

Oil Painting in Educational Settings

A Guide to Studio Safety

Best Practices

Recommendations

Technical Information

SUMMARY

For 600 years, oil painting has been the preeminent painting media. Oil painting has documented our cultural heritage and has endured and evolved through the advent of photography, the modernism of the 20th century and into the digital age.

Why does oil painting remain relevant? Because no other media carries the same raw power of communication. No other media gives artists the same intensity of color and breadth of mark-making possibilities. There is nothing more natural and enduring than oil painting.

Oil painting practice and instruction continues to grow in universities across the country. And standards have evolved over recent decades. Turpentine was once used in virtually all painting studios. Today it is a thing of the past. Leading schools and instructors have incorporated higher standards, which we share, for a safe studio environment and the responsible management of waste.

At Gamblin these ideas are not just important to us, they are the founding ideas for our color house. The objective of this guide is to provide two things for you: the proven solutions Gamblin has contributed on the materials side of the equation, and the systems developed by leading schools like the Rhode Island School of Design.

Our mission is to lead oil painting and printmaking into the future. This guide is intended to help Instructors, Heads of Departments, and Facilities Managers in schools to have painting studios that are as safe as possible for students and the environment.



Dedicated.

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Where does the oil in oil painting come from? How does it compare with other mediums?

THE NATURE OF OIL PAINTING

Linseed oil is pressed from the seeds of the flax plant. The flax plant has been the heart and soul of oil painting, giving us both the oil our colors are bound in and - from the stalks of the plant – the linen we paint on.

Linseed oil naturally dries faster than other oils and retains greater strength and flexibility as it ages. We also use safflower oil in some colors. Not only are both of these vegetable oils completely non-toxic, they are also both used in moisturizers, cooking oils, food and vitamins.

Linseed and safflower oils do not give off “fumes”. In fact, these oils take in oxygen as part of their drying process. Gamblin Artist’s Oil Colors do not contain solvent, nor do they require any solvent for their use.

The pigments used in oil colors are the same pigments found in watercolors, acrylics and pastels.

Since we do not use any pigments based on lead, mercury, or arsenic, with very few exceptions our colors are completely non-toxic and do not require health labeling of any kind.

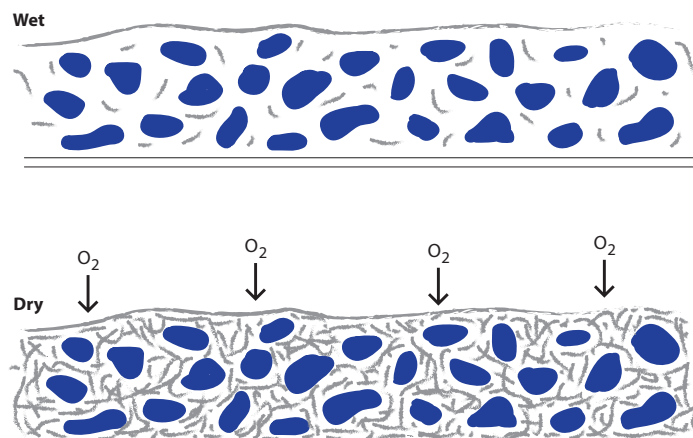


ACRYLIC COLORS

Artist’s oil colors are simple mixtures of pigment and linseed oil. Acrylics, by contrast, are more complex formulas of plastic, water, pigment, ammonia, and other chemicals.

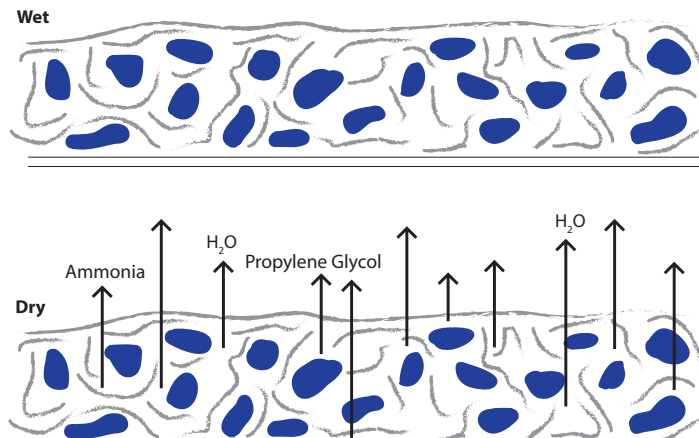
Oil colors pull oxygen out of the air to dry – there is no “off-gassing” with oil colors. In comparison, acrylics dry by the evaporation of their volatiles, such as water, ammonia, and propylene glycol.

Drying of Oil Colors



This diagram illustrates the oxidation of the linseed oil binder in oil colors. Oxygen enters the paint layer, which starts the polymerization (linking up) of linseed oil molecules into chains. This locks-in the pigment (shown in blue) to create what we experience as “dry” paint layers. This process takes several days to become “touch dry,” though the oxidation of oil paint layers continues after that.

Drying of Acrylic Colors



In acrylic colors, the pigments are bound in a longer-chain acrylic polymer. Acrylic colors dry by the evaporation of volatiles – first water, upon which the paint layer feels dry to the touch, and then ammonia and propylene glycol over days and weeks.

WATER-MISCIBLE OILS

After our testing of these materials, we have come to believe that water-miscible oils mean far too much artistic compromise for no real improvement in safety for artists or the environment. We encourage the use of traditional oil colors and contemporary or solvent-free painting mediums rather than the “new” water/oil paints for three reasons:

1. Artists can experience the luscious working properties of traditional oil colors without the compromises that water-miscible oils place on the painting experience.
2. History has demonstrated that chemical additives can harm oil paint films as they age. We know that conservation scientists are interested in these issues, but much is still unknown about the aging of water-miscible paint films.
3. Oil painters who carefully use traditional oil colors wash nothing down the drain and into the watershed.

Gamblin Artist's Oil Colors themselves are non-toxic when used as recommended. Linseed, poppy and safflower oil are natural “drying oils” that absorb oxygen from the air and dry naturally. Because they do not evaporate, there are no health hazards associated with them regardless of the type of oil or how it is produced.

Gamblin's stance on water-miscible oils, and studio safety in general, is that the toxicity concern surrounding oil painting has nothing to do with the colors themselves, but the solvent used to thin oil colors and painting mediums.

Our approach is to offer Gamsol, the mildest form of Odorless Mineral Spirits. Gamsol is used for thinning oil colors and for brush/studio clean-up, and is used to formulate our contemporary painting mediums. We also offer the broadest range of solvent-free painting mediums, which allow for the safest possible painting studios.

How do I choose and manage solvents in our oil painting studio?

Solvent is traditionally used in oil painting for brush and studio clean-up and to thin oil colors from the tube. Solvent is also a component of most painting mediums used to alter the viscosity of oil colors and speed drying. In making mediums, the solvent is mixed with a drying oil (e.g. linseed oil) and/or a resin (traditionally dammar resin or contemporary resins, such as soy-based alkyd). Gamblin's approach to painting mediums is to formulate a range of contemporary mediums based on alkyd resin, as it allows us to create mediums with the mildest form of odorless mineral spirits: Gamblin Gamsol.

There are hundreds of different types of solvents in the world – all with unique properties and applications in various industries. A variety of different solvents have been incorporated into oil painting studios over its history. Not all solvents are created equal. Below is information on what makes Gamblin Gamsol uniquely qualified to be the standard for studio safety in classrooms and home studios. A solvent's safety is determined by its evaporation rate, permissible exposure level and the ventilation in the workspace.

DEFINITION OF AN ARTIST'S SOLVENT

The Artist's Handbook of Materials and Techniques by Ralph Mayer and The Painter's Handbook by Mark Gottsegen are the two definitive books on painting materials published in America. They both define the working properties of an ideal artist's solvent the same way.

An artist's solvent should:

- Evaporate completely
- Evaporate at a uniform rate
- Have no effect on dried paint layers
- Be chemically inert to the materials with which it is used (i.e. have no chemical reaction)
- Mix completely with the materials with which it is used
- Have no toxic vapors
- Evaporate entirely from the dried paint film within a reasonable amount of time

Many solvents on the market satisfy some of these requirements. Gamsol meets all of these requirements when used as recommended. Gamblin Gamsol odorless mineral spirits balances both performance and safety like no other artist's solvent on the market.

GAMSOL VS. OTHER SOLVENTS

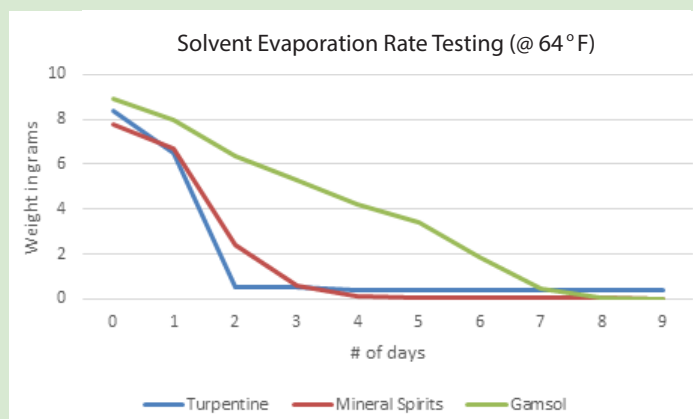
Gamsol allows painters to work in traditional and contemporary techniques without compromising artistic possibilities, permanence, or their well-being. Gamsol is also reusable, and non-toxic when used as recommended.

Most solvents available to artists are produced for the industrial paint industry where solvent strength and low cost take priority over safety. Gamsol is different. It comes from a family of materials used in products that come into more intimate contact with the body, such as cosmetics, hand cleaners and cleaning food service equipment. For an artist, there are a number of factors to consider when judging a solvent's safety. Aromatic solvents are the most harmful type of mineral spirits. Gamsol is an odorless mineral spirit which has all of the aromatic solvents refined out of it – less than 0.005% remains. In addition, Gamsol has a slow evaporation rate, a high flash point, and is not absorbed through healthy skin. *Unlike other solvents, Gamsol is readily biodegradable and contains no Hazardous Air Pollutants or Ozone Depleting Compounds.*

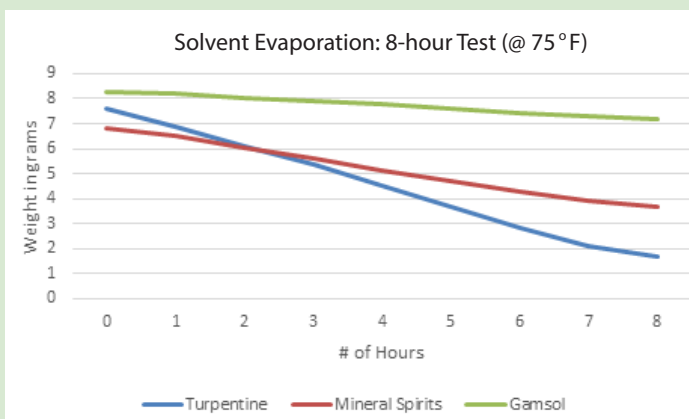
Evaporation Rate Testing

One key metric in determining the inherent safety of a solvent is the rate in which the solvent evaporates. The chart below documents the results from testing three common solvents: turpentine, mineral spirits and Gamsol. A tablespoon of each solvent was placed on a 3 ¼" wide metal lid, and subsequently placed on three different scales to measure the amount of time (in days) it took the solvent to evaporate.

** Note on above testing: During the 9-day solvent evaporation test, the average temperature in our lab in Portland, OR was 64°F.



Within the first 48 hours of this test, approximately 94% of the turpentine and 70% of the mineral spirits had evaporated. Gamsol's evaporation was slow and steady over the test's nine-day period.



This test was repeated to look at these same three solvents within an 8-hour time period. During the 8-hour period, 77.6% of the turpentine evaporated, 46% of the Mineral Spirits and only 13.3% of the Gamsol evaporated.

During the 8-hour test, the average temperature was 75°F.

Again, this test was prepared by placing 1 tablespoon of each solvent on 3 ¼" wide metal lids. When approximately 8 fluid ounces of Gamsol were placed in a Silicoil Brush-Washing Container, only 0.29% of Gamsol evaporated when tested over an 8-hour period.

Flash Point Comparison

The flash point of a volatile material is the lowest temperature at which it can vaporize to form an ignitable mixture in air. Measuring a flash point requires an ignition source (e.g. match or flame). The flash point is not to be confused with the auto-ignition temperature (which does not require an ignition source), which is a much higher number (635°F in the case of Gamsol). Below is a listing of common solvents, along with their corresponding flash points:

Solvent	Flash Point
Turpentine	95°F
Mineral Spirits	100.4°F
"Odorless Mineral Spirits"	110 – 120°F
Gamsol	144°F

Recommended uses for Gamsol

- **Thinning oil colors:** Gamsol beautifully thins oil colors. A little goes a long way; oil colors relax immediately when a little Gamsol is added. Since Gamsol evaporates completely, no sticky residue is left behind that could compromise the drying or strength of paint layers.
- **Modifying painting mediums:** Gamblin Galkyd painting mediums are formulated with Gamsol, so they readily accept Gamsol as a solvent. Gamsol should not be added to traditional painting mediums containing dammar, copal or mastic resins. They require stronger solvents such as turpentine. Adding Gamsol to oil painting mediums is an effective means of modifying the oil (fat) content of these materials to allow artists to explore indirect/glazing techniques.
- **Studio Clean up:** Gamsol is great for general studio clean-up of brushes, palettes, palette knives and other tools. As a brush cleaner, it effectively removes oil colors from brushes to allow for clean mixing and application of color.

What are the guidelines for air exchange in the oil painting classroom using Gamsol and Gamblin Oil painting mediums?

VENTILATION

According to the recommendation of environmental hygienists, studio air should be changed ten times per hour.* Normal HVAC systems in most buildings and homes will allow for adequate air exchange using Gamblin oil painting materials.

If you are interested in testing for solvent exposure in your own facilities, 3M offers monitoring systems: <http://www.shop3m.com/3m-organic-vapor-monitor-3500.html>.

How can our students paint in oils without the use of solvents?

SOLVENT-FREE OIL PAINTING

Painters who wish to paint in oils without the use of any solvents, have more solvent-free options available today than ever before.

Gamblin Solvent-Free Gel and Solvent-Free Fluid painting mediums both increase the flow of oil colors and moderately speed drying. Both mediums are made with safflower oil and soy-based alkyd resin and no solvent, not even Gamsol. Gamblin Safflower Oil can be used for removing color from brushes during the painting session. Brushes can be further cleaned after the painting session with either a small amount of Gamsol or soap and water.

What are the safest materials and techniques for brush cleaning?

Two Rag System

By using a simple “two rag” system outlined below, painters can reduce the amount of pigment that gets into their cleaning solvent or oil, thus eliminating waste and prolonging the usefulness of the cleaning material.

BRUSH CLEANING WITH GAMSOL

For brush cleaning during your painting session, first wipe excess paint from brushes with a rag. Then dip your brush in a container of Gamblin Gamsol. Next, wipe the Gamsol and any remaining pigment from your brush with a second rag and continue painting. After your painting session, brushes can be further cleaned using soap and water.

Use only as much Gamsol as you need for cleaning brushes throughout the painting session and for thinning and formulating painting mediums. The best type of containers to store Gamsol for brush cleaning are glass or metal jars with a screen which allows pigment to settle on the bottom of the jar (such as Silicoil Brush Cleaning Tanks). Mark all jars and cans containing solvents with appropriate labels.

SOLVENT-FREE BRUSH CLEANING

For brush clean-up during your painting session, first wipe excess paint from brushes with a rag. Then dip your brush in a container of Gamblin Safflower Oil. Next, wipe the safflower oil and any remaining pigment from your brush with a second rag and continue painting.

After your painting session, brushes can be further cleaned using Gamsol and/or soap and water.

* Mark David Gottsegen, The Painter's Handbook

Please note that oil-soaked rags should be, at a minimum, properly stored in an Oily Rag Safety Can (such as those offered by JustRite™) until they can be thrown-out. Even better, soak rags in water and place them in an old jar or similar container and dispose of them outside in your household trashcan or apartment building dumpster.

Using either Gamsol or Safflower Oil for brush cleaning prevents pigments from being poured down the drain and contaminating the watershed. Additional information on managing waste can be found in the section below as well as in the Brush Cleaning Tip Sheet for Oil Painting addendum to this document.

CASE STUDY: Gamsol in a Classroom Setting

The Safety Data Sheet for Gamsol identifies its Exposure Limit as 1200 mg/m³ (milligrams per cubic meter). This is based on a Time Weighted Average (TWA) of 8 hours.

Working with a classroom size that is 7 x 10 x 3.5 meters gives us a total volume of 245 cubic meters (8652 cubic feet). Gamsol is 6.42 pounds per gallon, which equals 22.75 grams per fluid ounce.

Throughout an 8-hour painting session, 12.9 fluid ounces (381.5 ml) of Gamsol would have to be evaporated (not used in fluid form, but evaporated in the air) in this classroom to reach its Exposure Limit. By using the .29% of Gamsol evaporated out of a Silicoil jar over an eight-hour period, it would require over 550 painters in a sealed room (no ventilation), to get to the Exposure Limit for Gamsol. The previously discussed Evaporation Rate Testing of Gamsol illustrates its slow evaporation rate compared to mineral spirits and turpentine.

Beyond its slow evaporation rate, it is important to note that any and all air exchange in the classroom, either through ventilation or normal air circulation, will help keep evaporated Gamsol well below its Exposure Limit.

We understand that this is an imperfect scenario, as painting techniques (and use of solvent) vary greater from painter to painter.

How do we responsibly dispose of the waste from oil painting compared to the waste of using acrylics?

PAINT DOWN DRAINS

It is best that you check with your local city or municipality on proper disposal of paint. In our state of Oregon, the law prohibits improper disposal of paint wastes (i.e. washing paint down the drain) [OAR 340-61-020 (1), OAR 340-45-015 (1) (a) & (b), and ORS 459.205 (1)]. Schools have already taken steps – on their own and/or at the direction of their municipality, to eliminate the practice of washing acrylic paints down the drain. For more information on the proper handling of acrylic waste streams, please refer to American Society for Testing & Materials (ASTM) D 7355-10 Standard Guide for Artists' Paint Waste Disposal in Smaller Commercial or Educational Settings or to <http://www.goldenpaints.com/just-paint-article3>.

Compared to artists working in water-based media, artists working in traditional oil colors are generally more conscious of how they manage their waste and prevent pigment from being washed down the drains and into the watershed.

Used Gamsol

Artists can reuse Gamsol over and over for brush-cleaning. Gamsol will clear as pigments settle to the bottom of the container. Recycle Gamsol for future brush-cleaning by pouring the clean portion into a separate container. Mark all jars and cans containing solvents with appropriate labels. We recommend using fresh Gamsol when thinning painting mediums.

Used Safflower Oil

Like Gamsol, safflower oil will clear as pigments settle to the bottom of your container. Note that it will take longer for pigment to settle in safflower oil compared to Gamsol. Pour “clear” portion of safflower oil into a separate container for future use.

CASE STUDY: Rhode Island School of Design (RISD)

RISD's Environmental Health & Safety Department has developed programs, policies and procedures to ensure safe working environments for students and faculty and to minimize waste from creative activities.

RISD's ARTS model forms the core of their Environmental Management System:

- **Active Commitment** to compliance and continuous improvement.
- **Reduction of pollution** through waste minimization, lowered materials consumption, and energy conservation.
- **Training and educating** faculty, students and staff about the environmental considerations of their activities.
- **Stewardship** in enhancing the quality of life for our employees, faculty, students and neighboring community.

EXAMPLES:

- **BRUSH WASHING STATIONS** (pictured)
Cycle usable solvent through hose, allowing settled solvent to remain settled in the bottom. This has reduced solvent waste by 75%.
ROI less than 2 years.
- **"PERMISSIBLE MATERIALS LIST" DEVELOPED**
Library of Safety Data Sheets (SDS)
Only Gamsol allowed in painting & illustration departments
- **PAINT MANAGEMENT**
Excess and unused materials, such as paint or solvents, are brought to a centralized location where they are further evaluated for their potential for reuse.



For the complete document outlining RISD's policies, please refer to: <http://www.epa.gov/region1/assistance/univ/pdfs/bmps/ArtRISDP21-8-07.pdf>

Sediment from brush-cleaning jars:

Once clear Gamsol or Safflower Oil has been poured out of brush cleaning jars, the residual pigment can be mixed with linseed oil or painting medium to the desired consistency for reuse. This process is demonstrated by artist Jonathan Simon at: http://www.youtube.com/watch?v=jvPhysL8Brk&list=UUKas181VW1tWaPMVysV_dVw&index=9&feature=plcp.

Used water

For acrylic painters wishing not to send waste water down the drain, Golden recommends the process in the following link: <http://www.goldenpaints.com/just-paint-article3>

ASTM STANDARD

For additional information on the safe and environmentally friendly clean up and disposal of artists' paints, please refer to the American Society for Testing & Materials D 7355-10 Standard Guide for Artists' Paint Waste Disposal in Smaller Commercial or Educational Settings.

REDUCING WASTE

Reducing studio waste is an important consideration for many artists. Reducing studio waste also has economic benefits. Oil painters, in particular, are well-positioned to reuse their excess materials in future paintings. Here are a few tips:

Saving and reusing oil colors

Instead of letting oil colors dry on your palette in between painting sessions, simply sealing your palette with a layer of plastic wrap will prevent the oil colors from drying out quickly.

Another option is to mix all of the colors that remain on your palette to make your own personal Torrit Grey. This often yields an interesting neutral/grey color that can be stored in an empty tubes or air-tight jars for future use.

Disposal of Rags

To prevent spontaneous combustion, Safflower or Linseed Oil-soaked rags should be, at a minimum, properly stored in an Oily Rag Safety Can (such as those offered by JustRite) until they can be thrown-out. Even better, soak rags in water, and place them in an old jar or similar container and dispose of them outside of classrooms and studios.

Spontaneous combustion is a concern when rags are soaked in a drying oil, most commonly linseed. This is not a concern when rags are wet with Gamsol or oil colors themselves. Gamsol-soaked rags should be kept away from heat or flame, preferably in an Oily Rag Safety Can.



Disposal of Packaging

Packaging (tubes, cans, and bottles) should be completely emptied of their contents before disposing. For tubes, consider investing in a Tube Wringer (www.tubewringer.com) to help get the most oil color out of each tube. Empty painting medium and Gamsol containers can be easily recycled. Check with your local recycling facility about recycling empty paint tubes.

How do I get the most complete information on the safety of art materials?

HEALTH LABELING ON ART MATERIALS

American Society for Testing and Materials (ASTM) wrote the health labeling standard adopted into Federal Law based on toxicology reports so consumers can easily recognize materials that pose potential health risks.

Look for this language on the label:

"Health Label conforms to ASTM D-4236."

If there is a safety concern associated with any of our materials, a health warning will be clearly printed on the label.

Artist's materials should be used in the manner for which they are intended and, as part of that, artists should be sensible in their use and management of all materials in their studio.

Personal Protection

Some painters choose to wear gloves while painting, as it makes clean-up easier. However, it is not necessary to wear gloves while oil painting. Oil colors can be easily removed from hands with soap and water.

We recommend wearing gloves and using a respirator when handling dry pigments.

PIGMENTS

Painters do not come into direct contact with the pigments themselves when oil painting – the pigments are thoroughly bound in the oil binder.

Pigments used in oil colors come from both inorganic and organic sources. Many of the inorganic pigments used in oil painting have been used as colorants by artists since antiquity. Painters' access to color has been greatly expanded with the development of organic pigments in the 20th Century.

Pigments made from such materials as lead, mercury and arsenic have been made obsolete due to their toxicity. Suitable replacements to these historical colors have been introduced in recent years.

Lead-based Pigments

All Gamblin materials are completely lead-free.

Gamblin Torrit Grey

Every spring, Gamblin Artists Colors collects a wealth of pigments from our Torrit® Air Filtration system. We filter the air around the areas where we handle dry pigments so that our workers are not exposed to pigment dust. Rather than sending any of our high quality, expensive pigments into the landfill, Gamblin paint makers recycle them into "Gamblin Torrit Grey".

"Pigment dust should not go into the earth, water or landfill, but into paint," says Robert Gamblin.

We make our Torrit Grey available to painters to encourage the reduction and reuse of studio waste.

Gamblin was the first to formulate Flake White Replacement. It has the working properties of lead white but is lead-free, so it is non-toxic. Similarly, we developed Naples Yellow Hue - a pale, opaque and earthy yellow. This color shares the working properties of traditional Naples Yellow, but is completely lead-free.

Cadmium and Cobalt Colors

There is no cadmium dust or “fumes” that come off paints in the tube, on your palette or in your painting. Similarly, Gamblin cadmium oil colors are safe to touch – there is no need to work with gloves.

Cadmiums present a health concern if the dry pigment dust is inhaled. We recommend using a NIOSH dust respirator if you sand surfaces made with a high percentage of Cadmium colors or work with cadmiums in dry pigment form.

The cadmium pigment sources we work with have developed cadmium pigments that are nearly insoluble in the human digestive system. They have been so successful that Gamblin cadmium colors **DO NOT REQUIRE** a Federal ASTM health-warning label for skin contact or ingestion. If other brands carry a warning label for these exposures, their supplier’s pigments do not meet these standards.

Over thirty years ago, when we first started making oil colors, the best cadmium pigments available were still much more soluble in the human system than they are now. The cadmium pigments that we work with today are largely insoluble through ingestion. Having said that, we still recommend that artists not eat their paints.

The only color in our line that carries a federal health-warning label is Cobalt Violet. The pigment is a compound of cobalt and phosphate. If you eat Cobalt Violet, you can expect cobalt to enter your body. It is safe to touch and to paint with, but not to eat. Cobalt Blue is a compound of cobalt and aluminum. Cobalt Green is a compound of cobalt and zinc. Oil colors made from these compounds do not carry health-warning labels because the cobalt cannot be readily absorbed into the body. Just like when using Cadmiums, artists should not inhale the dust from cobalt pigments when sanding dry paint layers and artists should not eat their paints.



PAINTING MEDIUMS

Painters use painting mediums to change the viscosity, texture, dry time, gloss level, and increase the transparency of oil colors. Gamblin’s approach is to offer artists contemporary oil painting mediums that are true to historic working properties, yet safer and more permanent.

Traditional vs. Contemporary Painting Mediums

Painting mediums have always been used for modifying the working properties of oil colors without making the paint layers too “fat.” Rarely has pure oil (100% fat) been used as a painting medium. In making painting mediums, oil is combined with solvent, and frequently a resin.

With traditional mediums, that resin has been a natural resin such as dammar. At Gamblin, we long ago moved away from dammar for two reasons: not only does dammar have very poor aging properties that it imparts to the paint film, but its use requires a strong solvent, such as turpentine.

Gamblin mediums are formulated with a soy-based alkyd resin, proven to retain its flexibility much better than dammar-based mediums. Since the alkyd resin is essentially a polymerized oil, it is compatible with the linseed oil binder of colors. Significant to this conversation, our resin allows us to create mediums with the mildest form of odorless mineral spirits: Gamblin Gamsol. For painters who wish to paint in oils without the use of any solvents, there are more Solvent-Free painting mediums available to painters today than ever before.

CONTACT GAMBLIN

If you have questions, or would like to receive samples of our materials for use in your institution’s painting studios, please feel free to contact Scott Gellatly here at Gamblin. Scott may be reached by email at scott@gamblincolors.com or by phone at 503-235-1945 x12.

Brush Cleaning Tip Sheet for Oil Painting



1. Set up a simple, 2-rag system - one "dirty" rag and one "clean" rag.



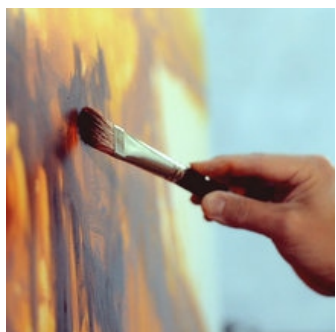
2. Remove color off your brush onto the "dirty" rag.



3. Dip brush in Gamblin Gamsol or Safflower Oil to remove residual color.



4. Wipe brush on second, "clean" rag.



5. Continue painting. Repeat steps 2 - 5 throughout the painting session.



6. Choose a brush soap for cleaning your brushes after the painting session.



7. Wash the brush in a mixture of brush soap and water in a ceramic bowl.



8. Wipe brush on paper towel.



9. Wipe dirty water out of bowl with a paper towel and dispose of in garbage.



10. Remove soap from brush and let dry before your next painting session.

By following these easy steps, painters can safely remove oil colors from brushes. In addition, this method prevents pigments from being rinsed down the drain and into the watershed.

For additional information, please refer to our Gamblin's Studio Safety Guide at gamblincolors.com