



Aerosols and their use in conservation

What is an Aerosol ?

Aerosols are so called colloidal systems of gases with very little solid or liquid particles with a size of 10^{-7} – 10^{-3} cm dispersed in them.

If this dispersed particles are solid – you call it smoke,
if the dispersed particles are liquid – you call it fog.

Because of their size, Aerosols are able to penetrate even very compact structures, what is a useful characteristic.

But because of its size Aerosols are also (as well as particulate matter) respirable and therefor can be harmful if you use anything other except special medicine or distilled water.

So when using Aerosols in conservation and working with glues or alcohol-water-mixtures a suction-unit or at least a mask (FFP3 / P3) should be used to prevent from harmful particles.

How to produce Aerosols ?

Besides natural sources of Aerosols they can be produced artificial – and one of the possibilities to produce them is by using an ultrasonic membrane.

Thereby a liquid is brought into waves by an elektric oscillator whereby capillary waves are produced on the surface of the liquid.

With rising oscillation amplitude the capillary waves increase and at least very little drops are lined out at the top of the waves.

If you now capture these little drops with an airstream you have an Aerosol.

How are Aerosols used in Conservation ?

Aerosol are used for

- Consolidation of flaking or powdery paint-layers – like Aquarells or Gouaches, when the solvents of the colours are evaporated and the pigments lay more or less lose on the surface, always be in danger to be lost – or when you have craquelling surfaces and colour-slices are in danger to get lost.

- Dampening parts of an object or dampening a whole object by using distilled water and spreading the Aerosol over the surface – totally or partially – or fill a chamber with Aerosol and place the Object in the Chamber for several hours.
- Removing water-solvable glues by swelling them with cold or warm Aerosol of distilled water and removing them from the surface mechanically.
- Removing watersoluble stains from the surface by etching them with distilled Water-Aerosol and removing them with blotting paper.
- Bringing alkaline solutions to the surface to deacidify Paper.
- Using coloured Gelatine to consolidate and at the same time retouche gelatine-fotographs.
- Use Hydrogen Peroxide to bleach Paper locally.

Using Aerosols for Consolidation in conservation:

The most popular application of Aerosols in conservation is consolidation of paint-layers – whereby it is not only used in Paper-Conservation but also very often in Picture-Conservation, Fresco-Conservation and even by handling with sculpture or stone.

Consolidation-solutions which can be used are:

- Methylcelluloses in distilled water, 0,5% max.
- Gelatines in distilled Water, 1,0 – 1,2% max.
- Wheat-Starch in distilled Water, 1,0% max.
- Issing-Lass in distilled Water, 1,0% max.
- Klucel G or Klucel E in Isopropanol, 0,5% max, for Leather-Consolidation (possible if tubes are chemically resistant against the alcohol and ONLY by using a suction unit !!)
- Funori (japanese alga) in distilled Water, 0,1 – 0,2% max.

Do not use liquids with a higher concentration than mentioned above !

This is because a liquid can only be brought into ultrasonic waves to produce Aerosol-drops when having a certain liquidity and surface-tention.
Higher concentrations of a glue will make the liquid jelly-like and Aerosol is not produced.

It is sometimes useful to use a DistilledWater-Ethanol-mixture of 1:1 because Ethanol makes the humidity penetrate better. But then use a suction unit !

Never use any solvent like Acetone, Ethylacetate, Toluol, Benzol etc. !!

This because of 3 facts:

1. Aerosols are respirable – and therefore you would respire solvents which is definitely harmful. Even suction-units can not totally prevent you from harm !
2. Some solvents – like Acetone – collect at the bottom of a room by spreading them as Aerosol and they are explosive when collecting !! Only a very little spark or electric spark (like activation a light switch) is enough to make the air-Acetone-mixture explode !
3. The tubes are not solid against solvents.

What is the great advantage of using Aerosols for Consolidation ?

Besides using Aerosols you can consolidate Colours with a brush bringing the consolidation-solution to the surface.

But the disadvantage of using brushes is, that you bring a relatively big amount of solution to the surface.

First of all this can cause water-stains / solution-stains on the surface which are non-reversible.

As colour-layers that have to be treated are dry and open-porous they are easily and quick sucking the solution out of the brush because of their capillary characteristic.

But if too much of the consolidation-solution is spread over the surface, the solution will fill the open pores of the colour-surface totally.

If the surface-pores of a colour is filled, you cause a non-reversible change (you could even say a damage) because it makes the colour appear darker and glossy.

This is because light rays are now not absorbed by the colour surface in the same way as it was before the consolidation but is somehow reflected in another way and therefore gets darker and glossy.

Using an Aerosol for consolidation in contrast is preventing the surface from changing and therefore also the colour from changing.

This is because the very little particles of an Aerosol penetrate the surface easily and deeply – but without filling the pores.

The Glue-particles only built very small bridges between the pigment-particles among themselves and between pigments and surface.

So no change is to be seen.

How long is Aerosol already used in conservation:

In 1990 Stefan Michalski was developing the method to use Aerosols in consolidation of colours on ethnographic Objects at the Canadian Conservation Institute by using a Ultrasonic-Steam-Dispenser.

In 1993 Marilyn Kemp-Weidner was developing and using a selfmade “moisture-Chamber / Suction-Table – Unit” to treat watersensitive Objects in combination with the treatment developed by Michalski.

In 1995 Anne F. Maheux is modifying the Ultrasonic-Steam-Dispenser of Michalski and using it for consolidation of Gouaches.

How to work with the RECOLO 1000 - Consolidation Step by Step

- When working with bigger amounts of consolidation-solutions or with distilled Water – fill the liquid directly to the nebulizer-chamber – 125 ml min. - 625 ml max.
- When using only a small amount of consolidation-solution – fill the liquid into one of the small beakers. Fill the mainchamber with distilled Water and put the beaker into the distance-ring. Be sure, that the distilled water in the main chamber covers the bottom of the beaker – because only then the ultrasonic waves are transferred from the distilled water to the bottom of the beaker and so to the liquid in the beaker – and the liquid in the beaker is then nebulized.
- Place the airtube and the Aerosoltube to the device.
- If using only distilled water or Methylcellulose or Klucel or Wheatstarch - it is not necessary to use the heating of the Aerosol-tube, because this solutions can also be used cold – but you can nevertheless use the heating, because warm Aerosols are penetrating the surface better than cold Aerosols do.
- If using Gelatine or Issinglass or Funori – you need to use the heating because this solutions are only liquid if they are warm. When using without heating, they will thicken at once when penetrating the cold tube and you only get “Air” out of the tube.
- Place the holding arm with the clasps on the device and place the unit near your working-place and Object. It is very usefull to use the five-wheel-carriage to roll the unit to the working place – so you have it near but not directly standing beside your Object.
- Put the nozzle to the Aerosoltube and pull it into the device.

Prepare your working-place the way I show you on the picture:

Place the Aerosolgenerator that way, that you can comfortably work on your object – you need enough tube to handle it and a direct view to the control-panel.



Put the tube into the clasps while preparing your object and every time when you are not holding it in your hand to work – and always bend the flexible end of the arm in a way, that it points downwards and away from your object.

This is to make sure that no occurring drops in the tube run on the surface of your object but make them all flow off the tube – just let them drop on a cloth to capture them.

The other half of the tube goes steeply downwards into the Generator – so all occurring drops in this area just flow back into the device.

Never (!) place or rest the tube during a working-break the way, that any drop can fall on your object – this causes non-reversibel damage – or let the tube just “hang” at the Generator – because this make drops to collect in the tube.

When beginning to work, put the tube out of the clasps – dab any drop of the nozzle using a cloth.

Using Aerosols and spreading them with a tube to a surface allways means, that condensed drops occur after a while – unfortunately there is no way to prevent this – but if you work carefully and disciplined and dab the nozzle before any working-passage – no problem should occur.

When spreading the consolidation-solution to the surface do this in a circular way – means:

You move the nozzle in a slowly and circular way over the part you want to concolidate. Do this the same way as if you would draw a helix on the surface with a pencil.

Go over the surface once – then make a break and put the tube back to the holder.

Let the surface dry – this should take a few seconds - make sure, that no change occurs.

Again take the tube off the holder – dab it – and again go over the surface in circular way.

Repeat this 4 times – then make a stability-test of the consolidated part by going over the surface with a brush.

If no particles are endangered – consolidation is well done.

Do not try to treat bigger parts of the surface (not bigger than 10x10cm) in one time.
Group the surface into several parts – and treat each part separate.

After finishing the treatment put the tube back to the clasps and stop the device – put it off.

Bring your object to another working-table or roll the Aerosolgenerator to another place to be cleaned there.

How can I use the RECOLO 1000 additionally ?

You can consolidate Objects by placing your object in a chamber – fill the chamber with consolidation-Aerosol – close it and let the consolidant “fall” down onto the surface.
Never over-saturate the chamber to avoid drops fall down!

If using the Aerosol-generator in Fresco-conservation (on the ceiling or at walls) a coverage made of plexiglass for example can be used – having a connection for the Aerosolgenerator an a handle to be fixed at the wall or ceiling.
Then fill the coverage with consolidation-Aerosol and let it penetrate the object-surface.

If you want to damp your object with Aerosols (distilled water) – place it in a chamber and fill the chamber with Aerosol – let it penetrate for a few hours.
But again: Never over-saturate the chamber to avoid drops fall down!

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