

Aqua Regia

Process:

Aqua Regia for noble metal etches and cleaning solutions to remove trace metals and organics.

Materials:

Hydrochloric Acid (40%) and Nitric Acid (70%) in a 3:1 ratio. Sometimes DI water for dilution.

Incompatible Materials:

No Solvents. No metal powders or organic liquids as many explosive and toxic gas emitting incompatibles exist. Watch for splattering and thermal 'run away' when etching metals, combustibles, or oxidizable materials. The first sign of a runaway is an unexpected increase in bubbling, whence you should remove your sample. Mixing with Acetic acid requires special training. Use caution as many other incompatibles exist. Both Teflon and Pyrex labware are ok.

Hazards:

Destructive on contact with human tissues. Though typically apparent immediately, burns may take minutes to become apparent. Harmful Hydrogen Chloride fumes will erupt from the bottle/baths. Certain metals and organics will cause outgas of toxic brown Oxides of Nitrogen or yellow Nitrosyl Chloride. Aqua Regia leaves somewhat persistent hazardous residues. Has many dangerous incompatibles. Expect heating if mixing Aqua Regia into a spent chemical accumulation bottle, and never tightly cap bottles as pressurization and explosion will occur.

Exposure Actions: Do what's below, and then notify NCNC staff within a few hours. For advice, call NCNC Staff.

Eyes: Hold eyes open in running eyewash station for 15 minutes and call 911 as soon as possible.

Skin: Remove splashed clothing, wash for 15 minutes and seek medical aid if irritation persists.

Personal Protective Equipment:

Goggles, face shield, heavy chemical gloves (blue disposable Nitridex)¹, and heavy chemical apron. Aqua Regia leaves somewhat persistent invisible residues, so rinse gloves often.

Acceptable Locations For Use:

Wet process stations 3, 8, 9, 11, 12, acid & base fume hood². If hotter than a simmer, only acid & base fume hood.

Additional Process Notes:

Measure water if necessary and slowly add Hydrochloric acid to water and stir. Then add Nitric Acid to water, and stir³. The solution may turn brown from dissolved oxides of Nitrogen. Heat only after mixing is complete if greater than ambient temperature is desired⁴. Thin films of Aqua Regia are transparent so be sure to rinse your work station after use². Never tightly cap bottles of spent Aqua Regia, which can cause an explosion. Mix a fresh bath each time because it goes bad over a few weeks and is dangerous to store.

Disposal:

Allow to cool, then decant or aspirate to neutralizer. Heavy metal bearing solutions should instead be disposed of in the "Persistently Oxidizing Acids" bottle⁵. Never tightly cap spent oxidizer bottles.

*Additional SOPs available, see: 1. PPE Choice and Cleaning
5. Haz Waste Management

2. Work Station Cleaning

3. Pouring and Mixing

4. Hotplates