

# Interaction of Melamine and Cyanuric Acid

## Keywords

hydrogen bonding, precipitation, nucleation, food safety.

## Hazards

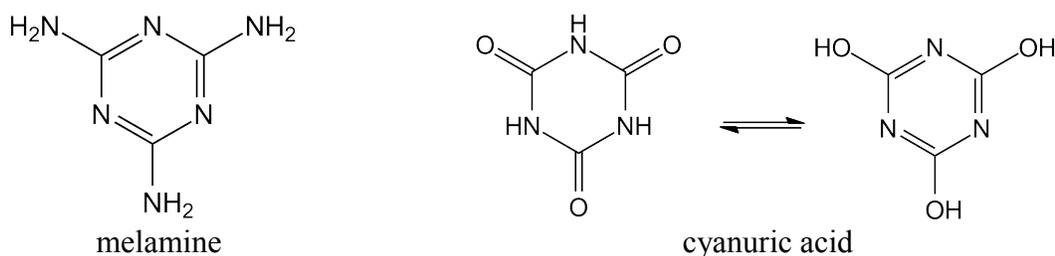
This experiment should be carried out by a person with appropriate chemical safety training. For all chemicals, follow manufacturer's safety recommendations, which may exceed the information given below.

- *melamine (CAS-108-78-1)*: Causes eye irritation, causes respiratory irritation, may be harmful if absorbed through skin, may be harmful if swallowed
- *cyanuric acid (CAS-108-80-5)*: Causes eye irritation, causes respiratory irritation, may be harmful if absorbed through skin, may be harmful if swallowed
- melamine and cyanuric acid, if ingested together, may exhibit higher toxicity than the individual compounds.
- *melamine cyanurate (CAS-37640-57-6)*: May cause eye irritation, harmful if swallowed.

## Materials

1L of a solution of 10 mM melamine (1.26 g) in water

1L of a solution of 10 mM cyanuric acid (1.29 g) in water



## Experiment

Both solutions should initially be clear. Upon mixing of the two solutions, a white, flaky substance forms.

## Explanation

Melamine and the tri-keto tautomer of cyanuric acid contain hydrogen bond donors and acceptors arranged in a complementary geometry. Upon mixing, large sheets of melamine cyanurate can form through hydrogen bonding involving the three sides of the molecules (see illustration).

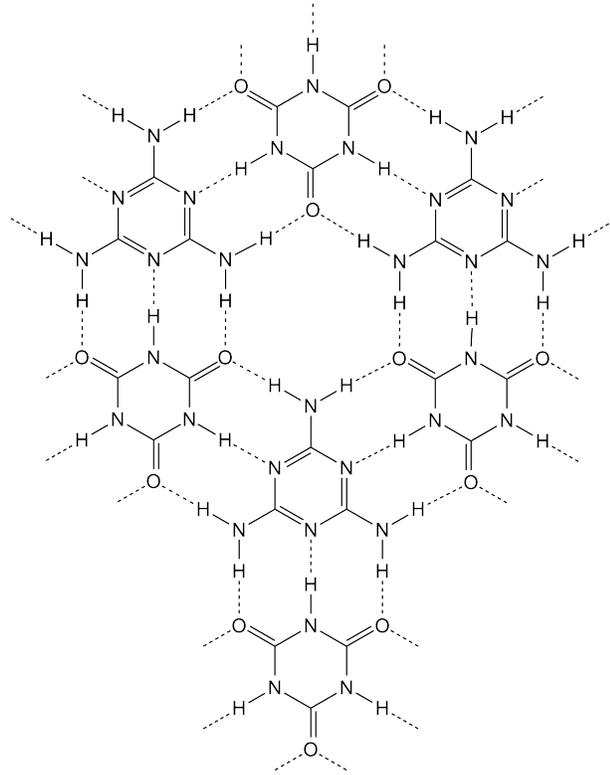
## Supplementary questions

- Why are flakes rather than macroscopic sheets formed?
- What determines the size of the flakes?
- Is this process pH dependent?

## Other information

- cyanuric acid is also used as a stabilizer in chlorine tablets for swimming pools (however, do not use chlorine tablets for this experiment – toxic chlorine could be released).
- Melamine has been used illegally as a food additive because it boosts the apparent protein content based on certain testing methods.

- Addition of melamine to infant formula has caused kidney stones in infants (China).
- Pet food containing both melamine and cyanuric acid has caused kidney failure in cats and dogs (USA; 2007).



melamine cyanurate

## References

[http://www.who.int/foodsafety/fs\\_management/Melamine.pdf](http://www.who.int/foodsafety/fs_management/Melamine.pdf)

S. Bowen, C. Hilty (2010)