organic chemistry

Posted by Anonymous on Thu, 2015-03-26 17:32

Organic chemistry: Could someone please advise about the safe storage and disposal of esters.

I haven't been able to find Australian references. One USA site said esters with a carbon-chain length of less than 5 can be disposed down (an American) sink. However, what about the situation in Australia, and NSW in particular?

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Laboratory Technicians

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Submitted by sat on 16 April 2015

In brief: It is best practice to dispose of laboratory waste in a controlled manner. For ester preparation activities, the best practice is to store the waste in appropriately labelled bottles

for collection by a licenced waste disposal contractor.

Although it is not prohibited in Australia to use a fume cupboard to evaporate waste, we advise against this practice as it introduces untreated waste into the environment.

Preparation and properties of esters

In schools, ester preparation often involves mixing a few drops of an alcohol and a similar amount of a carboxylic acid in a test tube, along with an acid catalyst such as concentrated sulphuric acid, and then heating the mixture in a water bath. The odour of the ester may then be observed by wafting fumes from the test tube or by pouring the mixture onto a small amount of water in a beaker and observing the odour from the ester layer which forms on top of the water.

On a larger scale, after heating the reaction mixture and allowing it to cool, the mixture may then be transferred to a separating funnel and washed with sodium carbonate solution to remove the acid catalyst as well as any unreacted carboxylic acid.

In school ester preparation activities, depending on the length of the carbon chain, the esters produced may be categorised as highly flammable, flammable or combustible. The alcohols used are also flammable and many are irritating to the skin and respiratory system. While esters often have a sweet fruity aroma, the component acids and alcohols can smell very unpleasant. Esters vary in their miscibility with water according to their chain length and structure.

Disposal of esters

We have researched the trade waste acceptance standards in all of the Australian states and territories and consulted directly with five water authorities. In general, the accepted concentrations for organic compounds are very low (e.g., from 1mg/L to 30 mg/L for saturated hydrocarbons). Flammable substances are specifically prohibited from being discharged to the sewerage system, as are water-immiscible liquids. The only carboxylate anion specified by any of the water authorities is acetate, which is accepted at the concentration of 300 mg/L in the ACT.

If the esters are prepared in test tubes, and not washed or added to water, then the entire contents of the test tubes should be transferred to a non-halogenated organic waste bottle and stored for collection by a licenced waste disposal contractor.

If the ester is washed with water or carbonate solution, then the composition of the aqueous layer would depend on the miscibility of the reagents used and ester(s) produced in the activity. In WA and NSW, small amounts of water-miscible organic substances from science laboratories are allowed to be discharged down the sink as long as there is appropriate dilution. In these states, any aqueous layers produced in ester preparation activities could be neutralised and then washed down the sink with lots of water.

We expect that the concentration of these substances in the aqueous layer would exceed the accepted limits in other jurisdictions. Therefore, in these cases, we recommend that the

aqueous layer be transferred to a separate waste bottle labelled as ‘Dilute aqueous waste’ and stored for collection via a licenced waste disposal contractor.

Best practice, would be to store the organic layer in a separate bottle to the aqueous layer. However, if the layers are difficult to separate, then it would be reasonable to transfer both layers to the same waste bottle.

Glassware contaminated with any of the organic compounds used or produced can be rinsed with a small amount of ethanol with the rinse liquid being added to the organic waste bottle. If any gas is produced from the stored mixture, it is likely to be carbon dioxide produced from the reaction of the sodium carbonate and the acid catalyst or unreacted carboxylic acid.

It is good practice to keep track of the substances which are added to a waste bottle. One way to do this is to attach a blank label onto the back of the waste bottle. Each time waste is added to the bottle, the names of the substances added can be recorded on the label. When the bottle is full, then the hand-written label can be replaced with a printed label containing this information.

Alternative Activity

Some schools use gourmet jelly beans to experience the aroma of esters; see the esters experiment alternative, Esters – A tasty investigation http://www.labnetwest.asn.au/experiments/. Do remember to use a non-science room for all activities where foods are consumed.

Links to some information specific to states and territories

Note: Some states have multiple water authorities responsible for trade waste. Ensure that you are looking at the correct authority for your region.

ACT: ‘Liquid trade waste’, icon water website, https://www.iconwater.com.au/Developers-and-Renovators/LiquidTradeWaste (Accessed 24/08/2020)

NSW: ‘Liquid trade waste’, NSW Department of Planning, Industry and Environment website, https://www.industry.nsw.gov.au/water/water-utilities/regulatory-assessments/liquid-trade-waste (Accessed 24/08/2020)

NT: ‘Trade Waste’, Power and Water Corporation website, https://www.powerwater.com.au/developers/water-development/trade-waste (Accessed 24/08/2020)

Qld: ‘Trade waste’, Urban Utilities website, https://www.urbanutilities.com.au/business/business-services/trade-waste (Accessed 24/08/2020)

Qld: Trade Waste Guidelines: City of Gold Coast website, https://www.goldcoast.qld.gov.au/files/sharedassets/public/pdfs/brochure... (Link Updated September 2021)

SA: ‘Trade waste management’, SA Water website, https://www.sawater.com.au/my-business/trade-waste/trade-waste-management (Accessed 24/08/2020)

Tasmania: ’Trade Waste and your business’, TasWater website, https://www.taswater.com.au/customers/businesses/trade-waste (Accessed 24/08/2020)

Victoria: ‘Trade waste agreements in Victoria’, CleanaWater website, https://cleanawater.com.au/information-centre/trade-waste-agreements-in-victoria (Accessed 24/08/2020)

Victoria: ‘Trade waste’ Barwon Region Water Corporation, https://www.barwonwater.vic.gov.au/water-and-waste/trade-waste (Accessed 24/08/2020)

Victoria: ‘Trade Waste’ City West Water website, https://www.gww.com.au/water-waste/trade-waste (Link Updated December 2022)

Victoria: ‘Trade Waste’, Goulburn Valley Water website, https://www.gvwater.vic.gov.au/business/trade-waste (Accessed 24/08/2020)

Victoria: ‘Commercial trade waste’, Gippsland Water website, https://www.gippswater.com.au/water-and-waste/commercial/commercial-trade-waste (Accessed 24/08/2020)

Victoria: ‘Manage trade waste’, South East Water Corporation website, https://southeastwater.com.au/water-waste-and-environment/trade-waste/

Victoria: ‘Trade Waste’ Yarra Valley Water website, https://www.yvw.com.au/help-advice/trade-waste (Accessed 24/08/2020)

WA: ‘Trade waste’, Water Corporation website, https://www.watercorporation.com.au/Help-and-advice/Trade-waste/

[Links edited 25/08/2020 to update with current links]
