

Simple Techniques to Make Everyday Lab Work Greener

Solvent Selection

- 1 Use dry ice/isopropanol for cooling baths**

Reaches essentially the same temperature as dry ice/acetone (-77°C vs. -78°C), but the lower volatility of isopropanol minimizes vapor emissions and inhalation, and makes the bath last longer.
- 2 Use heptane instead of hexanes**

Heptane has almost identical chemical properties to hexane, but is significantly less toxic due to the odd number of carbons, which alter its metabolic product in the body.
- 3 Use 2-MeTHF instead of THF**

2-MeTHF is indirectly derived from bio-based renewable feedstocks. Its chemical properties are very similar to THF but it is immiscible with water, making separations, recycling, and drying easier. See D. F. Aycock, *Org. Process Res. Dev.* **2007**, *11*, 156–159 for more information.
- 4 Substitute DCM in column chromatography**

One of the largest contributors to chlorinated solvent waste is chromatography. While selecting a new solvent system may seem challenging, J. P. Taygerly, et al. (*Green Chem.* **2012**, *14*, 3020-3025) have already done the work for you.

Waste Reduction

- 5 Recycle wash solvents**

Wash solvents are ideal for recycling because dryness and purity isn't as important. Simply wash your glassware as usual, collecting the liquid in a separate container. When it's full, transfer to the rotovap and distill into a clean collection flask.
- 6 Recycle solvents isolated from distillation/rotovaping**

If you are going to remove the solvent anyway, why not reuse it? When you are done your purification step, do a quick check of the purity of the solvent. If pure: reuse it for another reaction or as a wash solvent. This is ideal for single-solvent systems, azeotropes, and solvent mixtures with >10°C difference in boiling point.
- 7 Use a closed-loop cooling system for condensers**

Closed-loop cooling systems eliminate wastewater and accidental laboratory flooding. Use a commercially available chilled water recirculator, an aluminum condenser, or for high-boiling liquids simply use air.
- 8 Use Dry Column Vacuum Chromatography to purify large samples**

This is a relatively new technique that can dramatically reduce the amount of silica and solvents used. For larger purifications, it's faster than flash chromatography and the columns can easily be recycled. For more information see D. S. Pedersen and C. Rosenbohm, *Synthesis* **2001**, *16*, 2431-2434.

Energy Reduction

- 9 Close your fume hood**

A variable volume fume hood is 60% more energy efficient when the sash is closed.
- 10 Turn off/unplug stuff when you are done with it**

It just makes sense.

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