Making Polyurethane foam

Posted by Anonymous on Tue, 2015-05-19 13:05

Making Polyurethane foam: Could someone please tell me where I can find instructions for a Year 11 chemistry prac for making polyurethane foam?

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Laboratory Technicians

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Submitted by sat on 09 June 2015

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The preparation of polyurethane foam is an interesting and worthwhile demonstration of polymerisation. We have detailed some instructions below, but first it is important to be aware of the hazards that are involved. Polyurethane foam is prepared from components which are commonly available commercially in two parts:

- **Part A is a mixture of polyol, an amine and a silicone surfactant.1** This is a manageable hazard, it is a combustible liquid and is classified as a Category 3 irritant and a Category 2 corrosive.

- **Part B is a diisocyanate mixture.[2] This kind of chemical can present a serious risk if not handled safely and responsibly.** The diisocyanate component is also a combustible liquid. Diisocyanates are classified as Category 1 respiratory and skin sensitisers.[1] Exposure to diisocyanates may cause sensitisation after chronic exposure, or after a large single exposure.[3] The sensitisation effects may lead to an allergic reaction upon further exposure to diisocyanates. The effect may be life threatening and may be permanent. This MUST be handled in an operating fume cupboard.

We therefore advise that all precautions be taken to avoid any respiratory or skin exposure to the diisocyanate component when carrying out this reaction.

A site-specific risk assessment should be conducted before carrying out the activity. See the Science ASSIST Risk Assessment Template. We recommend that the reaction should not be conducted in the presence of any student or staff member who has a history of respiratory allergies.

Safe Handling

We recommend that this activity be conducted as a **teacher demonstration only** on a small scale in a working fume cupboard, taking all precautions to prevent skin and respiratory exposure to the diisocyanate component with the following safe handling precautions.

1. The preparation of polyurethane foam should be conducted in a running fume cupboard.
2. PPE including safety glasses, a laboratory coat and gloves (nitrile gloves provide good protection) should be worn.
3. The workstation in the fume hood should be covered with a large disposable plastic bag to catch any overflow or spillage caused by the expansion of the foam.
4. Disposable containers and tools should be used.
5. Pour approximately 20 mL of liquid Part A in a disposable plastic cup and label it cup A.
6. Add a few drops of food dye to cup A, if desired, and stir the mixture with a wooden stirrer.
7. The volume of Part B should be about equal or slightly less than that of Part A to ensure that all of the diisocyanate is completely consumed. Therefore, pour slightly less than 20 mL of liquid Part B into the second disposable plastic cup and label it cup B.
8. Add the contents of cup A to cup B and stir thoroughly with the wooden stirrer until the foam begins to expand.
9. Any unused diisocyanate component should be mixed well with sufficient of Part A to completely consume the diisocyanate component.
10. Observe the foam as it expands 25–30 times its original volume.
11. The foam products should be left to cure in the running fume cupboard, or outside, for 24 hours after preparation to avoid exposure of personnel to fumes of the diisocyanate.
12. This condensation polymerization reaction is exothermic and the cup will get warm. Do not touch the foam until it is completely hardened.
13. The hardened foam, used disposable cups, wooden stirrer and large plastic bag can be disposed of with regular waste.

Storage of components

- **Part A: Polyol component:** The polyol component can be appropriately stored with organic liquids.
- **Part B: Diisocyanate component:** This component should be stored in a cool dry place with general chemicals. The container of the diisocyanate component should be kept tightly sealed to protect it from atmospheric moisture.

Note: Diisocyanates react with water to produce carbon dioxide and an insoluble polymer. The carbon dioxide generated from this reaction could rupture the container given sufficient exposure to water.

It is recommended that neither part is kept for a period of longer than 3 years.

References

1 Flynn Scientific Inc. (2014). *'Polyurethane Foam System, Part A'* Safety Data Sheet, Retrieved from the Flynn Scientific Inc. website: https://www.flinnsci.com/globalassets/flinn-scientific/all-free-pdfs/sds...

2 Flynn Scientific Inc. (2014). '*Polyurethane Foam System, Part B'* Safety Data Sheet, Retrieved from the Flynn Scientific Inc. website: https://www.flinnsci.com/sds_607.6-polyurethane-foam-system-part-b/sds_6...

3 Safe Work Australia. (2020, July 1). *Guide to handling isocyanates,* Retrieved from the Safe Work Australia website: https://www.safeworkaustralia.gov.au/doc/guide-handling-isocyanates

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