



Range of colours achieved
by differential heating



Pale gold LOS patina
with lacquer sealant

ABOUT LIVER OF SULPHUR

Liver Of Sulphur can be used to create beautiful iridescent colours on fine or sterling silver, from the palest gold as on the leaf above right to a deep blue-black.

Liver of Sulphur is the alchemists' name for a chemical mixture that is produced by heating potassium carbonate with sulphur and was made as long ago as 776AD by the celebrated Arab alchemist Jabir Ibn Hayyan. It is not a true compound but a metastable mixture of potassium polysulphides and potassium sulphate. (K_2S , K_2S_2 , K_2S_3 , K_2S_4 , K_2S_5 , K_2SO_4). Since the end point of the reaction used in Liver of Sulphur production varies from batch to batch, the exact constituents of Liver of Sulphur also vary from batch to batch.

While the range of colours possible in the treatment of silver with Liver of Sulphur is known (pale to deep gold, green, blue, magenta, purple, blue-black) the actual outcome of any single application is highly variable and depends on:

- the composition of the Liver of Sulphur, which can vary within the same batch
- strength of the mixture
- temperature
- the type of water used (distilled or tap water)
- length of time the piece is treated
- composition of the metal being treated (sterling reacts differently from fine silver)

These variables make it virtually impossible to predict or duplicate the outcome unless only the deep blue-black is desired, and it may be necessary to clean the piece and re-apply the treatment to get a satisfactory result.

Liver of Sulphur is affected by light and moisture so has a limited shelf life. The lump form lasts longest (which can be years if it is properly stored), flake form the next longest and the liquid form lasts the shortest time of all. Once made up into a dilute solution it is good only for a few days at best.

The diluted solution of Liver Of Sulphur is no longer useable when it loses both its colour and smell.

Provided the quantity is small, spent solution can be further diluted then poured down an outside drain, such as the one for your kitchen sink, followed by flushing with generous amounts of water.

HOW TO USE LIVER OF SULPHUR

** First of all read the **Safety Information** at the end of this handout

** Make sure you wear gloves and have good ventilation before starting. It is a good idea to wear long sleeves as well.

Almost everyone who uses Liver of Sulphur has their own way of doing it, and there is more than one way to achieve a desired effect. As with most chemical reactions, the higher the temperature the faster the reaction. LOS can be used up to temperatures approaching boiling point, but the hotter the water the more hydrogen sulphide gas is given off. This gas is TOXIC so good ventilation is essential. LOS is also a powerful irritant to the skin so covering any exposed skin is a good idea.

THE BASIC RECIPE

- 1 small piece of liver of sulphur, about 6mm in diameter (slightly larger than a peppercorn) or liquid LOS
- 500 ml hot distilled water - it is perfectly acceptable to use tap water or bottled mineral water but be aware that minerals in them may affect the colour of the result.
- 1 tablespoon (15ml) clear household ammonia (optional) and/or
- 1 teaspoon (5ml) pure salt (sodium chloride) (optional) - it is perfectly acceptable to use iodised table salt, sea salt or iodised salt but be aware that they may produce variable results

You will also need:

- Small bowl of clean hot water
- Small bowl of cold water - iced if possible
- Small glass bowl for mixing up the LOS solution
- Soft toothbrush
- Washing up liquid
- Kitchen towel
- Tweezers or a short length of wire

The piece to be coloured must be perfectly clean and preferably finished to a mirror finish where patina will not be required. It is easier to remove unwanted patina from a mirror finish than from a textured one, even if the texture is satin. Scrub the piece thoroughly with washing-up liquid and the toothbrush under running water, being careful not to touch the areas to be coloured (grease from your fingers will affect the reaction and lead to uneven colours).

Colours can sometimes be intensified by dipping or brushing the surface with methylated spirits before applying the LOS.

DIPPING METHOD

1. Add the hot water to the lump of Liver of Sulphur OR add a few drops of liquid LOS to the hot water, add the ammonia and/or salt if used and stir until the LOS is dissolved. The resultant solution will be very pale yellow and smell of rotten eggs. The smell is hydrogen sulphide gas so do not bend over the container.
2. Use a short piece of wire to make a handle to hold the piece, or hold it in tweezers.
3. Immerse the piece in the hot water and blot it dry quickly on kitchen towel. Alternatively, warm it with a hairdryer or place it on a cup warmer for a minute or two to warm up. Heating the piece before dipping it ensures that it is the same temperature everywhere and avoids differential heating when the piece is dipped.
4. Dip the piece into the LOS solution and remove it immediately to the bowl of cold water to stop the reaction. You should see an immediate colour change which may be pale yellow or a darker colour - it all depends on how hot and how strong the solution is.
5. Wash the piece in soapy water and rinse well.

Repeat from step 3 until you have achieved a colour you like.

Use fine polishing papers or metal polish to remove patina from areas to be left uncoloured.

Polish the patina to a sheen by buffing very gently with a soft cloth. Too much buffing, or too hard will remove the patina.

If you have not taken the colour to blue-black it will continue to darken as a result of contact with sulphur compounds in the atmosphere. You can prevent this by polishing the patina with beeswax or museum wax, or by applying a protective layer of lacquer or acrylic sealant.

PAINTING METHOD

Follow the steps as for the dipping method but at step 4 use a paintbrush to apply the LOS solution to the selected area.

MASKING METHOD

You can prevent patina from developing by painting selected areas with nail polish or a permanent marker and letting it dry before using the dipping method. The nail polish/marker ink acts as a resist and is subsequently removed by cleaning the piece with acetone or an acetone nail polish remover on a cotton bud.

ABOUT GOLD

Liver of Sulphur will not affect fine (24ct) gold, so is perfect for emphasising areas gilded by Keum Boo or application of Accent Gold for Silver™. It will however colour carat golds to a darker shade (which can be polished off).

STORAGE

Keep your Liver of Sulphur stored in a cool, dark place. Lump Liver of Sulphur is best stored in a plastic bag with a desiccant sachet inside an airtight plastic container and if correctly stored will remain effective for 2 years or more.

TROUBLESHOOTING

- Patina flaking off** The solution was too strong or the piece was left in it for too long. You can get the deep blue-black by long soaking or by using a strong solution, but this results in a thick layer of patina. It is better to use a weaker solution and multiple dippings, with rinsing in between dippings, and build up the colour gradually.
- No colour change at all** If lump LOS has turned grey or liquid LOS has lost its colour and smell then it has become ineffective and should be disposed of.
- You hate the result** Refire the piece either in a kiln or with a torch. This will remove the patina.
- Colours have gone too far** Refire the piece either in a kiln or with a torch. This will remove the patina, and you can repolish the piece before trying again



LIVER OF SULPHUR SAFETY INFORMATION

Chemical Name	Sulphurated Potash; Liver of Sulphur
Formula	Mixture of potassium polysulphides and potassium thiosulphate
Physical Data	Very soluble in water.
Appearance and Odour	Yellowish-brown lumps or dark orange-red liquid. May discolour on exposure to air and light. Odour of hydrogen sulphide.
Reactivity	Decomposes in air to free sulphur and potassium carbonate turning yellow to grey. Incompatible with acids, oxidizers, alcohol, carbonate water.
First Aid	CONTACT - wash contact area thoroughly with water. If eye irritation persists, see a doctor. If swallowed, give water or milk and induce vomiting. INHALATION - remove to fresh air, give oxygen or respiration as needed. Get medical assistance. Launder clothing before reuse.
Spills and Leaks	Sweep up spill and collect for disposal. Ventilate area. Wash spill area thoroughly with water. Disposal to hazardous waste.
Stability	Stable, but flammable. Dust may form an explosive mixture with air. Incompatible with strong acids, alcohols, strong oxidizing agents, strong reducing agents, combustible materials, halogenated hydrocarbons.
Toxicology	Harmful if swallowed or inhaled. Severe irritant. Toxic gas (hydrogen sulphide).
Risk phrases	Harmful by inhalation Harmful if swallowed Irritating to eyes Irritating to respiratory system Irritating to skin
Transport Information	Materials liable to spontaneous combustion
Personal protection	Gloves, safety glasses, adequate ventilation.