

Section 5.16 Title: Making and Using Aqua Regia
Prepared By: Mike Trenerry and Michael Roy

Revision Date: 11/01/19
P.I.: Prof. John F. Berry

Prior Approval: This procedure is NOT considered hazardous enough that prior approval is needed from the Principal Investigator.

Involves Use of Particularly Hazardous Substance (PHS)? No
 Carcinogen Reproductive Toxin High Acute Toxicity
Does this procedure require medical surveillance? No
Does this require use of a fit-tested respirator? No

Brief Description of Procedure:
Preparation and use of aqua regia.

Location: *List the locations (buildings/rooms) where this procedure may be performed. For use of a PHS indicate a more precise location within the room, if appropriate, as a designated area.*
Daniels Chemistry - All Berry group labs

Chemicals Involved:

Chemical	Physical or Health Hazard (e.g. carcinogen, corrosive)
Concentrated hydrochloric acid	Corrosive solution and fumes; causes severe skin burns and eye damage
Concentrated nitric acid	Oxidizer, corrosive solution and fumes; causes severe skin burns and eye damage

Other Hazards: *Include hazards, other than chemical, that may be present during operation of the procedure.*

Concentrated acids can react violently with organics. Rinse glassware thoroughly with water before and after treatment with aqua regia. Aqua regia releases NO_x gasses. Only tightly close containers of aqua regia for transportation.

Exposure Controls: *(Check all that apply)*

PPE: Safety Glasses Face Shield Chemical Splash Goggles
 Chemical Apron Gloves (Nitrile) Lab Coat
 Respirator (type) Other:

Engineering Controls:

Fume Hood Biosafety Cabinet Glove box
 Vented gas cabinet Other: Store labelled waste jug in the vented cabinet below the northwest fume hood (left of acid cabinet) in 6319. If the waste jug is near 3/4 full, notify the group member responsible for waste disposal. The waste jug should be tightly capped and kept in a secondary container when transported.

Administrative Controls: *List any specific work practices needed to perform this procedure (e.g., cannot be performed alone, must notify other staff members before beginning, etc.).*

Prepare minimal amounts of aqua regia at a time. The total volume of made should not exceed that of the glassware being cleaned. Avoid leaving aqua regia unattended for over 24 hours. Aqua regia should only be used on glass instruments, never metal or plastic.

Task Hazard Control Table: *For procedures involving numerous steps, it may be convenient to indicate specific requirements for individual tasks in the table below:*

N/A

Waste Disposal: *Describe any chemical waste generated and the disposal method used.*

Used aqua regia should be transferred to the appropriately marked jug in Daniels 6319. This jug should always be loosely sealed to prevent pressure buildup and kept in a secondary container within a ventilated cabinet. Thoroughly rinse all used glassware with water after treatment with aqua regia.

Accidental Spills: *Describe the procedure for handling small chemical spills that may occur during this procedure. Note that for large spills it may be appropriate to call 911.*

Contain spill and neutralize with saturated NaHCO₃ solution. Notify others in the laboratory area and Jeff Nielsen (608-712-9145) in the event of a large spill.

Decontamination Procedures (required for PHS use): *Describe the procedure for decontamination of personnel and equipment.*

N/A

Training: *Describe any training needed prior to performing this procedure. Include training performed in-lab and any required demonstrations of competency.*

Training is required. Training is performed by a group CHO or another lab member they have approved. The procedure will be demonstrated at least once and new members will be supervised their first time.

Principle Investigator Approval: I have reviewed this procedure and approved it for use. Note: Modifications to the procedure may require update to this form.

Name: John F. Berry

Signature: _____

Date: _____

Making and Using Aqua Regia

General Tips:

- Aqua regia should be used as a last resort for removing metal-based impurities from glassware. Attempt other cleaning methods specified in the Cleaning labware SOP beforehand. Aqua regia can also have synthetic uses in chemistry involving noble metals, and is prepared/disposed of in the same manner.
- Only use aqua regia to clean glassware. Never use on items made of plastic, metal, etc.
- Keep aqua regia clear of all organic solvents. Thoroughly rinse glassware to be cleaned with deionized water both before and after treatment with aqua regia.

Preparation and Use:

1. Avoid making aqua regia in excess. Determine beforehand how much volume is required and prepare accordingly.
2. Prepare aqua regia in a fume hood by slowly adding 1 volume equivalent of concentrated nitric acid to 3 volume equivalents of concentrated hydrochloric acid in an appropriately sized beaker. Before use, let mixture stand for 1-2 minutes as solution changes from colorless to golden.
3. Place glassware to be cleaned in a secondary container (e.g. a beaker) and pour aqua regia into glassware. If the glassware to be cleaned contains a glass frit, let aqua regia pass through the frit by gravity; never use vacuum filtration to pull aqua regia through a frit.
4. Items being cleaned by aqua regia can be left in a fume hood overnight. Aim for an unoccupied space near the middle of the fume hood to maximize ventilation of the evolving gasses. Avoid leaving aqua regia out for longer than 24 hours as this can begin corroding the monkey bars in the fume hood.

Waste Management:

Transfer used aqua regia to the 4L waste container jug labelled "Used Aqua Regia [and lists metals dissolved]" kept in Daniels 6319. This jug is stored in the ventilated cabinet below the northwest fume hood immediately left of acids cabinet. Add any metals to the label as necessary. Because aqua regia evolves chlorine and noxious gases, this waste jug should be slightly open during storage to prevent pressure buildup. It should also be kept in a plastic secondary container. To prevent corrosion of the plastic secondary container over time, a very wet paper towel can be used to wipe down the outside of the waste jug after filling. If the waste jug is nearly 3/4 full, notify the lab member in charge of chemical disposal. The waste jug should be tightly capped when transported.

In the event of accidents:

Contain small spills and neutralize with saturated NaHCO_3 solution. In the event of a large spill, evacuate the laboratory, notify others in the laboratory area, and contact Jeff Nielsen (608-712-9145).

Remove contaminated clothing or gloves immediately. Rinse skin under cold tap water and seek medical assistance in the event of major acid burns.