Cost-Effective Teacher

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Dry-Ice Bath Based on Ethylene Glycol Mixtures

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Experimental chemists often need to prepare low-temperature baths for maintaining reaction temperatures or for conducting crystallizations. Our work has regularly required bath temperatures between −20 and −80 °C. We have found the various literature methods (*1, 2*) to be impractical owing to the unavailability of the organic solvents prescribed. Even if solvents are available, we find these baths cannot dependably maintain a constant temperature. Liquid nitrogen baths present a workable alternative, but dry ice is more economical, especially for longer reaction times.

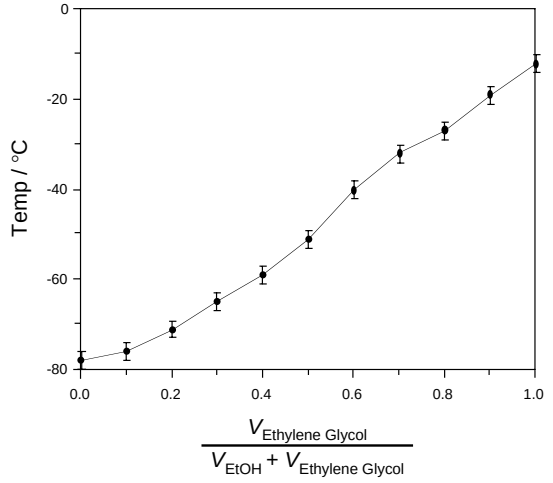

Figure 1. Steady-state temperatures of dry ice–ethanol and ethylene glycol mixtures.

Baths of mixtures of *ortho*- and *meta*-xylene cannot adequately maintain our desired temperatures. However, we find bath mixtures of ethanol and ethylene glycol (**Caution:** Toxic when ingested! Do not swallow!) in dry ice produce sustainable constant temperatures over the range from −12 to −78 °C. We find an approximately linear relationship between the bath temperature and the volume fraction of ethylene glycol (see Fig. 1). To maintain the desired temperature within the error range, a small portion of dry ice must be added periodically.

Our bath is less toxic than mixtures of *ortho*- and *meta*-xylene and our mixture does not intractably solidify, as will dry ice slurries of xylenes. Our bath may be prepared from −12 to −78 °C, while the xylene bath ranges only from −26 to −72 °C. Moreover, this bath reliably sustains constant temperatures for up to 5 hours. Finally, the cost of this mixture is 20% less than that of the xylene mixtures.

Acknowledgment

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Literature Cited

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2. Rondeau, R. E. *J. Chem. Eng. Data* **1966,** *11*, 124.