Aquazol as Used in Conservation Practice

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The first part of this discussion of Aquazol, "Evaluation of the Use of Aquazol as an Adhesive in Paintings Conservation" (*WAAC Newsletter*, May 2003, vol. 25, no. 2, pp. 12-18), dealt with the properties and characteristics of the resin as determined by a series of empirical tests. This article complements that data with descriptions of the ways that Aquazol is being used in conservation practice based on a survey of conservators.

A questionnaire was prepared and circulated to conservators who were recommended by their colleagues or who replied to a Conservation DistList posting. Ten paintings conservators, four objects conservators, two furniture conservators, and two paper conservators were interviewed after receiving the questionnaire. The questionnaire was designed to help the conservators to characterize their experiences with Aquazol in terms of its physical properties. In particular, how those properties affected their choice of the material and how they used it relative to other adhesives available.

Aquazol is used in essentially four ways: as a consolidant for matte paint, paint layers, or gilding; as an adhesive for objects; as an inpainting medium; and as a barrier or fill material. Conservators from the various conservation disciplines all had different, and specific, expectations of Aquazol. These expectations often determined whether a conservator liked or disliked using Aquazol.

The results of the questionnaire are presented below, organized according to use. The conservators' experiences with some of the negative aspects of Aquazol, such as discoloration or failure under high relative humidity conditions, are also discussed.

Aquazol as a Consolidant

Consolidation refers to the use of Aquazol in applications where penetration of prime importence followed by bond strength/ adhesion, surface appearance (saturation and gloss), and removability. Such applications might involve matte or friable paint, cracked gilding, fractured materials in general, or gluing small losses. Plasticization and flattening of cupped/ tented paint can also be included here because penetration is the primary property necessary followed by bond strength. Surface appearance and removability can be more important in some instances, especially for gouache or other matte friable paint.

Molecular Weight Choice

There are different viewpoints about which molecular weight is best for consolidation. It was observed that the apparent bond strength follow the molecular weights: 500 is stronger than 200 which is stronger than 50. The thickness of the paint or nature of the material often dictates the strength needed and hence the molecular weight required.

Aquazol 200 is often selected because it is thought that since it is the middle molecular weight, one will get enough penetration and bond strength. Aquazol 50 may form too weak of a bond to be successful as a consolidant while Aquazol 500 often has difficulty in penetrating cracks.

However, there are conservators who routinely use Aquazol 50 because it will penetrate more effectively the area to be consolidated, and a high concentration solution of Aquazol 50 allows a high percentage of solids to be delivered. For example, Aquazol 50 in water could be used where sturgeon glue would be used, without the shrinkage of sturgeon glue.

Other conservators routinely use Aquazol 500 because it will form the strongest bond. Thicker paint appears to require a dilute solution of Aquazol 500 in solvent applied in multiple applications to get more penetration with the lower surface energy. The viscosity of Aquazol 500 can be exploited in order to fill voids without much shrinkage; multiple applications of a dilute solution can give the penetration and strength required.

One technique that may give the best option is first to consolidate with an Aquazol 50 or 200 solution in order to achieve penetration, followed by an Aquazol 500 solution to achieve a strong bond between the surfaces. Some conservators advise that for a porous or chalky material, one should use Aquazol 200 in order to ensure penetration, but for a stiffer or thicker material, one should use Aquazol 500 for better adhesion.

The different molecular weights of Aquazol can be blended in order to create an adhesive of custom viscosity and bond strength, although it is more common to use each MWT on its own. One example of a molecular weight blend is 10% 1:1 Aquazol 50:500 in alcohol for consolidation of lifted oil paint. Another example is 20% 1:1 Aquazol 500:200 in water for the consolidation of dry gouache-like thick paint. This was chosen because the conservator felt it did not oversaturate the surface and did not leave much reside. The adhesive solution readily sank into the porous surface. The residues were cleared before they dried. In some cases no dramatic difference was noted in the bond strength of the blends.

Solvent Choice

For consolidation or adhesion Aquazol is used most commonly in water, ethanol, or isopropanol in a 5-10% concentration (w/v). However, conservators often keep 20% stocks ready for use and dilution. The solvent choice can depend on the solvent sensitivity of the surface.

Organic solvents generally provide less surface tension, better wetting, spreading, and penetration. In alcohols, the Aquazol solution has good surface penetration, dries fast, and paint may also become plasticized to a degree. For the consolidation of oil paint, Aquazol solutions in alcohol penetrated the area better than those in water, most likely due to surface tension. The surface tension of an Aquazol solution can also be decreased by the addition of a small amount of alcohol or Triton (few drops) to an aqueous solution. There was some concern about adversely affecting deeper paint layers that may be sensitive to alcohols.

Some conservators would pre-wet the area of oil paint consolidation with 1:1 water: alcohol and then let the area dry a bit before application of an Aquazol solution. In this manner, the surface tension of the area is reduced, and the adhesive solution can penetrate better.

Aquazol in alcohols has also been recommended for specific situations. For example, Aquazol 50 in isopropanol has been recommended for the consolidation of sensitive, friable powdery paint that will saturate or have an altered appearance if the adhesive is not cleared. Aquazol 50 in alcohol penetrates quickly, dries quickly, and leaves little material on the surface. Since Aquazol is reported to be more stable than Beva 371, for example, some conservators were comfortable leaving Aquazol residue in specific cases.

Solvent mixtures of water and alcohol (ethanol or isopropanol) have also been used. It is easier to relax cupped or flaking paint in some situations with an alcohol or alcohol: water solvent mixture. For example a 10% solution of Aquazol 500 or 10-20% solution of 1:1 Aquazol 500:Aquazol 200 in 1:1 ethanol: water could be used for consolidation of cracks in gouache. It consolidates the flaking paint while not saturating it. For an oil painting with flaking and cracked paint, the flakes were consolidated with 20% Aquazol 500 in 1:1 ethanol: water or 10-15% Aquazol 200 in 90:10 ethanol: water followed by flattening with a hot spatula without any swelling of the paint. Tented or cupped paint can also be relaxed if it is not too thick.

Some conservators take advantage of Aquazol's slight solubility in hydrocarbon solvents in order to retard the drying time of the adhesive as well as accomodate the solvent sensitivity of a surface. A 15% solution of Aquazol 50 in 1:1 naphtha: isopropanol or in 1:1 Shell Sol 135: isopropanol was used to consolidate a solvent sensitive surface while another conservator used the addition of naphtha to increase the working time when adhering pieces together.

Application Methods

Applications methods are varied. Dilute solutions have been applied with an ultrasonic mister; more concentrated solutions have been applied by brush or syringe. Aquazol can be applied with a suction plate, which helps control placement and makes clearing minimal. The use of a suction plate and humidity was reported to achieve better penetration as well as flatten canvas distortions and fill small gaps in cracked paint in one step.

Dilute aqueous Aquazol has been used with an ultrasonic mister on matte underbound paint on canvas. In a Southern historic house where no solvents could be used, large areas of powdery, flaking paint were consolidated using a HVLP spray gun. The goal was to preserve the old paint rather than paint over it. The original paint was very friable. The entire room was consolidated using a very dilute solution of Aquazol 500 (~1.5%) in water with a small amount of ethanol. The application had to be repeated several times in order to ensure complete consolidation. Excess Aquazol was easily removed if too much was applied in one spot. Additional Aquazol could also be applied to loose areas. The flaking paint was pressed back into place using hand pressure and a heated iron. A force meter, that measured the force required to dislodge a piece of paint, was used before and after consolidation in order to evaluate the success of the treatment.

The treatment of the Southern historic house was successful and is a testimony to the longevity of Aquazol consolidation in non-optimal conditions as the historic house was not climate controlled. The adhesion was tested after a year, and the treatment has remained stable and the paint consolidated.

Heat and Aquazol

Aquazol is a thermoplastic adhesive: it can be moved with heat even after it has dried completely. Aquazol is thermoplastic and thermostable.

Clearing

Clearing Aquazol is another consideration. The rate of resolubilization of Aquazol in water is much slower than in acetone. However, it is often applied in an alcohol and cleared with water or water with a few drops of Triton. Solvent choice was not reported to affect the ease of clearing. Acetone is the fastest method of clearing. The slow clearing of Aquazol with water has been identified as a drawback.

Aquazol's ability to be applied in one solvent and removed with another was cited as one of its strengths. Conservators clear with the same solvent as the adhesive solution, with alcohols, water, or a 1:1 mixture of alcohols with water. Some conservators reported seeing a glossy tide line when clearing with acetone. Aquazol is reported to clear more easily than Beva 371, however the clearing sometimes takes longer. Sometimes the cleared area may be still shiny the next day.

Most conservators did not use saliva to clear Aquazol residues: they used deionized water, if using water. It was recommended to clear while the Aquazol is still wet using a tissue or a brush-like mop, which is less abrasive than a cotton swab, especially for sensitive surfaces like modern paintings.

Re-treatablity

An important observation is that the application of Aquazol does not close the door to other adhesives, if it should prove to be unsatisfactory. In the past, protein based adhesives were the only adhesives that had this property.

Adhesive Preference

If the material for treatment is stable to polar organic solvents but not water stable, there is a preference for Beva 371 over Aquazol because the latter is more polar and has higher surface energy. However, Beva 371 remnants on the surface are also a consideration against Beva 371, as well as its waxy properties. The ageing properties of remnants of Aquazol, Paraloid B-72, and methylcellulose are preferred.

In water Aquazol may be preferred over gelatine, sturgeon glue, or PVA emulsion because it is reported not to support mold growth and does not get brittle with low RH like gelatine or sturgeon glue. Also it does not have a lot of surfactants like PVA emulsion. Aquazol is also more transparent than PVA emulsion, has better ageing properties, and is more easily reversible. However, gelatine and sturgeon glue have a phase during which they are tacky, which facilitates the assembly of fragments. Aquazol does not have this phase. In addition, sturgeon glue and gelatine are felt to be traditional and benign materials. If an art object is historical or if there are any question about material compatibility, many conservators will opt for gelatine or sturgeon glue over Aquazol. However if the art object is to go into an controlled environment, Aquazol may be chosen over gelatine and sturgeon glue. In addition, Aquazol may be chosen over gelatine and sturgeon glue for the consolidation of acrylic paint because the materials are more chemically similar. However, in some cases acrylic paint was reported to darken with the application of Aquazol.

Some conservators found Aquazol to be "gummy" as compared to gelatine or sturgeon glue and, in general, did not find Aquazol to be as easy to work with. Some felt that better adhesion can be obtained with PVA emulsion per unit volume and that PVA is better for gap filling. However, Aquazol is often preferred over Lascaux P550 because P550 is considered to be not as good for setting down flakes of paint, not really reversible, is slow evaporating, and is high swelling.

In objects conservation, aqueous adhesives such as starch paste, methylcellulose, and sturgeon glue are considered to be not very strong and to be brittle. Aquazol has been reported to be stronger and more flexible, with working properties most similar to methylcellulose. On paper Aquazol appears to be more reversible than Beva 371, which is not reversible. The staining and ringing that one might see with Aquazol depends on the application method. Ringing, which can occur on certain types of paper or paint, can be avoided by using suction.

Aquazol's responsiveness to relative humidity was a concern. Some conservators felt that Aquazol could not be used as a consolidant unless it was on flaking paint where the Aquazol is then isolated with another coating. These conservators preferred to use an adhesive that was not as responsive to RH. Some conservators felt that methylcellulose, gelatine, sturgeon glue, and hide glue were all less reactive to RH than Aquazol.

Aquazol as an Adhesive

Adhesion describes gluing two parts of an art object together. Usually the pieces are larger and thicker than small flakes of paint. Issues are bond strength, wetting, penetration, gap filling, and clearing. For this survey, conservators who dealt with objects or furniture were more concerned with adhesion than consolidation.

Molecular Weight Choice

For adhesion, Aquazol 500 was routinely used because of its bond strength, viscosity, and ability to fill voids without much shrinkage. If penetration was a concern, pre-treatment with Aquazol 200 followed by Aquazol 500 was recommended. If Aquazol 500 is thinned so it will flow readily, the large molecule may still not penetrate the material and the amount of adhesive on the surface may be too little to form a strong bond. It was recommended to first penetrate the surfaces with a low molecular weight Aquazol and then follow with the higher molecular weight for the actual bond.

Some conservators routinely blended the different molecular weights of Aquazol to achieve a desired degree of adhesion. For example, a mixture of Aquazol 200: 500 1:1 in 1:1 ethanol: water was used for consolidating gilding. The ability to blend makes Aquazol very versatile.

Usually a 20% stock of Aquazol was thinned as conservators required. In addition, Aquazol pellets could be swollen with solvent or water and then applied as a gel.

Solvent Choice

Usually conservators dissolved Aquazol in alcohols with some water added (between 10 and 50%). In the case of treating gesso, the presence of the water seems to allow the adhesive to form a better bond with the gesso and to remove distortions in the gesso. The water also relaxes tented lacquer. In addition, a bit of water in the stock solutions can extend the open or drying time. Finally, the addition of an aliphatic solvent, such as naphtha, to an alcohol solution of Aquazol can extend the working time and decrease the polarity of the solution.

Application Methods

Dilute solutions were applied by brush and syringe. In some cases a much more viscous application may be desired, for example for adhering two larger pieces together as in objects conservation. In this case the Aquazol resin beads can be swollen in solvent and used in their gelled state. When used like this, Aquazol is reported to have a tack-like feel, which allows the controlled placement of the adhering pieces. As the Aquazol dries, it appears to pull the pieces together cleanly, as compared to Paraloid B-72, PVA emulsion, or AYAS which are bulky, can interfere with the placement of small pieces, and can build up in the joins.

Clearing

Conservators liked Aquazol for consolidating water gilding because it can be applied in ethanol: water, and the excess can be picked up in ethanol without affecting the gilding layer. Aquazol gives the conservator more latitude. On the surface of water gilding, gelatine and sturgeon glue are difficult to clear without damaging the gilding.

Adhesive Preference

Aquazol in alcohols or water has been used on ivory, which is sensitive to moisture, polyester resin, cupped lacquer, and wood veneer. In one case the ivory object was comprised of many small pieces where higher molecular weight adhesives, such as Paraloid B-72, were too bulky to use. Aquazol's ability to hold and pull the pieces together was advantageous in this case. It has been suggested that a barrier layer may be necessary in order to isolate the hydroscopic Aquazol from the reactive organic components found in bone.

For a polyester resin bust, traditional adhesives such as methylcellulose, Klucel, and sturgeon glue were not strong enough, and PVA could not be safely removed. The ethanol solvent gave better surface tension, and the adhesive was easily removed. Aquazol 50 (5%) in acetone has been used for spot gilding water gilding. Aquazol was also used to adhere degraded enamel and glass. Aquazol 500 was used in different concentrations and solutions: 50% Aquazol in 4:1 ethanol: acetone and 70% Aquazol in acetone for joining, and 20% Aquazol in water for coating.

There appears to be a larger open working time with Aquazol than with other aqueous adhesives. Some conservators have been able to go back to an area of consolidated gesso, thick paint, or adhered pieces, even the next day, and the area was still plasticized enough to set be it down or even moved with the application of heat. It is presumed that Aquazol must retain water or solvent in order to be able to do this. As mentioned previously, some conservators routinely add a bit of water in their solvent based stock solutions in order to extend the open or drying time.

Since the choice of adhesive depends on the surfaceof the object, each adhesive has its appropriate use. It has been observed that Aquazol wets a broad range of traditional materials in addition to glass, as opposed to gelatine, sturgeon glue, and Beva 371. Aquazol also appears to wet and penetrate filthy surfaces that are almost water repellent. When using protein glue on a filthy surface, usually the surface would first have to be wetted with an alcohol followed by water followed by glue. The wetting of grimy surfaces is a particular concern when treating objects on site or in architectural situations. Aquazol in alcohol with a little water can deliver the adhesive in a controlled manner as well as plasticize any flakes and help them relax.

Aquazol can also be used in cases where water can blanch or damage a surface. For example, a degraded lacquer screen with mother-of-pearl and metal inlay was faced with Aquazol in alcohol and consolidated with Aquazol in alcohol. Lacquer blanches or stains when water is applied. The Aquazol solution plasticized the lifted flakes and allowed them to be set down with a tacking iron. The Aquazol bonded well to the lacquer, and it was easy to clear the surface. In this case, the screen was waxed as a final step. Some lacquer pieces that were consolidated five years ago and that had been in non-optimal environments were in perfect condition except for one or two spots, which required re-treatment. In another case a furniture conservator reported that consolidation and gilding treatments from 1995 were still satisfactory.

Sealing Aquazol treatments with a coating is recommended because Aquazol is hydroscopic. This is especially true for furniture or other art objects that are used rather than just displayed. Coating insures that the repair will be more durable.

It has also been observed that the glass transition temperature of Aquazol is higher (55°C) than that of Paraloid B-72 (40°C), which may make it a good material for archaeological sites where high temperature and low RH can be an issue.

Aquazol as an Inpainting Medium

Many of the conservators in this survey had tried to use or are using Aquazol as an inpainting medium. Some had become familiar with it through the work of Richard Wolbers and Mark Lewis while others learned about it in Jim Bernstein's Inpainting Workshop. In general Aquazol has plastic properties – in between gums and oils (which have body and are flexible). It has been described to be like a paste color or an opaque gouache but fuller bodied. It has sheen. Some have described it as having an "oil paint consistency."

Molecular Weight Choice

A solution of Aquazol 50 or 200 in water is commonly used. The solution is then mixed with dry pigments, watercolor, or gouache tube paint. Paint made with each of the molecular weights varies in saturation when dried. Aquazol 50 wets the pigments better than the higher molecular weights. Aquazol 500 doesn't wet dry pigments as well as the lower molecular weights and is viscous. Aquazol 500 is flexible but can scratch and scale. In inpainting, Jim Bernstein usually uses Aquazol 50 or 200: he may use Aquazol 500 for a middle-tone but the paint can be skin-like and could peel. Also, the addition of 20% Aquazol 500 to a watercolor palette improves the glaze quality of the paint, and therefore it is good for glazing abraded paint. It is transparent and reversible. Conservators have also used blends of Aquazols for inpainting. For example a 40-50% solution of 1:1 Aquazol 500: Aquazol 200 has been used for inpainting gouache and enamel paint on paper.

Aquazol has also been described as being less hygroscopic than gum arabic. Some conservators recommend overcoating Aquazol inpainting. Varnishes such as ~7% Paraloid B-72 or other coatings were used.

The concentrations of Aquazol used are as thick as possible. For inpainting the concentrations for aqueous solutions are as follows: ~67% for Aquazol 50, ~33% for Aquazol 200, and ~18-20% for Aquazol 500. These concentrations are the starting point and can be diluted as needed. When the paint is applied, the solvent is absorbed and the paint looks lean. The Aquazol paint should be viscous enough so that the support does not draw off too much of the binder and the pigments remain saturated.

Solvent Choice

Aquazol can be used in water, alcohol, acetone, or water: alcohol / water: acetone mixtures for inpainting. For example, a 10% solution of Aquazol 200 in ethanol or in 95:5 water: ethanol is used for inpainting. The alcohol cuts the surface tension and evaporates faster than water. For inpainting, acetone can be used if fast evaporation is desired. Jim Bernstein sometimes uses "water extra dry" (water containing acetone). This solvent mixture composed of 10-40% acetone in water reduces the surface tension. It allows you to inpaint more quickly and to see how the color will dry sooner than with watercolors or gums. To speed up drying you can also pre-desiccate the canvas or paper by blowing air on it. You get a richer color that does not blanch.

Aquazol's ability to dissolve in a variety of solvents is exploited by some conservators. It can be applied in water over inpainting that has been done in a solvent-based binder. The Aquazol layer would be less likely to dissolve the under layers than another application of the solvent-based paint.

Aquazol has been satisfactorily used to inpaint acrylic paint as it does not fuse to the paint like the solvent based inpainting resins. Aquazol 50 in 1:1 or 80:20 ethanol: water with dry pigments was applied with a nebulizer in order to imitate the look of gouache on a fill in an area where the gouache was powdered almost to a pastel. Aquazol has also been used on a clear glass vase with a scuffed painted interior that was displayed with the light coming from the inside. The inside was wet with pigmented Aquazol that covered the scuffs. This was a quick solution and was water-soluble.

Some conservators observed that Aquazol's greatest shortcoming as an inpainting medium was that it was glossy and did not dry hard. In addition, some batches of Aquazol 50 were yellowed and therefore could not be used on lighter colors. They could only be used with darker colors and on fills. Conservators who did not use Aquazol for inpainting cited its reactivity to relative humidity. However, they did concede that Aquazol might be a solution for inpainting solvent-sensitive areas and that one could seal the Aquazol inpainting with resins in Stoddard solvent or benzine in order to protect the Aquazol material from relative humidity changes.

Other Uses of Aquazol: Fills, Gilding, Barriers, Hinging

Aquazol 500 can be used to make a gesso putty as a fill material. Gesso putty made with Aquazol can be tooled with heat. However, it can be hard to make good putty with Aquazol because it remains sticky, unlike traditional gesso putty, which has a clay-like consistency. Some conservators describe Aquazol gesso as plastic-like and observed that it was not carvable after it had dried. The gesso putty also tends to settle or level off. Conservators also cautioned that fills made with Aquazol must be sealed against moisture.

Another gap-filling formulation is 20g Aquazol 50 in 30g of water bulked with fumed silica. The resulting translucent solution appears similar to wax and can be used for inpainting or gap-filling encaustic. Aquazol in water layered with Regalrez in Shellsol has also been used to fill in scratches within multiple layers of acrylic emulsion glazes. The layering with Regalrez isolates the Aquazol from high RH.

Aquazol can also be used as a barrier. There were two reports of using Aquazol as a barrier on unsized, unprimed, and unpainted canvas. In both cases a viscous solution of Aquazol was applied to the bare canvas like a size and allowed to dry. This application protected the canvas from penetration and saturation by another adhesive used to consolidate adjacent paint. The excess adhesive could be removed from the protected textile without penetration or saturation. The thick Aquazol "skin" was then swollen with water and/ or peeled away.

Another use of Aquazol as a barrier was for applying identification numbers to amber. Amber is clear and solvent sensitive. Aquazol was desirable as a barrier because it is water-based, reversible, and dries clear. The uncoated thin layer of Aquazol became tacky if it were breathed upon. However, protected by a solvent-based resin solution, such as Paraloid B-67(to which the labels were applied), Aquazol was a good isolating layer on the amber. A ~10% solution of Aquazol 200 in water was used for the isolating layer.

A furniture conservator developed a method for replacing hide glue with Aquazol in bole for gilding. He wanted to replace the glue with Aquazol in order to get better control of the introduction of water to the surface, and faster drying with an alcohol-based solution. He chose Aquazol 500 because it is a little more viscous and has good bond strength: it is solvent deliverable but hygroscopic so it is compatible with traditional water gilding. For replacing hide glue in bole layers, for compensation, Aquazol bole is not as viscous as the traditional mix. He tries to mimic the viscosity of hide glue by using 10-20% Aquazol 500 in alcohol for gilding. Aquazol bole can be burnished like traditional water gilding. It dries even faster than protein glue-based bole. The clay makes it burnishable. Aquazol gilding must be overcoated, especially on furniture, in order to protect it from warm or wet hands.

Aquazol has also been tried for hinging in paper conservation. A 10% Aquazol 500 solution in water was blended with PVA emulsion (1:1) in order to attempt to make the hinges more reversible. The hinges were still quite strong.

Concerns about Aquazol: Color, Cold Flow, Mold Growth, and RH

There were some observations of a yellowish or brownish color in some batches of Aquazol 50 or 200 resin. Other conservators, though, have never received a colored batch of resin nor have their resins changed color (in pellet form or solution), in one case even after seven years. There was one reported case of colorless pellets forming a yellowed solution (20% Aquazol 200 in water). The manufacturer considers the color to be within the specification limits, as that Aquazol is not designed as a conservation material. (Polymer Innovations, 2002).

There were also reports about cold flow. In general it was most often observed for Aquazol 50 and sometimes for the Aquazol 200, however not all conservators reported seeing this. Conservation studios were reported to have typical environments of 50-70% RH and 70-75°F. The manufacturer has not addressed the cold flow.

Aquazol is a synthetic polymer and cannot support mold growth. Most conservators reported no mold growth even for stock solutions that were four years old. Mold growth has been observed in the aqueous stock solutions of Aquazol where a brush was the source of contamination or the aqueous stock was over three years old. As one conservator observed, his Aquazol solutions had become a bit dirty, however after six months "any solution will get bad." There were no reports of mold growth in solvent-based solutions.

The greatest concern appears to be the response of Aquazol to high RH. It is presumed that at high RH Aquazol would gel and lose the ability to act as a consolidant or an adhesive. Some conservators felt that methylcellulose, gelatine, sturgeon glue, and hide glue are all less reactive to RH than Aquazol. Others saw Aquazol's response to RH as an advantage because it would behave like the surrounding materials (wood, animal glues). Conservators, who worked with organic materials where exposure to water could be detrimental, were concerned about the hydroscopic nature of Aquazol.

Aquazol as Used in Conservation Practice, continued

There were several reports of failed, or less than satisfactory, treatments using Aquazol. Aquazol failed as a consolidant in a painting and on some gilding that was so porous and the Aquazol solution so dilute that it was just flowed through the material. In another case, Aquazol proved too weak an adhesive to hold together delaminating canvas from a gypsum wall. However, it was successful in consolidating the paint on the canvas. Also, a repair of a glass vessel failed in a hot humid environment.

There were only two reports of Aquazol adhesion failure due directly to high relatively humidity. In one case the wall where the Aquazol had been used to consolidate paint became wet, and the adhesion failed. In the other case, the repair of a weight-bearing and non-porous surface (a glass vessel) failed under high RH conditions. In general, Aquazol was not recommended for weight-bearing repairs.

Aquazol's lack of tack at its gel point has been cited as a drawback (whereas sturgeon glue or Beva 371 have this property). Some conservators feel that it is not a strong enough adhesive, especially for thick, tented paint layers. Aquazol's low glass transition temperature and responsiveness to RH were cited most often as the largest negative aspect. Another drawback is its sheen, at least with the Aquazol 500. Aquazol's ability to saturate some surfaces and the paint layers was considered an obstacle, although it depends on the surface. Its ready solubility has also been cited as a drawback when cleaning is to be done after consolidation.

Conclusion

Aquazol is currently being used in the treatment of many different types of objects. It has great appeal because the adhesive itself is non-toxic, is soluble in relatively low toxicity solvents (water, ethanol, isopropanol, acetone), is compatible with a wide range of materials (from paint to plastic), is available in a range of molecular weights (and thus bond strengths), and is stable to thermal and light ageing. In addition, if the treatment is unsatisfactory, it is reversible in water, ethanol, isopropanol, and acetone. Finaly, it does not eliminate re-treatment with another materials.

Conservators from different conservation disciplines have different, and specific, expectations of how Aquazol would serve them best. Aquazol has several characteristics which can be manipulated in order to adapt its properties. For example, Aquazol's solubility in a variety of solvents is being taken advantage of by conservators not only in order to accommodate the solvent sensitivity of the materials to be treated, but also to adapt the properties of the adhesive solution so it will penetrate more or less or evaporate faster or slower. In turn, this can effect gloss, saturation, plasticization, and bond strength.

Aquazol is not the answer for all conservation problems and Aquazol's hydroscopic nature is a concern for conservators. However, Richard Wolbers and Mark Lewis have indicated that the presence of unbound metal ions (such as in dry pigments or friable paint) may decrease the reactivity of Aquazol to moisture. In addition, the lack of reports of treatment failure due to high RH and the reports of satisfaction with treatments using Aquazol over time indicates that Aquazol may have a permanent place in the conservation repertoire.

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