

# Demixing of Acetone-Salt Water

## Equipment:

glass cylinder or  
high form glass beaker (400 mL)  
2 graduated cylinders  
magnetic stirrer and stir bar  
mortar with pestle  
glass beaker (50 mL)

## Chemicals:

sodium chloride  
acetone  
deionized water  
methyl violet

## Safety:

acetone ( $\text{CH}_3\text{COCH}_3$ ):

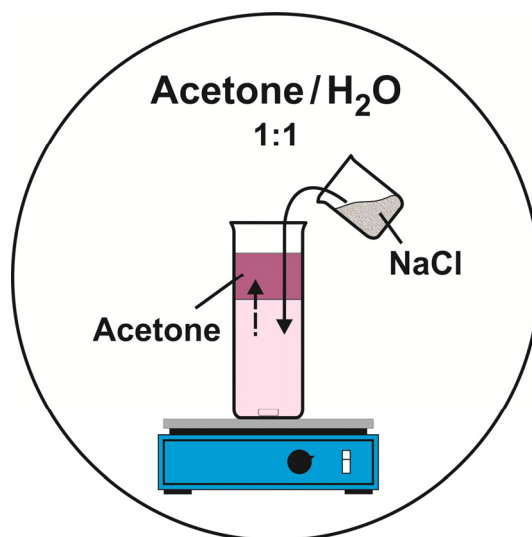


H225, H319, H336, EUH066  
P210, P233, P305 + P351 + P338

methyl violet:



H302-318-351-410  
P280-281-305 + 351 + 338-308 + 313



Both liquid acetone and acetone vapor are highly flammable. Acetone has a relatively high vapor pressure and should be handled only with adequate ventilation or in a fume hood.

Methyl violet can cause serious eye damage. Affected eyes should be rinsed cautiously with water for several minutes.

It is necessary to wear safety glasses and protective gloves.

## Procedure:

Preparation: About 30 g of sodium chloride are finely ground using a mortar and pestle; 20 g of the salt are placed into the small beaker. 100 mL of acetone colored pale purple with about  $0.5 \text{ mm}^3$  of methyl violet powder are filled into the glass cylinder.

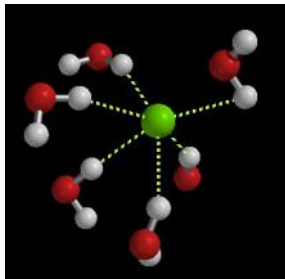
Procedure: 100 mL of water are added to the acetone in the glass cylinder and the liquid is thoroughly stirred with the magnetic stirrer. A homogeneous solution is obtained. Subsequently, the content of the small beaker is added and the liquid is stirred continuously until all the sodium chloride has dissolved.

## Observation:

The result is a deep purple acetone layer of about 50 mL on top of a pale purple water layer.

### Explanation:

Acetone and pure water are soluble in all proportions; they are completely miscible. The reason for this behavior is the formation of hydrogen bonding interactions between the oxygen atom of acetone molecules and the O-H bond of water molecules.



from: Tom Kuntzleman

However, when salt is added to the mixture, the resulting  $\text{Na}^+$  and  $\text{Cl}^-$  ions interact very strongly with the water molecules through ion-dipole forces. These ion-dipole interactions are much stronger than the acetone-

water hydrogen bonds. As a result, the acetone molecules are forced out of the aqueous phase and two layers are formed: a less dense acetone layer on top and a salt water layer at the bottom. Obviously, acetone and salt water are incompatible and therefore

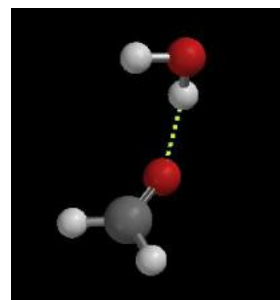
immiscible; they do not mix in all proportions.

The dye methyl violet, which dissolves better in acetone than in water, accumulates in the acetone layer.

This “salting out” technique can be used to remove organic molecules from an aqueous solution.

### Disposal:

The acetone-salt water mixture has to be disposed of as hazardous waste in accordance with the guidelines of the particular institution.



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