine in the same way described in the standard experiment. It is recommended that the students create at least five dilutions, including some dilutions that are somewhat lighter and some dilutions that are somewhat darker than the sample of the sports drink. Next, the students can place the dilutions and the sample of the sports drink in the same size test tubes in a test tube rack. Finally, to use color comparison, students will visually compare the sports drink to the prepared dilutions rather than measure the absorbance with a spectrophotometer. This is similar to the process used to test pH or chlorine in a pool testing kit used in homes. The concentration of tartrazine in the dilution with the closest color match to the sports drink is the approximate concentration of tartrazine in the sports drink. Although this measurement is not as accurate, the students can effectively learn about concentration, light, energy, absorbance, and experimental design using this alternative. In addition, this alternative eliminates the need for using graphs and linear equations to solve the problem, which may be more appropriate for students at lower grade levels or students with special needs. |

Figure 7. The use of color comparison as a low-cost alternative.