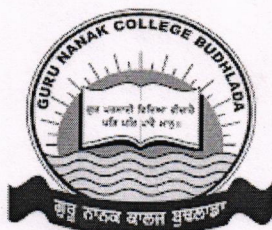


TREATMENT POLICY FOR HAZARDOUS CHEMICALS



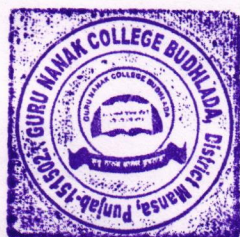
Department of Chemistry **Guru Nanak College, Budhlada**

Practical Information on Neutralizing and Treating Chemicals

Although it is always preferable to use Group 1 disposal techniques, there may be circumstances in which those techniques are impractical due to a lack of the necessary technology or methodologies, or because it is impossible to transport the chemicals or trash. Additionally, before they can be disposed of, many of the chemicals need to undergo some sort of treatment (such as neutralization).

This section offers a thorough compilation and useful information on various techniques for neutralizing and treating chemicals that are appropriate to certain substances or classes of chemicals. Numerous of the "first-choice procedures" described have only been evaluated inside of controlled laboratory environments and are referred to as "laboratory methods" since they are normally utilized for small-scale chemical waste disposal in reputable laboratories. It is acknowledged that not all situations and locales may allow for the application of those techniques. If so, the next best environmentally friendly option, which is listed second or third in the lists below, must be adopted. The specialist's job is to determine which therapeutic approach is most appropriate to use considering the intricacies of a given condition, keeping in mind all health, environmental, technical, and legal issues.

Safety and Health Concerns



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The methods outlined in these instructions should be carried out in accordance with general health and safety regulations. It is acknowledged, however, that this might not always be achievable and that various circumstances need the use of various safety measures. Before chemical neutralization and treatment can begin, precautions must be taken, including making every effort to:

- (a) Confirm that trained persons will be on hand to oversee the treatment and conduct the treatment.
- (b) Assure that the necessary safety gear is accessible, such as
 - (i) nitrile rubber gloves,
 - (ii) full-face respirators, and
 - (iii) chemical-resistant clothes.

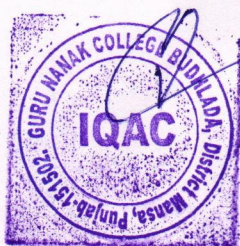
Additionally, the equipment, glassware, and chemicals required for treatment before disposal must to be accessible.

Neutralisation of Pure Acids and Bases

Note that both acids and bases are frequently confiscated at the same time, especially in covert laboratory locations. These seized acids and bases may be used to neutralize one another, taking into account any incompatibilities, provided they are clean. Although it is beyond the purview of these recommendations to compile a comprehensive list of neutralization "partners," it is advised that specific lists of compatible pairs of acids and bases be created, along with the quantities needed for neutralization, based on the substances that are most frequently encountered at the national and provincial levels.

Information about neutralizing acids and bases in a lab setting, including pertinent model calculations.

Unidentified or Unlabelled Chemicals



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Basic tests are needed to identify the qualities of the chemical in question and decide the best manner of disposal in situations when chemical containers are open, labels are missing, or the original manufacturers' seals are destroyed. In this case, presumptive tests that can be performed on-site are beneficial.

Getting Rid of Containers

When discarding containers that had contained chemicals, caution should be exercised. The amount of chemicals that frequently remain in "emptied" containers is not insignificant. Small leftovers in the container, as in the case of flammable chemicals, may be sufficient to produce flammable vapors at or just below the chemical's explosive limit. If the two chemicals are incompatible, ether remains can produce explosive peroxides, and other chemical residues can trigger violent reactions when additional chemicals are put to the container.

Depending on the chemical that was previously contained in the containers, chemical residues should be eliminated by adding base or acid or by rinsing the container with water. The containers should be crushed, compressed, and shipped for material recovery or disposal after being emptied and neutralised, if possible.

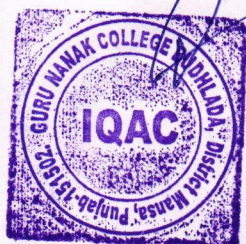
Emptied containers should not be disposed of in the same pit or ditch that is used for the treatment or disposal of chemicals when on-site treatment/disposal is taking place. Waste containers could impede the reaction or cause trench sinking in the case of neutralization.

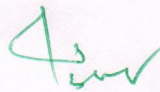
Typical Techniques

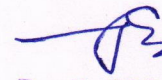
Technique 1: Acids

Discussion: Before neutralisation, always dilute acids at a ratio of around 1:10. To achieve this, progressively aerate the water (never the other way round).

Technique 1.1: Dilute acids 1:10 with water for inorganic acids (such as sulphuric acid) (dilute acids are less dangerous)




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Choose a basic substance, such as calcium carbonate, sodium carbonate, potassium bicarbonate, or calcium bicarbonate. Before using, strong bases (such as NaOH, CaOH, KOH, LiOH, $\text{Mg}(\text{OH})_2$, $\text{Ca}(\text{OH})_2$) must be diluted 1:10 with water.

Neutralization Technique

1. To a solution of the basic substance chosen above, gradually add diluted acid. Always verify pH.
2. Keep going with the procedure until a pH of between 6 and 8 is reached.
3. Use the sewer system to dispose of the neutralized acid, or dig a trench and bury it if you're in a rural place.

Technique 1.2: Particular Acids

Glacial acetic acid (laboratory method)

Use a lot of water to dilute the acid (pH 6-8) with 5% sodium hydroxide or sodium carbonate before disposing of it in the sewer system.

Technique 2: Organic Acids

Burn the diluted organic acid in an organic solvent with a flammability value of 2 or 3.

Oxalic acid (Laboratory Method)

Heating oxalic acid in concentrated sulphuric acid causes it to break down into carbon dioxide, carbon monoxide, and water. When utilising this technique, put on nitrile rubber gloves, a lab coat, and eye protection. Oxalic acid is added to concentrated sulphuric acid in a round-bottom flask in the fume hood (if possible). The mixture is kept at 80–100°C for 30 minutes using a heating mantle. Since just a little amount of water is produced during the decomposition process, the sulphuric acid can be utilised again for the same procedure. If not, let the reaction mixture cool to room temperature before carefully and gently pouring the sulphuric acid into a pail of cold water (or cold water and ice). Next, neutralise the acid with sodium carbonate to a pH of 6 to 8 and dispose of it in the sewer system with lots of water.

Neutralize Acid 1 (NA1) (Laboratory Method)



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Non-oxidizing acids that could produce heat when neutralized

Concentrated acids such as formic, hydrochloric, hydrobromic and lactic acids

1. Mix the acid and water 1:10. (i.e., slowly add acid to water).
2. Neutralize by gradually incorporating 6 N sodium hydroxide solution while continuously stirring.
3. As the temperature rises, add more water.
4. Use a suitable indicator to track pH change, or use pH paper to check periodically.
5. The solution can be disposed of in the sewer system with 18 parts water once the pH is between 6 and 8.

Neutralize Acid 2 (NA2) (Laboratory Method)

Oxidizing Acids, Such as Nitric and Perchloric Acids

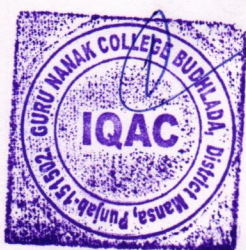
1. To dilute the acid, add 10 parts water.
2. Utilize a potassium or sodium hydroxide 6 M solution to neutralise. As nitric oxide formed during the process of neutralising nitric acid, the solution may turn yellow or brown. A white precipitate of potassium perchlorate will occur if potassium hydroxide is applied. Together with the rest of the solution, this precipitate can be dumped in the sewage.
3. Use pH paper or another appropriate indicator to check the pH.
4. The solution can be disposed of in the sewer system with 18 parts water if a pH of 6 to 8 is obtained.

Neutralize Acid 3 (NA3) Concentrated (57%) Hydriodic acid (Laboratory Method)

1. Add 10 parts water to the dark orange/brown solution to dilute it.
2. Fill bottle with water, then add rinsed water to the remaining solution that needs to be neutralised.
3. Include 6 M of sodium hydroxide or another appropriate base.
4. Since the colour of the solution will interfere with most indicators, track pH changes using pH paper.
5. As pH 7 is approached, the solution will turn nearly colourless. The solution can be disposed of in the sewer system with 18 parts water if a pH of 6 to 8 is obtained.

Technique 2: Bases

Caustic Alkali (e.g., NaOH, KOH) and Ammonia (NH₄)



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Discussions: Base should always be diluted at a ratio of about 1:10 before being neutralised. To do so, gradually add the base to the water (never the other way round).

Due to carbon dioxide absorption, older base solutions frequently effervesce.

Technique2.1: General

1. Alkali 1 to 10 diluted with water (Dilute alkali are less dangerous).
2. Pick a material that is acidic. Strong acids must be diluted 1:10 or more before use, such as hydrochloric acid and sulphuric acid.

NeutralizationProcedure:

1. To a solution of the acidic substance chosen above, gradually add diluted base. Always verify pH.
2. Keep on with the procedure until you reach a pH of between 6 and 8.
3. Add more water to the solution, ranging from 1 to 10.
4. Bury the neutralised base in a trench or, in isolated areas, in the sewer system.

Technique2.2: Neutralize Base 1 (NB1) KOH,

NaOH etc.(laboratory method)

1. A maximum of 2 litres of the alkali solution should be added to 10 litres of water.
2. Gradually pour in a dilute acid solution.
3. Use pH paper to observe pH changes.
4. The solution may be disposed of in the sewer system with extra water once pH 9 has been reached.

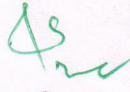
Technique3:Peroxides

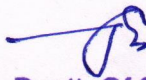
Elimination of peroxides (this method can be used in remote areas, if the solutions are available or in a laboratory setting)

The measures listed below must be taken to get rid of peroxides if the solution tests positive for them:

1. To the solution, add 10 ml of 5% ferrous sulphate aqueous solution, 6 grams of hydrated ferrous sulphate and 6 ml of concentrated sulphuric acid in 11 ml of water, or 3.5 grams of sodium iodide in 70 ml of glacial acetic acid.
2. Continue adding this mixture until the ethyl ether does not test peroxide-positive.




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Note: No attempt should be made to remove the peroxides if the solution looks to have dried crystals on its internal surface or the liquid appears to have slurry of crystals in it.

The container needs to be properly disposed of because it contains hazardous, shock-sensitive materials.

Technique3.1: Ether should be diluted 1:3 with stronger alcohol (such as isopropyl alcohol) or another readily accessible solvent with a flammability rating of 2 or 3.

Technique3.2: (Large quantities or samples contaminated with peroxides)

1. Transport to a safe outdoor location.
2. Use an excelsior train, a slow-burning fuse, or a "det cord" to light the fire.

Technique4: Organic Acid Halides (e.g., acetyl chloride) [Laboratory method]

- ✓ Slowly add the organic acid halide and thoroughly combine in a big container with extra sodium bicarbonate (or calcium carbonate, or sodium carbonate).
- ✓ Dilute with water until the pH is between 6 and 8, then leave the mixture stand for 24 hours.
- ✓ Put waste in the sewer system or, in a rural place, bury it in a trench.
- ✓ Always keep in mind that organic halides and water can react badly.

Technique5: Aldehydes (e.g., Benzaldehyde)

Organic Halogen Compounds (e.g., Benzyl Chloride)

Chemicals that generate peroxides must be tested. If so, peroxides need to be eliminated before disposal as explained in technique 3 above.

Technique5.1:

- ✓ Add the substance gradually to a pit filled with sodium bicarbonate.
- ✓ Burn after covering with scrap wood.

Technique6: Aliphatic Amines (e.g., Diethyl Amine)

- ✓ Add the amine and dilute with a significant amount of water in a sizable container with an excess of sodium bisulphate until the pH is between 6 and 8.
- ✓ Bury in a trench or dispose of in the sewer system in distant areas.

Technique7: Carbon Disulfide



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- ✓ To prevent fire via static discharge, any metal or electrical equipment utilised in this approach, as well as contact surfaces, should be grounded (earthed).
- ✓ Add water to cover.
- ✓ Burn (start a fire with a "det cord").

Technique8: Inorganic Salts (e.g., Aluminum Chloride)[Laboratory Method]

- ✓ To a lot of extra water, add the salt.
- ✓ Add extra soda ash and sodium (calcium) carbonate, and then leave for 24 hours.
- ✓ Remove the aqueous layer, check the pH, and adjust it to a range of 6 to 8 if necessary by adding acid or basic material.
- ✓ Place in sewer along with a lot of water.

Technique9: Oxidizing Agents (e.g., Potassium Permanganate, Hydrogen Peroxide, Sodium Dichromate)

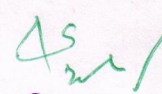
Technique9.1 (laboratory method)

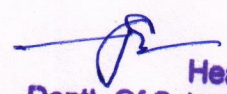
1. A considerable volume of a concentrated solution of sodium hypo-bisulfite (sodium metabisulfite) or a ferrous salt should be treated with an oxidising agent.
2. Utilize diluted sulfuric acid to acidify.
3. When the reduction process is finished (when no more heat is produced), neutralise the solution with soda ash or weak hydrochloric acid.

Technique9.2 (Developed for Potassium Permanganate in Solid State or Aqueous Solutions)

- ✓ Put 450 grams of potassium permanganate in 8.0 litres of water and stir to dissolve.
- ✓ Dig a hole at least 50 feet away from anything that could catch fire.
- ✓ Fill the trench with green leafy stuff (do not use dry or combustible material).
- ✓ Pour the potassium permanganate solution into the trench gradually as shown below:
 - ❖ Change color from purple to brown, little by little.
 - ❖ Adjust the rate of pouring so that all of it browns since heat may be produced.




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- ❖ Keep an eye on the outcome; you might need to add more green leafy material.
- ❖ Keep an eye out for the purple color to fade (the reaction is over).
- ❖ Pour water into the trench. Add more leafy stuff if purple is the color.
- ❖ When finished, fill the trench with earth.

Note: Sulphuric acid and potassium permanganate are frequently discovered together in distant regions. If the sulfuric acid is sufficiently diluted, the above procedure may be employed!

Technique9.3: Special Procedures for Calcium Hydroxide, Hydrogen Peroxide & Potassium Permanganate

1. Acidify with diluted sulfuric acid to pH 2.
2. Increase the amount of aqueous sodium bisulfite by 50%.
3. If the temperature doesn't start to rise, add more sodium bisulfite.
4. Change pH from 6 to 8.
5. Bury in a trench or dispose of in the sewer system in distant areas.

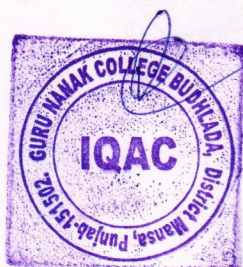
Technique9.4: Sodium Dichromate (Laboratory Method)

- ✓ 5g/100ml of solid dichromate should be added to a container of water. (The maximum batch size is based on the size of the glassware that is readily available.)
- ✓ To get a pH of 3, acidify with diluted sulphuric acid (about 40-60 ml).
- ✓ Add solid sodium thiosulfate slowly while stirring, roughly 15g per 100ml batch, until the solution turns hazy and blue in colour.
- ✓ Add sodium carbonate to the solution to neutralise it. A blue-gray flocculent precipitate forms after a short period of time.
- ✓ The fluid may be flushed down the drain.
- ✓ The solid waste should be dried, packaged, labelled, and disposed of after being washed in hot water to remove any sodium sulphate.

A. OrganicChemicals:

Activated carbon

Sugars and sugar alcohols Starch



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Citric acid and its Na, K, Mg, Ca, NH_4 salts Lactic acid and its Na, K, Mg, Ca, NH_4 salts
Urea¹

B. Inorganic Chemicals:

Silica Sulphates: Na, K, Mg, Ca, Sr, NH_4 Phosphates: Na, K, Mg, Ca, Sr, NH_4 Carbonates:
Na, K, Mg, Ca, Sr, NH_4

Oxides: B, Mg, Ca, Sr, Al, Si, Ti, Mn, Fe, Co, Cu

Chlorides: Ca, Na, K, Mg, NH_4 Borates: Na, K, Mg, Ca

¹The preferred option for disposal of urea, if pure/not contaminated, is use as fertilizer. Urea should not be used for neutralization of acids; it reacts with sodium hypochlorite to form nitrogen trichloride, an explosive.

C. Tablet Excipients

Typical tablet excipients, binders, dyes and cutting agents are classified as non-toxic and can be disposed of in a landfill. Inorganic pigments, such as cadmium orange (CdS) should be disposed off carefully in excess of water.

Technique 11: Arsenic, Antimony and Bismuth Compounds

The slurry should then be sealed up and dumped at a hazardous waste landfill in line with all relevant regulations. The beverage ought to be dumped in the sewer with a lot more water than usual.

Technique 12: Alkali Metals (Laboratory method)

- ✓ Metal alkoxide and hydrogen are produced when small amounts of the metal (about 1 gram) are allowed to react slowly and under controlled conditions (for instance, in a cooled reaction flask) with an alcohol (e.g., ethyl alcohol).
- ✓ The atmosphere is filled with hydrogen gas.
- ✓ The alcohol is then heated to a very low temperature and the metal alkoxide is hydrolyzed with water, producing metal hydroxide and alcohol, which is then disposed of in the sewer system.

Technique 13: Aqueous Solutions of Water-Miscible Flammable Organic Solvents (e.g.,



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Solutions of less than 18% Acetone, Ethanol, Methanol and other Water-Soluble and Water-Miscible Solvents)

Technique13.1: (Laboratory Method)

Following the instructions in municipal rules, the majority of aqueous solutions can be dumped in the sewage.

Technique13.2: The organic solvent should be poured onto an absorbent medium, such sand, and allowed to evaporate.

Technique14: Iodine (Laboratory Method)

1. If feasible, cautiously add iodine to a sodium thiosulfate solution (300 ml of 4%), which also contains sodium carbonate, in the fume hood (0.1 g).
2. Stir until the iodine has completely dissolved (solution is colourless).
3. Use sodium carbonate to neutralise the solution to a maximum pH of 8.5 (if pH larger than 9, iodine will re-dissolve).
4. When the reduction is finished, neutralise the mixture by adding sodium carbonate or diluted hydrochloric acid.
5. Place waste in the sewer system with extra water.

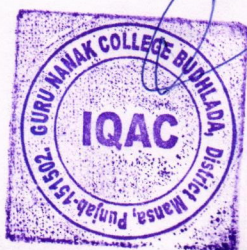
Technique15: Sodium Hypochlorite (Laboratory Method)

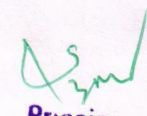
- ✓ Add a significant amount of bisulphite or a ferrous salt to the sodium hypochlorite solution and acidify with diluted sulphuric acid.
- ✓ Add soda ash or diluted hydrochloric acid to the solution to neutralise it when the reduction is finished.
- ✓ Dump the waste into the sewer system with a lot of extra water.


Technique16: Compressed/Liquefied Gases

Technique16.1: Gases and liquid gases shouldn't be transferred; instead, they should be left in their original containers and delivered to a professional disposal business.

Technique16.2: A professional may also slowly expel gases to the air in a secure environment.




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