Persist Solvent Gel Kit™

Instructions for Use

For professional use only. Extensive surface testing is advised before cleaning. Persist Solvent Gels™ may cause damage to items being cleaned and thus extreme caution is required during use. Polysciences, Inc. disclaims all warranties and liability for damage resulting from use of Persist Solvent Gels™. Refer to further warnings and limitations set forth in these instructions.

The **Persist Solvent Gel Kit™** contains six common solvents that have been gelled to aid the conservator in increasing the range of cleaning resources that might be brought to bear on difficult or intractable fine art coatings. The solvent gels contained in the kit, in order from the least polar (PolySol™ D60) to the most polar (NMP), are as follows:

PolySol™ D60 – An aliphatic hydrocarbon similar to ShellSol™ D60 or Exxsol™ D60
Xylene – An aromatic hydrocarbon
Benzyl Alcohol – An aromatic alcohol
Isopropanol – The simplest secondary alcohol
Acetone – The simplest ketone
NMP (N-Methyl-2-pyrrolidone) - A cyclic amide

In addition to solvent, these gels incorporate both a polyacrylate polymer and a surfactant (Surfactant A or B, depending on the solvent). Both polymer and surfactant are held together through ionic forces, and in most solvents, the bond is near permanent. The polymer increases the viscosity of the solvent, which allows for control of application, spreading and penetration of the solvent into the art structure. The surfactant aids in increasing the polymer solubility in a wide range of solvents and allows for an equally wide range of rinsing or clearance materials. The surfactant acts to solubilize and disperse intractable soils that are not easily dissolved in the solvent alone. These gel preparations have been manufactured to have consistent rheology, incorporated solvent and component purity.

The Teas Plot below should be used as a guide to formulate and use the gels contained in the Persist Solvent Gel Kit™

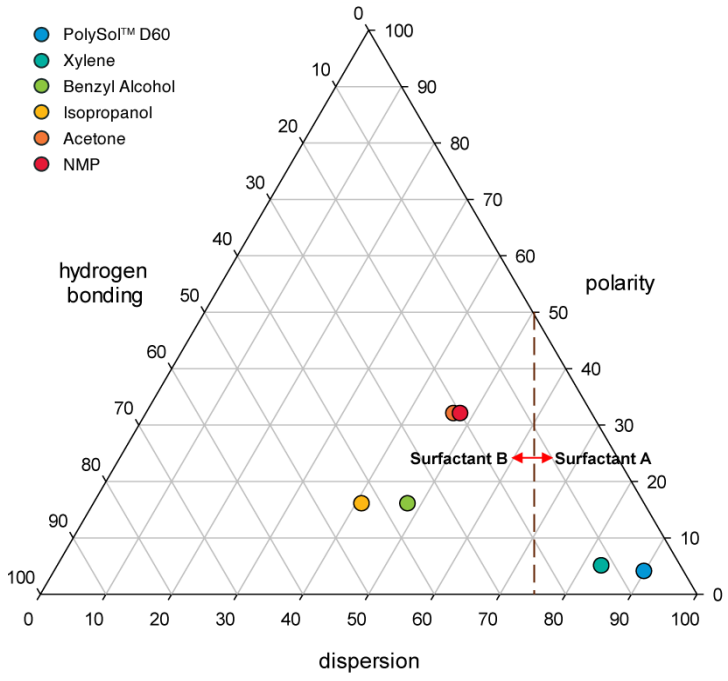

Figure 1. A Teas Plot for the solvent gels contained in the **Persist Solvent Gel Kit™**.
The Teas Plot should be used as a guide to estimate and tailor the solvent gel properties.

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Chemistry beyond the ordinary

Here are some ways in which to consider using and modifying **Persist Solvent Gel Kit™** to better tailor them to individual cleaning applications:

1. Persist Solvent Gels™ are typically applied by brush or cotton swab, stirred on a surface to solubilize materials such as coatings, adhesives, etc., and then wiped away with a dry cotton swab. The surface treated in this manner is then rinsed with a 'weaker' (less polar, less hydrogen-bonding) solvent or solvent mixture to clear the remaining gel and solubilized materials from the artwork surface.

2. Persist Solvent Gels™ incorporate surfactant materials and are viscous in nature; they need to be manipulated (moved or agitated) on the surface of the painting to help solubilize coatings, adhesives, etc. Gels that are simply placed on a surface and not manipulated will have little more effect than using neat solvent. Gently agitating the gel makes the most efficient use of the surfactants in the formulation, and sets them apart from gelled solvent compositions that only use a polymer as a thickener (and therefore only modify viscosity).

3. The Persist Solvent Gels™ can be used alone; however, they can be modified in a number of ways to better tailor their cleaning strength. Due to their viscous nature, weight ratios (w/w), rather than volume ratios, are used to tailor the gel cleaning strength.

4. Solvent gels formulated with the same surfactant (either A or B) can be inter-mixed in all proportions by weight. ***Gels made with different surfactants should not be intermixed.***

   Example: A 1:1 Acetone:Isopropanol Gel is easily be made by combining equal weight proportions of an Acetone Solvent Gel and an Isopropanol Gel. An Acetone Gel should never be mixed with a Xylene Gel as they contain different surfactants.

5. Free solvents can be blended into any of the stock gels to modify the viscosity or solvent strength of the gel. Free solvents that are on the same side of the dashed red line in **Figure 1** can be mixed into the stock gels in any proportion to modify these properties. Small amounts of free solvents can be added to the stock gels from the opposite side of the red line so long as the solvent parameters (dispersion, polarity, hydrogen-bonding) of the resultant mixture is still on same side of the red line as the starting gel.

   Example: The 'stock' gel is too thick. By adding more solvent (e.g., neat acetone to the Acetone Gel), the viscosity can be lowered so that the gel has a rheology commensurate with the surface cleaning application at hand. Gels applied with reduced viscosity will conform better to a surface. Gels that can be stirred with a soft brush to help suspend material therein will be more efficient. Low viscosity gels can be wiped away more easily and completely than stiffer gels.

   Example: In a small test area, the Acetone Gel began to take up a degraded varnish, but with some effort. Making the gel stronger or more efficient may mean adding a 'stronger' solvent to it. The addition of neat NMP (N-methyl-2-pyrrolidone) will increase the polarity of the gel, while the addition of an alcohol, such as ethanol or isopropanol, will increase the gel's hydrogen-bonding character. At times, a weaker solvent gel may be desirable. Adding petroleum benzene to the Acetone Gel will reduce its overall polarity, and make it weaker.

6. Any individual solvent or combination of solvents on the same side of the red line as the stock gel may be used as rinsing solvents.

   Example: The Acetone Solvent Gel can be rinsed with any solvent on the surfactant B side of the Teas plot in **Figure 1**. Generally it is advisable to first remove the bulk of the gel material and any dissolved or suspended material from the surface with a dry swab. The last bit of remaining gel on a surface should be rinsed with a solvent. In practical terms, it might be preferable to choose the least polar solvent or solvent mixture possible to rinse away the gel residues. In the case of the Acetone Solvent Gel, while free acetone, isopropanol, NMP or any other polar solvent on the surfactant B side of the Teas diagram could be used to rinse the gel away, there would be very little advantage to using them. Rinsing with Isopropanol, for example, would simply dilute the Acetone Gel, reduce its viscosity, and create a mixture of Acetone/Isopropanol that would affect underlying oil paint materials (move the composition farther into the peak swelling region for oils). Rinsing the Acetone Gel with a composition such as isopropanol:petroleum benzene (1:2 w/w) would clear the residual gel and would be less likely to swell oil bound materials.

7. *Water cannot be used to rinse gels*. The same caution should be exercised for the addition of wet solvents and wet/damp surfaces that the gel may come in contact with or be applied to.

   Example: A small volume of water is used in the formulation of the gels; this water is necessary to form a 'salt' or ionic bond between the two gel components (to form a stable polyacrylate-surfactant complex). The small amount of water generally resides in the region of the ionic bond between the polymer and surfactant, and to some extent on the surfactant. This ionic bond between the polymer and surfactant is near permanent in most solvent environments, but in water, this bond will fail and the gel will simply collapse. Depending on the pH of the aqueous material, either the polymer or surfactant will be left as a residue on the surface.

Table 1. The Teas solvent parameters of some common solvents and oil paint constituents.

Solvent	Dispersion	Polarity	Hydrogen-Bonding
n-Hexane	100	0	0
VMP naphtha	94	3	3
Mineral spirits	90	4	6
Benzene	78	8	14
Toluene	80	7	13
Xylene	83	5	12
Ethylbenzene	87	3	10
Cellosolve	42	20	38
Carbitol	48	23	29
Acetone	47	32	21
Methyl Ethyl Ketone (MEK)	53	30	17
Ethyl acetate	51	18	31
Acetonitrile	39	45	16
N-Methyl-2-Pyrrolidone (NMP)	48	32	20
Ethanol	36	18	46
2-Propanol (Isopropanol)	41	16	43
Benzyl Alcohol	48	16	36
Turpentine	77	18	5
Oleic Acid	62	14	24
Stearic Acid	65	13	22
Linseed Oil	66	17	17
Mineral Oil	100	0	0

References

1. Alan Phenix and Richard Wolbers, "Removal of varnish: organic solvents as cleaning agents" in Conservation of Easel Paintings, Joyce Hill Stoner and Rebecca Rushfield (Eds), Routledge:New York (2012), p 524-563. ISBN 9780750681995
2. Richard Wolbers and Chris Stravroudis, "The Cleaning of Paintings" in Handbook for Critical Cleaning, Applications, Processes, and Controls, 2nd Edition, Barbara Kanegberg and Edward Kanegsbert (Eds), CRC Press:Boca Raton (2011), p 399-410. ISBN 9781439828298
3. Dusan Stulik, David Miller, Herant Khanjian, Narayan Khandekar, Richard Wolbers, Janice Carlson, and W. Christian Petersen, Solvent Gels for the Cleaning of Works of Art: The Residue Question, Valerie Dorge(Ed), Getty Publications: Los Angeles (2004), 180 pages. ISBN 978-0892367597
4. Richard Wolbers, Cleaning Painted Surfaces, Aqueous Methods, Archetype Publications: London (2000), 198 pages. ISBN 9781873132364

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