



Immiscible Liquids

Preparer's Version

Introduction

Miscibility refers to the ability of two liquids to mix and form a homogeneous solution. The miscibility of substances is largely determined by the nature of their intermolecular forces (IMFs) and their chemical properties. Substances with similar types and strengths of IMFs are generally miscible, following the principle of "like dissolves like." For instance, polar solvents tend to be miscible with other polar solvents due to the mutual attraction of their dipole-dipole interactions or hydrogen bonding, while nonpolar solvents mix well with other nonpolar solvents due to their dispersion forces. In the demonstration involving water dyed with cupric sulfate and methylene chloride dyed with alizarin yellow R, the two liquids initially form a temporary green emulsion when mixed, but they quickly separate back into distinct layers. Water is a polar solvent with strong hydrogen bonding, while methylene chloride (dichloromethane) is a moderately polar solvent with significant dipole-dipole interactions but lacks the capability for hydrogen bonding. The disparity in their IMFs prevents them from forming a stable, homogeneous mixture, leading to the observed phase separation.

Safety Hazards

- Personal Protective Equipment
 - Safety glasses/goggles
 - Nitrile gloves
 - Chemical & flame retardant lab coat
- Chemical Hazards
 - Methylene chloride may cause skin irritation, eye damage; may cause drowsiness and dizziness; may cause damage to liver, kidneys, blood, and central nervous system; may cause cancer.
 - Copper(II) sulfate is harmful if swallowed; may cause skin irritation and severe eye irritation.

Materials

- Immiscible liquids demonstration bottle.

Safety Data Sheet(s)

- [Methylene chloride](#)
- [Copper\(II\) sulfate](#)
- [Alizarin yellow R](#)



Procedure

1. Measure 250 mL of deionized water and dissolve enough cupric sulfate to dye the water a deep blue. Mix thoroughly until all copper(II) sulfate has been dissolved.
2. Measure 250 mL of methylene chloride and add enough Alizarin yellow R to dye the methylene chloride a pigmented yellow. Be sure to work with this chemical under the fume hood – it is extremely volatile!
3. Combine the two solutions in a glass Duran bottle and seal it tightly. Shake the bottle to test that the liquids will create a green emulsion before separating again.

Tips & Tricks

- None

Clean-Up Procedures

1. Rinse glassware used for the water and cupric sulfate thoroughly with deionized water, bottling the runoff in a waste container.
2. Rinse glassware used for the alizarin yellow R with acetone. Any labware used for methylene chloride can be left in the fume hood/blown with compressed air, as it is volatile enough that it will rapidly vaporize away.
 - a. *IMPORTANT: Methylene chloride is considered halogenated organic waste. While trace amounts can be allowed to evaporate, any liquid waste needs to be disposed of through EHS's waste disposal system and segregated from all other waste.*
3. Clean labware thoroughly with laboratory detergent and water.