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Posted by Anonymous on Thu, 2019-05-02 10:44

Acetone and polystyrene foam: Is it suitable and safe in a primary school to conduct the activity in which a foam cup is “dissolved” in acetone? Is this a demonstration of a physical change where the foam is just disintegrated and the gas is released? My concerns are both obviously for the use of acetone in an open classroom with primary school students and also if there is anything gaseous/toxic released during the disintegration process.

Voting:



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Year Level:

6

Laboratory Technicians:

Laboratory Technicians

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Acetone and polystyrene foam

Submitted by sat on 02 May 2019

Answer Review 20 February 2023

Suitability for primary schools

There are two aspects to consider here:

1. **The curriculum application.** This is a complex example of a physical change and not easily reversible.

2. **Management of hazardous chemicals in primary schools:** Are there systems in place to ensure that the risks to health and safety are managed? For example: Has a chemical register for hazardous chemicals been established and maintained? Has appropriate information and training been provided for staff?¹

For the primary school level application, we do not recommend this activity and instead recommend using simple examples of a physical change,² such as:

1. change of state (e.g. from a solid to a liquid or gas or the reverse)
2. creation and/or separation of a mixture (e.g. mixing sand with marbles)
3. physical deformation (e.g. crumpling or tearing paper)

Handling acetone

Acetone is a hazardous chemical. It is highly flammable, in both liquid and vapour form; it causes serious eye irritation and may cause drowsiness or dizziness.³

Safe storage and handling procedures must be followed:

- “Handle in an operating fume cupboard or well-ventilated area.
- Avoid inhaling fumes, vapour or mist.
- Avoid contact with skin and eyes.
- Handle away from heat and other sources of ignition.”⁴

Acetone and polystyrene foam demonstration

Polystyrene is a polymer made up of the monomer styrene⁵. It is a hard, solid plastic used in many appliances.⁶ When polystyrene beads contain an expanding agent and are steam heated, they soften and expand up to forty times their original size to form polystyrene foam which is 98% air.⁷

The Royal Society of Chemistry explains that when polystyrene foam comes in contact with acetone, it is softened and releases the air and therefore collapses. *“The resulting colloidal gel consists of propanone (acetone) molecules dispersed in a network formed by a tangle of large polystyrene molecules – a similar structure to ordinary jelly in which water molecules are dispersed in a network of protein molecules.”*⁸

This means that this is a physical change because there has been no chemical change to the polystyrene.⁹ Since it is largely air that is released, there is unlikely to be exposure to toxic gases from this source. The greatest risks in this activity are exposure to the acetone and its flammability.

Science ASSIST recommends that IF this activity is conducted, it is done so as a demonstration rather than a class activity, observing the following:

- Conducted in a well-ventilated area, such as outside in the open air, away from sources of ignition.
- Wear safety glasses and avoid skin contact with acetone.
- Provide additional shielding or use a (transparent) secondary container to minimise the likelihood of the acetone splashing as the polystyrene collapses.
- Disposal: Decant the excess acetone from the mixture into a bottle for non-halogenated organic liquid waste. Alternatively, small quantities of waste acetone can be placed in a shallow vessel in an operating fume cupboard and allowed to evaporate. Transfer the residual gel to a shallow disposable container and place in an operating fume cupboard, and allow the acetone to evaporate. When the residual acetone has evaporated, the polystyrene residue will harden, and this can then be disposed of as general waste.

References

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