**RISK ASSESSMENT** **University Senior College Adelaide Students**

# Ester Hydrolysis

**Written by:** Lyron Winderbaum **Commenced on:** 18 Apr 2018 **Expires:** 18 Jul 2019

**Classes for which experiment is required**

**Teacher:** Glen Arthur (training code 1) **Year Group:** 12 Chemistry

| Room | Period | Date |
|---|---|---|
| SB203 | 9am - 12:40am | Wed 18/4/18 |

**Procedure or reference, including variations**

Investigations Folio: Organic Preparation --- Ester Hydrolysis (Curriculum and Methodology B, University of Adelaide Teaching Degree)

**Equipment to be used**

### beaker, medium (250 mL to 1 L)

*Potential hazards*
Breakage of beaker. Cuts from chipped rims.

*Standard handling procedures*
Inspect and discard any chipped or cracked beakers, no matter how small the damage. Sweep up broken glass with brush and dustpan; do not use fingers.

### beaker, small (<250 mL)

*Potential hazards*
Breakage of beaker. Cuts from chipped rims.

*Standard handling procedures*
Inspect and discard any chipped or cracked beakers, no matter how small the damage. Sweep up broken glass with brush and dustpan; do not use fingers.

### boiling chips

*Potential hazards*
Add boiling chips to cold liquid before heating. Never add boiling chips to hot liquid, due to possibility of superheated liquid and rapid evolution of vapour ("bumping").

### boss head

### buchner funnel

*Potential hazards*
Funnel may break; broken glass or ceramic may cause cuts.

*Standard handling procedures*
Inspect and discard any chipped or cracked funnels no matter how small the damage. Sweep up broken glass or ceramic with brush and dustpan; do not use fingers.

### bunsen burner

*Potential hazards*
Roaring flame is very hot and can cause severe burns. Rapid passage of hand through fully luminous flame usually does not result in a burn. Roaring bunsen burner may "burn back" at low gas flow, with flame emerging from air holes in base; this makes the base of the burner hot to touch and liable to cause burns. Gas from gas tap or from end of rubber tube burns with large luminous flame, likely to cause burns. Rubber hose is easily melted by flame from burner, e.g. if burner knocked over, resulting in fire from burn hole in tube. Ensure hair is tied back, so does not catch alight.

*Standard handling procedures*
Inspect and clean the jet and base of bunsen burners regularly. Inspect and replace tube whenever any sign of wear or damage is noticed. Use only hoses of the correct size to ensure a comfortable fit on both bunsen burner and gas tap.

### distillation apparatus

*Potential hazards*
Glass equipment may break. Hot vapours may cause burns. Breakage of distillation flask will liberate contents, possibly resulting in a fire, if contents are flammable and an ignition source is present. Sudden boiling of superheated contents ("bumping") may cause

*Standard handling procedures*
Store and handle distillation apparatus with care. Sweep up broken glass with brush and dustpan; do not use fingers.

the still head to fly off and boiling liquid/vapour to spray upwards. Add boiling chips to cold liquid to encourage controlled boiling; never add boiling chips to hot liquid.

**flask, pear shaped, small (<100 mL)**

*Potential hazards*
Bottom of flask prone to crack or break if dropped; chips around rim may cause cuts. Pear shaped flask generally stronger than other shapes; only use pear shaped or round bottom flasks for vacuum distillations.

*Standard handling procedures*
Inspect and discard any chipped or cracked flasks no matter how small the damage. Sweep up broken glass with brush and dustpan; do not use fingers.

**retort clamp**

**retort stand**

*Potential hazards*
Centre of mass of supported object is often high and the stand may topple over.

**test tube, medium (~150 x 15 mm), soda glass**

*Potential hazards*
Breakage of test tubes. Cuts from chipped test-tube rims. Commonly, thinner walls and more fragile than borosilicate test tubes. Less resistant to thermal shock than borosilicate test tubes. Small test tubes more likely to eject material during exothermic reactions.

*Standard handling procedures*
Inspect and discard any damaged test tubes. Sweep up broken glass with brush and dustpan; do not use fingers.

## Chemicals to be used and produced

**hydrochloric acid, 10-12 M (32-37% wt/wt), concentrated** **$HCl_{(aq)}$**

*Class:* 8 *PG:* II *Users:* Tch* *Training:* 1-5 *UN:* 1789 *CAS:* 7647-01-0

*GHS data:*

**DANGER**

Causes severe skin burns and eye damage
May cause respiratory irritation

*Potential hazards*
HIGHLY CORROSIVE TO EYES, LUNGS, GUT AND SKIN. Evolves highly lung-irritant HCl gas. Do not mix hydrochloric acid with formaldehyde solution, since highly carcinogenic bis(chloromethyl) ether is formed. Do not mix hydrochloric acid with acetone and hydrogen peroxide solution, since dangerously explosive acetone peroxide may be formed.

*Standard handling procedures*
Avoid inhalation of vapour or skin contact. Handle in a fume cupboard if possible; otherwise a well-ventilated area. Do not breathe vapour. Avoid splashes in eyes or on skin. Use sulfuric acid rather than hydrochloric acid as a catalyst for the preparation of urea-formaldehyde polymer.

**methanol 0.78-5.3 M (2.5-17% wt/wt)** **$CH_3OH_{(aq)}$**

*Class:* nc *PG:* none *Users:* 7-12 *Training:* 1-5 *CAS:* 67-56-1

*GHS data:*

**DANGER**

Harmful if inhaled
Harmful in contact with skin
Harmful if swallowed
Causes damage to organs

*Potential hazards*
TOXIC IF SWALLOWED; TOXIC VAPOUR. Absorbed through the skin. Causes liver damage and blindness.

**methyl salicylate** **$HOC_6H_4COOCH_3$**

*Class:* 6.1 *PG:* III *Users:* 7-12* *Training:* 1,2,5* *UN:* 2810 *CAS:* 119-36-8

*GHS data:*

**WARNING**

Harmful if swallowed
Causes skin irritation
Causes serious eye irritation

*Potential hazards*
Slightly toxic. Powerful odour. Eye, skin and lung irritant.

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**potassium dichromate >0.58 M (>17% wt/wt)** $K_2Cr_2O_{7(aq)}$

*CAS:* 7778-50-9

*Class:* nc *PG:* none *Users:* Tch *Training:* 1,2,5

*GHS data:*

**DANGER**

**Allergy alert!**

May cause cancer
May cause genetic defects
May damage fertility and the unborn child
Fatal if inhaled
Toxic if swallowed
Causes damage to organs through prolonged or repeated exposure
Harmful in contact with skin
Causes severe skin burns and eye damage
May cause allergy or asthma symptoms or breathing difficulties if inhaled
May cause an allergic skin reaction
Very toxic to aquatic life with long lasting effects

*Potential hazards*
HIGHLY TOXIC; MAY CAUSE CANCER OR GENETIC DEFECTS; MAY DAMAGE FERTILITY OR THE UNBORN CHILD; CAUSES ORGAN DAMAGE; CORROSIVE TO SKIN AND EYES; SENSITISER.

*Standard handling procedures*
Solubility ~120 g/L at 20°C. Should not be handled by pregnant women. Women of reproductive age should avoid handling the chemical.

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**salicylic acid, solid** (2-hydroxybenzoic acid) $HOC_6H_4COOH$

*CAS:* 69-72-7

*Class:* nc *PG:* none *Users:* 7-12* *Training:* 1-5

*GHS data:*

**DANGER**

Harmful if swallowed
Causes serious eye irritation

*Potential hazards*
Slightly toxic. Fine particles irritate eyes.

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**sodium hydroxide >1.3 M (>5% wt/wt)** $NaOH_{(aq)}$

*UN:* 1824 *CAS:* 1310-73-2

*Class:* 8 *PG:* II *Users:* 11-12 *Training:* 1-5

*GHS data:*

**DANGER**

Causes severe skin burns and eye damage

*Potential hazards*
EXTREMELY CORROSIVE TO EYES AND SKIN; EXTREMELY CORROSIVE TO GUT. Releases heat when disssolved in water. Reaction of hot concentrated solutions with the surface of the eye is so rapid that first-aid washing of eye with water cannot be performed fast enough to prevent damage to the cornea, resulting in blindness.

*Standard handling procedures*
WEAR SAFETY GLASSES!

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**Others**
Traffic --- lots of students packed into a room, occasionally all going to the same place for the same thing, bumping into each other holding glassware and chemicals.

**Knowledge**
I/we have read and understood the potential hazards and standard handling procedures of all the equipment, chemicals and living organisms.
I/we have read and understood the (Material) Safety Data Sheets for all chemicals used and produced.

I/we have copies of the (Material) Safety Data Sheets of all the chemicals available in or near the laboratory.

**Agreement by student(s)**

I/we, Lyron Winderbaum, agree to conduct this experiment safely in accordance with school rules and teacher instructions.

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**Risk assessment**

I/we have considered the risks of:

| | | | |
|---|---|---|---|
| fire | breakage of equipment | electrical shock | radiation |
| explosion | cuts from equipment | escape of pathogens | waste disposal |
| chemicals in eyes | sharp objects | heavy lifting | inappropriate behaviour |
| inhalation of gas/dust | rotating equipment | slipping, tripping, falling | allergies |
| chemicals on skin | vibration and noise | falling objects | special needs |
| runaway reaction | pressure | heat and cold | other risks |

**Assessment by student(s)**

I/we have assessed the risks associated with performing this experiment in the classroom on the basis of likelihood and consequences using the School's risk matrix, according to International Organization for Standardization Standard ISO 31000:2009 and the Risk Management Guidelines, HB 436:2013.

I/we consider the inherent level of risk (risk level without control measures) to be:

**Low risk** Medium risk High risk Extreme risk

Risks will therefore be managed by routine procedures in the classroom.

**Certification by teacher**

I have assessed the risks associated with performing this experiment in the classroom on the basis of likelihood and consequences using the School's risk matrix, according to International Organization for Standardization Standard ISO 31000:2009 and the Risk Management Guidelines, HB 436:2013. I confirm that the risk level and control measures entered by student(s) above are correct and appropriate.

**Name:** ..... **Signature:** ..... **Date:** .....

**Certification by Laboratory Technician**

I have assessed the risks associated with preparing the equipment, chemicals and living organisms for this experiment and subsequently cleaning up after the experiment and disposing of wastes, on the basis of likelihood and consequences using the School's risk matrix, according to International Organization for Standardization Standard ISO 31000:2009 and the Risk Management Guidelines, HB 436:2013.

I consider the inherent level of risk (risk level without control measures) to be:

☐ Low risk ☐ Medium risk ☐ High risk ☐ Extreme risk

Where the risk level is "medium risk", "high risk" or "extreme risk", the following control measures will be employed:

*Control measures (attach further pages as required):*

☐ safety glasses ☐ gloves ☐ lab coat ☐ apron ☐ fume cupboard

With the specified control measures in place, I have found that all the risks are "low risk". Risks will therefore be managed by routine procedures in the laboratory, in combination with the specified control measures.

**Name:** ..... **Signature:** ..... **Date:** .....

**Monitoring and review**

This risk assessment will be monitored using comments below and will be reviewed within 15 months from the date of certification.

*Attach further pages as required*