

Cleaning Bonsai Pots

By Mark Wallerich, January 2025

Introduction -

Cleaning bonsai pots after use is actually essential, not only to prevent disease transfer, but also to get rid of the calcium deposits (deposits of calcium and magnesium) that normally build up due to mainly hard water or other reasons. These deposits are also known as limescale, scale, or mineral deposits. The deposits are mostly a neutral to basic (opposite of acidic) and can only be removed chemically or manually with acid, soap, scrubbing, or all combinations. This paper will detail some of the ways that these deposits can be removed from a variety of different types of bonsai pots. Note that not all combinations of cleaning the pots or pot materials have been tested.

❖ Safety -

When using acids and bases, it is essential to prepare yourself and the work area, to deal with these nasty chemicals that can cause permanent injury to your eyes, lungs and skin. Most of these chemicals are toxic if swallowed, dangerous to the touch, and harmful in concentrated forms. You must work in a well ventilated area, preferably outside. You must wear chemical resistant gloves (Nitrile), eye protection, and clothing protection as needed. Breathing protection is also recommended if you are working in an enclosed space or do not have very good ventilation.

- **Gloves** - Prolonged skin contact can cause severe irritation or even burns. Chemical Resistant heavier duty Nitrile Rubber Gloves are generally available and are recommended. The gloves should at least come half way up your arm to the elbow. Other compounds like Latex and Butyl Rubber Gloves are not recommended.
- **Eye Protection** – Exposure (vapor) can cause irritation and eye burns. Direct contact with the eyes (splashing) can cause irreversible damage, including blindness. Goggles that prevent vapor transfer are preferred, but if working outdoors, regular safety glasses/goggles are OK to protect against chemical splashing.
- **Clothing Protection** – Prolonged skin contact can cause severe irritation or even burns. Prolonged clothing contact will damage and destroy the clothing. It is recommended to use a chemical apron, preferably nitrile coated cloth, to prevent chemical burns and protect your clothes.
- **Breathing Protection** – Inhalation may cause irritation of respiratory tract, coughing, and/or shortness of breath. If you are using breathing protection, a mask that has activated charcoal filters is recommended.

❖ Chemicals and supplies -

Acidic Toilet Bowl Cleaner - Acidic Toilet Bowl Cleaner (Zep Brand from Home Depot; Ace hardware also has an Acidic Toilet Bowl Cleaner), Zep Brand contains 10% Hydrochloric acid and 3% Sulfamic acid and is fairly corrosive and toxic. Use full strength with paint brush application.

Cleaning Vinegar - Vinegar is a dilution of acetic acid, aka ethanoic acid. For general household cleaning, there is a concentrated vinegar (sometimes available in hardware stores) that is 30% or more acetic acid. Acetic acid is not a very aggressive acid, but it can irritate skin, irritate lungs, damage your eyes and can damage clothes. Use full strength.

Calcium Lime and Rust Remover - Calcium Lime and Rust Remover (CLR, ZEP, various) is a general Multi-Use Household Cleaner for cleaning bathtubs, toilet bowls, sinks, and other surfaces. Use full strength. CLR contains Lactic Acid, Lauramine Oxide, Gluconic Acid, Tripropylene Glycol n-Butyl Ether (percentage

is proprietary). This cleaner is not particularly aggressive, but it can irritate skin, damage your eyes and can damage cloths.

Trisodium phosphate - Trisodium phosphate (TSP) is a mixture of soda ash and phosphoric acid. TSP is a general multi-use industrial cleaner (soap) for cleaning just about anything that would normally require much more caustic and poisonous chemicals. TSP can be supplied as a powder or liquid. TSP does not create any fumes. TSP can be acquired at many hardware stores.

Orange/Citrus Soap Type Cleaner - Orange Cleaner is a general multi-use household cleaner for cleaning just about anything. This cleaner is pretty good at cleaning a lot of dirt, oils, etc. from surfaces. This cleaner is not particularly aggressive, but it can irritate skin or damage your eyes.

Abrasive Eraser - An abrasive eraser is basically an abrasive rubber loaded with very fine sand. The product tested for doing this is Sandflex abrasive block in coarse or medium grades (from Stone Lantern <https://stonelantern.com>). Note that Stone Lantern shipping rate is \$9.95 for orders up to \$199.99 and free for \$200.00 or more.

Pumice Scouring Stick - Pumice Scouring Stick (grocery store; for cleaning calcium deposits from sinks, bath tubs and toilets) is a light pumice and is safe to use on glazed and non-glazed pots.

Concrete Mixing Tubs - Two would normally be needed (Home Depot). One for cleaning the pots and one for rinsing or neutralizing the acid. The tubs are normally black Polypropylene (PP).

Plastic bowl – A Plastic bowl made of High-density polyethylene (HDPE) or Polypropylene (PP) identified as a 1, 2, or 5 in the triangle on the bottom (do not use any other numbers).

Nylon brush - Nylon scouring brush to scrub the acid into the calcium deposits.

Paint Brushes - Cheap Nylon or natural paint brushes to paint the acid on the calcium deposits.

Baking Soda - Baking soda would be used for neutralizing acid. The powder can be sprinkled directly on the acids to neutralize them. It can also be used in the neutralizing tube for rinsing the acids.

❖ Chemical Reactions –

- When acetic acid (vinegar) and baking soda (sodium bicarbonate) are mixed, they undergo a chemical reaction that produces water, carbon dioxide, and sodium acetate (a salt) ($C_2H_3NaO_2$).
- When hydrochloric acid (HCl) and baking soda (sodium bicarbonate, $NaHCO_3$) react, they undergo a neutralization reaction, producing carbon dioxide, water, and sodium chloride.
- When calcium metal (the deposits) reacts with hydrochloric acid, it produces calcium chloride ($CaCl_2$) and hydrogen gas (H_2). Chemical equation: $Ca + 2HCl \rightarrow CaCl_2 + H_2$. Hydrogen gas is flammable, so no smoking or flames around your work area.
- When hydrochloric acid (HCl) comes into contact with mica, no significant chemical reaction occurs. Mica is considered a very inert mineral and generally does not react with most acids.
- When hydrochloric acid (HCl) comes into contact with stoneware or ceramics with the concentrations noted herein, no significant chemical reaction occurs. For the most part, glazed and non-glazed bonsai pots are inert to the acids in this paper.
- Trisodium phosphate (TSP) can be harmful to the environment because it can cause algae blooms and deplete oxygen levels in lakes and rivers. This can harm aquatic plants and animals. Do not dispose of TSP in any area that runs into the water or sewer supply.

❖ Cleaning Ceramic and Glazed Pots -

Most earthen and stoneware bonsai pots can be cleaned by these methods. Some custom earthen ware pots might be affected by strong acids. Soaps, cleaners, and the acids noted herein, can remove paint and other decorations to glazed and non-glazed pots. These types of pots were not tested and there may not be a good way to clean them. Check a small spot on the bottom or inside to insure no damage and compatibility. Use a concrete mixing tub for cleaning the pots and containing the acid and one for rinsing or neutralizing the acid. Also, the chemicals used are more effective when warm (room temp.).

Method 1 –

For light deposits on pots, the pot can be scrubbed with the abrasive eraser (Sandflex) or the pumice scouring stick. It is better to do this dry so that you can see your progress. If you want to do this wet, use water or household vinegar (3 to 5%) or citric acid (lemons, oranges, grapefruit, etc.). Let it soak for a while to loosen up the deposits. After the work is done, scrub the pot again with soap and water and wipe dry. Note that you could end up using a lot of pumice scouring sticks. The abrasive eraser lasts a lot longer. This is the safest method so far. This method can also be used after the acid cleaning and before subsequent final cleaning. **Minimum safety requirements should be gloves.**

Method 2 –

This is used for medium deposits on pots. With the household cleaning +30% vinegar, pore some vinegar into a small bowl and paint it on the affected areas. Let it soak for a while (30 minutes or more), to loosen-up/dissolve the calcium deposits. Scrub the affected area with the nylon scouring brush, pumice scouring stick or the abrasive eraser to scrub away the deposits. Reapply the vinegar and repeat the process until you cannot see any more calcium. Rinse with water to neutralize the acid and let dry. Sometimes the pot can be scrubbed dry with the abrasive eraser to remove any residuals noted. Scrub the pot again with soap and water and wipe dry. Repeat if necessary. The used acid solution should be neutralized with baking soda before disposal. **Minimum safety requirements should be gloves.**

Method 3 –

This is used for medium to heavy deposits on pots. With the household cleaning +30% vinegar, submerge unglazed and glazed pots in the vinegar and soak it for extended periods to remove the calcium deposits. Inspect the pot occasionally to check on the calcium removal. This can take up to 30 days. After cleaning, soak the pot in water for 30 minutes minimum to neutralize any remaining acid. Sometimes the pot can be scrubbed dry with the abrasive eraser to remove any residuals noted. Scrub the pot again with soap and water and wipe dry. Repeat if necessary. NOTE –The household cleaning vinegar vapors are kind of obnoxious. **Minimum safety requirements should be gloves, goggles and maybe breathing protection. Clothing protection could also be used.**

Method 4 –

This is used for medium to heavy deposits on pots. This method would primarily be used for glazed and non-glazed pots that are not decorated with paint or other applied decorations. With the acidic toilet bowl cleaner, pore some into a small bowl and paint it on the affected areas. Let it soak until it stops bubbling (5 to 15 minutes). Scrub the affected area with the nylon scouring brush, abrasive eraser or pumice scouring stick to scrub away the deposits. Repeat the process until you cannot see any more calcium. Soak the pot in a baking soda/water tub to neutralize the acid, then rinse with water and let dry. Repeat if necessary. Sometimes the pot can be scrubbed dry with the abrasive

eraser to remove any final residuals. Scrub the pot again with soap and water and wipe dry. After the work has been completed, the used acid solution should be neutralized with baking soda before disposal. **Minimum safety requirements should be gloves, goggles and maybe clothing protection.**

Method 5 -

This method would primarily be used for glazed and non-glazed pots that are not decorated with paint or other applied decorations. With the Trisodium Phosphate (TSP) powder, mix according to instructions for the industrial/stronger solution. Submerge the pot in the TSP and let it soak for an extended period of time (can be a week or more). Scrub the affected area with the nylon scouring brush, abrasive eraser or pumice scouring stick to scrub away the deposits. Repeat the process until you cannot see any more deposits. Rinse with water and wipe dry. Check for deposits and repeat if necessary. After the work has been completed, neutralize the TSP with a lot of water and dispose it in a manner that will not get into a water system or lake. **Minimum safety requirements should be gloves.**

❖ Cleaning Mica Pots (from Korea) -

Mica pots are made of mica powder and plastic. Methods 2, 3, 4 and 5 from above can be used for cleaning the pots, except the pumice scouring stick and the abrasive eraser should not be used. Scrubbing the pot seems to be safer using the nylon scouring brush. Both the pumice scouring stick and the abrasive eraser abrades the surface.

❖ Cleaning Plastic Pots -

Do not use a pumice scouring stick or the abrasive eraser on plastic pots, as this will scratch the surface. If the pot is identified on the bottom with the type of plastic as High-density polyethylene (HDPE) or Polypropylene (PP), then you can use the chemical removal methods 2, 3 and 4. If there is no plastic identification on the pot, it might be damaged by hydrochloric acid, so use method 2, 3 or 5, but it should be tested in a small spot first. If there is any damage, do not use that method. Try cleaning with soap and water, Orange Cleaner, or CLR. **Minimum safety requirements should be gloves.**

Tested results so far –

- **Method 1** – Not very effective on any pots with medium to heavy deposits and can be very labor intensive. The Sandflex abrasive block in course or medium grades works best (tested was the medium grade). The pumice scouring stick does work, but it abrades away very quickly. Using the abrasives on mica pots does roughen the surface and removes some material.
- **Method 2** - Using the concentrated vinegar works better than method 1. The vinegar is more effective when warm (room temp.) but also smells a lot. The abrasive block or pumice scouring stick is not affected by the vinegar.
- **Method 3** - Soaking the pots for extended periods of time using the concentrated vinegar seems to work better than method 2. The vinegar is more effective when warm (room temp.) but also smells a lot.
- **Method 4** – This is the most effective and least costly method for the glazed and non-glazed pots for medium and heavy deposits. Followed up with using the abrasive eraser dry and soap/water wash.

Vapors from the acidic toilet bowl cleaner were not too noticeable. Muriatic acid diluted 3 to 1 can be substituted but protect from vapors.

- **Method 5** – Trisodium Phosphate (TSP) is a soap, as a result it does not actually dissolve the calcium deposits. It gets underneath the deposits to lift them off the surface. This method has not been confirmed as it was too cold outside to get a proper reaction. No particular vapors were noted.

❖ **Observations and Final Thoughts –**

- The chemicals and cleaners used here are more effective when at room temperature or warmer.
- Regardless of the method used and after the deposits are removed, the pot should be scrubbed with soap and water to remove any residuals and wiped dry.
- Some of the pots used for this testing have had bonsai in them for one to more than 20 years, so the deposits can be quite substantial. Some of the mica pots tested were used for +30 years and show some surface degradation and aging from weathering. Some very heavy deposits can be chipped off.
- Using power tools (die grinder, drill, etc.) with a grit abrasive wheel or a rubber with grit wheel should not be used. It is too aggressive. Sand blasting using glass beads at low pressure is not cheap or recommended.
- Using a pressure washer with a soap/water mix might work but might damage painted pots and other decorations.
- Scrubbing using steel wool, metal scrubbing pad, or using a metal brush is not advised as there is a good chance that you can leave metal in the surface of the pot which is difficult to remove and can rust.
- A scotch bright pad for metal (reddish color) should not be used on glazed pots as the grit is very hard and can scratch the surface; use on unglazed pots should be OK.
- **NOTE** - Calcium Lime and Rust (CLR) remover changed their formula a while ago. As a result, the cleaner is not quite as effective as it once was, but it still works pretty well.
- **NOTE** – The Pumice Scouring Stick abrades away quickly and is not affected by the acids used here. The abrasive eraser (Sandflex course or medium grades) lasts a lot longer and does not seem to be affected too much by the acids noted.
- **NOTE** - It has been noted that citric acid (lemons, oranges, grapefruit, etc.) can be used also to dissolve some of the deposits. This would be used in method 1.
- **NOTE** – None of the painted or decorated glazed and non-glazed pots were tested. Although, one old grey textured non-glazed pot lost a bit of patina with the pumice scouring stick.
- **NOTE** – For final removal of deposits, the most effective way was to use the abrasive eraser dry on glazed and non-glazed pots.
- For some of the deposits that the acid or other cleaning methods does not completely work, final cleaning in the dish washer, calcium lime and rust remover (CLR or similar), orange/citrus soap type cleaner, trisodium phosphate (TSP) or with soap/water soak and brush scrub might take off the last bit of deposits. Be careful with the dish washer and plastic pots as the heat can melt the pot.
- If you are careful, you can use a dremal tool to abrade away some stubborn spots using a rubber with grit abrasive wheel.
- These are all possibilities that work, but should be tested first. Other cleaning methods and cleaners may be used, but it should be tested first to insure no damage and compatibility.

❖ References –

- Occupational Safety and Health Administration (OSHA) Safety Standards.
 - Book - Materials Selector Book by Materials Engineering, 1985 to present
 - MSDS (material safety data sheet) for CLR Bath & Kitchen Cleaner
 - MSDS (material safety data sheet) for Zep Brand Acidic Toilet Bowl Cleaner
 - Google AI Overview generation with “Pool acid”, “White vinegar”, “Camellia oil”, “Trisodium Phosphate (TSP)”, “triangle identification of plastics containers”, “What is the deposits from hard water”, and “environmental of Trisodium phosphate”.
 - Google AI Overview generation with Chemical reactions of “acetic acid and baking soda”, “hydrochloric acid and baking soda”, “hydrochloric acid and Mica”, and “chemical reaction hydrochloric acid and stoneware pots”.
 - Discussions with Phoenix Bonsai Society members who have had success in removing the calcium deposits.
 - Experience with acids and bases in a metallurgical lab for 1 ½ years.
 - Key points about plastic triangle identification on plastic items:
 - Number 1 (PET): Polyethylene terephthalate, often used in water bottles (quite often Polypropylene is identified as 1).
 - Number 2 (HDPE): High-density polyethylene, commonly used in milk jugs and some juice containers.
 - Number 3 (PVC): Polyvinyl chloride, not recommended for food contact due to chlorine content.
 - Number 4 (LDPE): Low-density polyethylene, found in plastic bags and squeeze bottles.
 - Number 5 (PP): Polypropylene, often used in yogurt containers and some food storage containers.
 - Number 6 (PS): Polystyrene, commonly found in Styrofoam.
 - Number 7 (Other): Any plastic not included in the previous categories, often polycarbonate.
- NOTE – This is mostly followed by manufacturers but not always. When in doubt, use the letters/abbreviation under the triangle. HDPE and PP are safe to use for acid/base exposure, other plastic designations are not completely safe to use. Strong acids and bases will harm a lot of plastics.