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DYEING IN VEIN

SAFETY PRECAUTIONS AND DYE ROOM SETUP

To make textile magic, we must use dye, and not die from the array of products utilized in our craft! If we know how to protect ourselves when using powders, chemicals, and aerosols, the dye room will be set up in such a way that it supports our safety; this is why safety and dye room setup go hand in hand.

Safety is the most important knowledge base for a painter–dyer. Exposure to the chemicals we use is cumulative and eventually will have permanent effects (like premature death) if artisans do not take proper safety precautions. In the following chapter, you will find my recommendations for personal safety, how to decode SDS sheets, and how to apply the information therein. Additionally, I will discuss general dye room cleanliness, setup, and most wanted dye-room equipment.

Figure 1.1 A large light-filled film studio dye room.
Photo courtesy of Beth Herd.

KEEP IT CLEAN

Cleaning as you go in the dye room is much like putting away cooking ingredients as you use them – decluttering the workspace while preparing for your next steps. Having loads of old towels to dampen and wipe surfaces down while you are working is key in the dye room. This will minimize powders that can potentially be airborne and get inhaled by those using the space or that could

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transfer to other damp projects in the room. Some dyers like to use a damp towel or newspaper on the powder mixing workspace for this very reason – the damp article attracts the dye particles so they don't go into the air, your lungs, or on the damp piece you just dyed that is hanging in the work room! Additionally, you will minimize exposure for the future you, as you will eventually be picking up this towel to launder it (or newspaper to throw away) and don't want particles flying everywhere when you do.

The "ProChem Studio Safety and Guidelines" leaflet sums up the basic and most important safety rules of a dye studio (Figure 1.2).

PRO™ CHEMICAL & DYE

STUDIO SAFETY GUIDELINES

The products listed on our web site are considered relatively non-toxic, but it is best to avoid unnecessary exposure. Keep in mind that they are industrial chemicals and not intended for inhalation or ingestion. We encourage teachers to advise students about safety precautions and proper use of safety equipment, clean work habits and responsible use of products.

ALL ARTISTS SHOULD USE THE FOLLOWING SAFEGUARDS

- Do not eat, drink, or smoke in areas where dyes and chemicals are used.
- Work in a well ventilated area.
- If you experience an adverse symptom to anything, move away from the area to fresh air. If the symptoms persist, stop using the product & consult your physician.
- Wear a disposable dust/mist respirator if you dye fabric occasionally. If you dye fabric on a regular basis wear a MSHA/NIOSH approved respirator with cartridges for dusts, mists, and fumes. Disposable dust/mist respirators don't help with fumes.
- Even though dyes are not absorbed by the skin you should wear rubber gloves, old clothes or protective clothing, and even old shoes.
- Wear goggles when working with corrosive chemicals such as acetic acid and lye (you only have one set of eyes).
- Contact lens wearers should be careful around powders to avoid eye irritation.
- Cover your work area with dampened newspaper. Weigh and mix dyes and other powders with local exhaust ventilation or use a mixing box. See Helpful Information at right.
- Do not mix powders near furnace or air conditioner intake pipes.
- Use appropriate utensils to stir solutions and dye baths. If you use food utensils as dyeing tools don't reuse them for food preparation.
- Avoid exposure to dye powders, auxiliary chemicals and vapors during pregnancy or lactation.
- Avoid prolonged or repeated contact with the skin.
- Vacuum floors and surfaces, do not sweep.
- Keep dye and auxiliary containers closed and in a cool dry place, away from food and out of the reach of children when not in use.
- Wipe up spills immediately. Liquid dye dried to a powder can be accidentally inhaled or ingested.
- Label dye container with purchase date to insure out of date dye is not used. See page 24 for shelf life information.
- Clearly label all solutions and containers of powder. Do not remove the supplier's name or hazard warning labels.
- Always add acid to water.
- Always add Lye to cold water.

Figure 1.2 ProChem's safety guidelines sum up the most important safety protocols when working with paint and dye.
Image courtesy of ProChemical and Dye.

DISPOSAL

Quantities of dyes and auxiliary chemicals used by home dyers rarely exceed limits set for disposal in municipal or even septic systems. Concentrated highly acidic or alkaline waste water can upset the balance of a septic system. The amount of rinse water used for a normal dye bath is sufficient to dilute your dye bath for disposal purposes. Therefore, waste water disposal should not be a problem. If you have questions about disposal contact your local board of health for guidelines specific to your area.

CLEAN UP

Clean up work area with damp sponge and towels. Remove dye stains with a household cleaner containing bleach. Do not use bleach to remove dye stains from hands. Instead use a specifically designed hand cleaner - ReduRan. While hands are dry, rub a small amount of hand cleaner on hands and work in well. Add a small amount of water and work until dye residue is loosened. Wash off thoroughly with soap and water and dry hands. Repeat as necessary.

Protect those who cannot protect themselves - children and pets. Clearly label dyes and auxiliary chemicals and keep in safe storage and out of the reach of children. Supervise children carefully.

HELPFUL INFORMATION

How to make a mixing box: Cut off the top and one side of a 10"x10" cardboard box. Cut a stack of newspapers the size of the inside dimensions and place them inside the box. Dampen the surface of the newspaper with a sponge or spray bottle filled with water. Measure dye or auxiliary powder and dissolve it with water. Once the powder is mixed with water, carefully roll up the top sheet of newspaper and discard. This way any excess powder that falls on the damp newspaper does not blow around.

WAX

Waxes pose a specific set of safety concerns. Read and follow the guidelines below before batiking with hot wax.

- Always use proper ventilation in your work area. Create a local exhaust system by putting a portable exhaust fan in a window, so it pulls air from the room to the outside.
- Heated wax releases irritating chemicals including acrolein and aldehydes. There is no approved MSHA/NIOSH filter for acrolein. A respirator is not a substitute for good ventilation
- Heat wax to the lowest temperature at which it remains liquid.
- Hot wax is a fire hazard. Do not leave it unattended.
- Wax forms potentially hazardous vapors at high temperatures and may ignite. Do not use open flames, such as a gas or propane burner, to heat wax. Instead use a crock pot or electric fry pan with a temperature control.

CALIFORNIA PROPOSITION 65

California Proposition 65 is a labeling act that requires a special label on products that contain (in any amount) any chemical on the Prop 65 list. Many household items including rubbing alcohol and some bug sprays are on the list, as well as car exhaust and cigarette smoke. You will find this label on many of our products because trace amounts of these listed chemicals such as copper, Ethyl Oxide and rubbing alcohol are on the Prop 65 list.

MATERIAL SAFETY DATA SHEETS (MSDS)

California Proposition 65 is a labeling act that requires a special label on products that contain (in any amount) any chemical on the Prop 65 list. Many household items including rubbing alcohol and some bug sprays are on the list, as well as car exhaust and cigarette smoke. You will find this label on many of our products because trace amounts of these listed chemicals such as copper, Ethyl Oxide and rubbing alcohol are on the Prop 65 list.

Figure 1.2 Continued

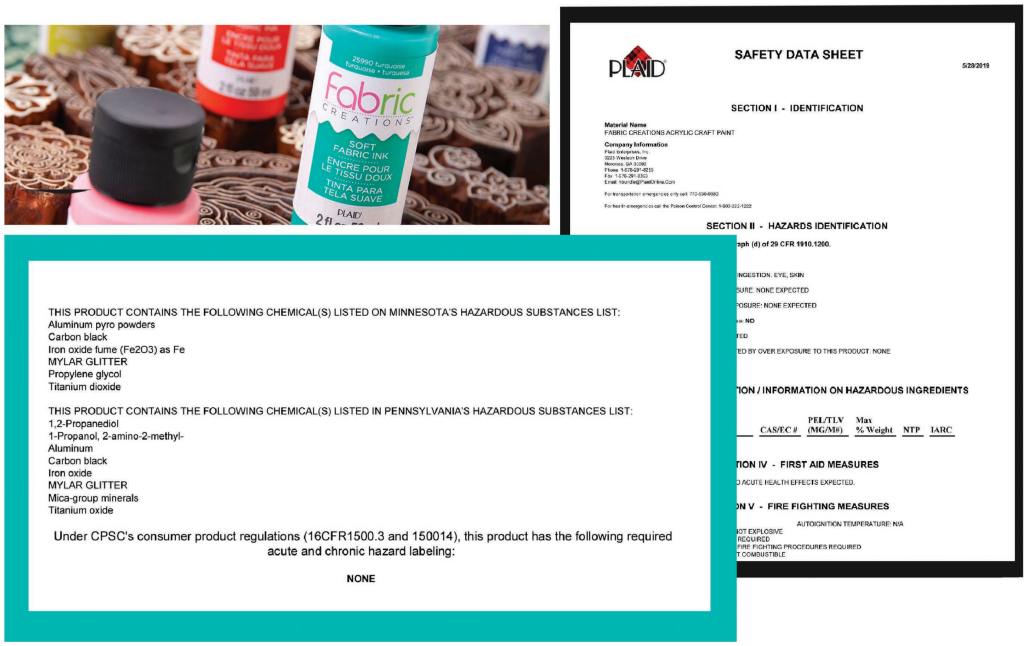

Figure 1.3 Notice on the SDS for a nontoxic and water-based fabric paint, these paints do contain chemicals considered to be toxic in some states!

LABELS

Reading product labels the first time you use a new product is a smart and worthwhile activity. You will encounter different types of labeling that may tempt you to use minimal safety precautions because the label states that the products are nontoxic or natural. These labels could not be more misleading. In her book *The Artists Complete Health and Safety Guide*,[1] Mona Rossol discusses these labels in detail. There are a few labeling terms I feel are important to mention including biodegradable, water-based, and nontoxic.

Rossol states,

> "Biodegradable" really means this: You won't get into trouble if you flush or trash the product, but there are no guarantees related to your health while you use it. And the product may not be safe for the environment in the long run either.

Regarding water-based products, Rossol adds,

> Many people assume that "water-based" products are "safe." But the material safety data sheets from the manufacturers reveal that many water-based products contain both water and solvents. "Water-based" really means this: Water is probably an ingredient, but the product may also contain solvents and other toxic substances. Consult the material safety data sheet for further information.

One of the most misleading and misunderstood labels includes the term "nontoxic". Rossol defines what this term really means: " 'Nontoxic' on a consumer product really means this: The

ingredients don't kill half or more of the animals in short-term toxicity tests, but there are no long-term guarantees."

As you can see, these seemingly innocuous labeling verbiages do not mean the product is safe on your skin or near food. When you pull out that water-based paint and intend to use it through an airbrush, consult the SDS sheet to review safety precautions; you will be glad you did.

SDS: SAFETY DATA SHEETS

Being informed is your primary job as an artist, painter, and dyer. Learning how to read a *Safety Data Sheet* (SDS) (formerly known as MSDS or Material Safety Data Sheet) quickly and effectively is imperative in protecting yourself and others from the damaging effects of chemicals and solvents.

All states require employees to have access to a Safety Data Sheet (SDS), which contains information on health hazards, chemical ingredients, physical characteristics, control measures, and special handling procedures for all hazardous substances in the work area. The laws say that SDSs must be readily accessible to all employees and it is illegal to have any blanks on the sheet. If no information exists, "no information" must be written in the space. The laws also state that SDSs must contain complete, accurate, and up-to-date information. Nevertheless, many SDSs are inaccurate and incomplete; they may, however, still be very useful if you know how to read them and where to look for more information.

SDSs may differ slightly in organization, but they must all contain the same basic information on hazardous ingredients, health effects, legal and recommended exposure limits, physical properties, and control methods. Please see the following table (table 1.1) that breaks down each section of the SDS into digestible pieces.

Table 1.1 Decoding the Safety Data Sheet.

SECTION 1: Identification	**What is this product and who makes it??** The name of the product and trade name(s), recommended use, company address, and emergency telephone number of the manufacturer must be provided.
SECTION 2: Hazards Identification	**Am I dealing with any hazardous chemicals?** This section will identify hazardous products as applicable to law, including hazard classification (i.e., flammable liquid).
SECTION 3: Identifies Ingredients	**What is this product actually made of?** This section identifies chemical ingredients of the product, including impurities and stabilizing additives. Whether or not something is considered nontoxic by law will also be included in this section.

(Continued)

Table 1.1 (Continued)

SECTION 4: First Aid Measures	**What happens if I mess up and get this stuff on me. . .?** First aid instructions on how to mitigate exposure based on whether you inhaled the product, had skin or eye contact, or ingested it. This section also lists symptoms or effects of exposure. Unfortunately, a lot of MSDSs in circulation do not contain complete and accurate health hazard information.
SECTION 5: Fire and Explosion Hazard Data	**If this product lights on fire, how do I put it out??** This section should provide information on the fire hazards of a product and specific products used to extinguish a fire. **There are different types of fire extinguishers for different products!**
SECTION 6: Accidental Release Measures	**Whoops, I spilled it all over the place – how do I clean it up?** How to clean up and contain a spill of the product, methods and materials for containing the products, and what protective equipment is needed in cleaning up. Usually, we use such small amounts of products that this really isn't a huge concern.
SECTION 7: Handling and Storage	**When it's time to put it away, where's the best place?** This includes how to handle the product, what product or elements to NOT store it next to, and how to store the product properly.
SECTION 8: Control Measures	**HOW DO I PROTECT MYSELF??** The SDS must list control measures that can reduce or eliminate the hazard, including ventilation and other engineering controls, safe work practices, and personal protective equipment. For respirators, information on the type of respirator, degree of protection and the appropriate filter cartridge (such as acid gasses, dust or organic vapors) must be included. In addition, all gloves do not protect against all chemicals. The correct type of glove should be specified here on the SDS.
SECTION 9: Physical and Chemical Properties	**What does it look and smell like?** This section identified properties associated with the product including appearance, odor, pH, melting point, viscosity, flammability, solubility, flash point, etc.
SECTION 10: Stability and Reactivity	**Is it shelf stable?** Discusses chemical stability, any hazardous reactions during storage, and what are the hazards and the physical description of what may happen to the product as it decomposes.
SECTION 11: Toxicological Information	**In what way could this product kill me?** This section details routes of exposure (lungs, eyes, skin, etc.), a description of immediate, delayed, or chronic effect from exposure, measure of toxicity based on how many rats died in the lab, descriptions on symptoms of exposure, and a report on carcinogens.

SECTION 12: Ecological Information	**What if I spill this in a lake or river?** What happens if you release this product into the environment and how to mitigate.
SECTION 13: Disposal	**How do I throw this product away?** How to dispose of the product including containers to use, whether or not it should go to the landfill or down the drain.
SECTION 14: Transport Information	**How will this be shipped?** Guidance on transportation of the chemical by rail, road, air, or sea.
SECTION 15: Regulatory Information	**Even more info:** Safety, health, or environmental regulations that are not found anywhere else on the SDS.
SECTION 16: Other Information	**How old is this SDS? Is it the most current one available?** When the last SDS was prepared or when the last revision was made.

WHICH CHEMICALS ARE COVERED?

State laws differ about which chemicals are required to be listed on an SDS. Federal *OSHA* (Occupational Safety and Health Administration) hazard communication standards require evaluation of all chemicals and those found to be hazardous are covered by the law. Some state laws contain a list of thousands of chemicals that must be included, and a few require all ingredients to be listed, even those which are not hazardous. Companies can say that the blend of chemicals are a trade secret but still have to report hazards associated with chemicals used in the product. Assume that all of the chemicals that you work with should be included unless the manufacturer or employer can prove otherwise.

WHAT ARE THE NAMES OF THE CHEMICALS?

Chemicals are often known by different names: a *trade name*, such as Rit Color Remover, is the brand name of the product. It does not tell you what chemicals are in the product, or whether the product is a mixture of chemicals or a single chemical. A **generic name** describes a family or group of chemicals. For example, there are several different "isocyanates", and thousands of different "chlorinated hydrocarbons". Sometimes an SDS will try to get away with just listing the generic names. However, the law says that chemical names must also be listed. **The chemical name is the easiest name to use when doing research on the health effects of chemicals and how to protect yourself.** The SDS must list the chemical name of all hazardous ingredients that make up more than 1% of the mixture (or 0.1% for cancer-causing substances).

The CAS Number is a number given by the Chemical Abstract Service to each chemical. While different chemicals may have the same name, they will all have their own CAS number, which can be used to look up information. The Chemical Abstract Service publishes a book that contains a list of all CAS Numbers and the chemicals they represent.

PERSONAL SAFETY

Now that we have reviewed chemical designations and how to find information from a SDS, let's discuss personal safety in the dye room. Painter dyers use a variety of chemicals and powders on a daily basis. Exposure to these products create cumulative health impacts. So, while one or two exposures to the products will not kill you, the cumulative impact of using these products unsafely will.

WATER SOLUBILITY IS A BLESSING AND A CURSE

Some dye powder is **water-soluble**. This means powders want to find water and bond with it, dissolving in solution. Besides the dye pot or your rinse water container, what else nearby could be wet and attracts dye? Your eyes, nose, and mouth!!! Your eyes and mouth have glands that secrete moisture to keep those areas working properly, and the nose has mucus membranes that secrete moisture there to keep the body healthy. While these biological features help when taking a hike, they also attract dye powders with their moisture.

I had a student once who wouldn't wear a mask in dye class. We had been working on face casting and had a five-gallon bucket to wash the plaster off our hands. The craft room was a multipurpose room that also had a vent hood and dye vat. Another student dyed costumes that night, ten feet away from the plaster wash-off bucket. In the morning, the water in the bucket was a deep red color, matching the dye the other student had been using. I used this as an example, to the cavalier student, of how dye powder travels. For the same reason that wet white piece of silk hanging on the line 20 feet away from where you were mixing dye got speckled all over with dye, the bucket of water was dyed red. Both are full of water and attract substances that bond with that water the same way your eyes nose and mouth do! Have I beat this horse long enough?

Your drink or food will also attract dye powder from its moisture, therefore NEVER BRING FOOD OR DRINK INTO THE DYE ROOM!! Do not use any tools that you also use for preparing food or cook food in room used for dyeing. Seems like a no-brainer but you would be surprised how many theatres use the dye room sink to wash and dry their dishes. If your dye shop has a kitchen in it, do everything in your power to separate the two areas. If you cannot separate the areas, do not use the kitchen and advise your friends in the shop also to steer clear. Dye travels. Dye poisons. We like to use dye. Use it responsibly!

THE ACTUAL PRODUCTS – A PERSONAL CHOICE

Choosing safety products is an important and personal choice. I will discuss my experience with these products and give my favorite recommendations. Although these are my favorite products, you may have to try many types of gloves, masks, respirators, and so on, before you find your winning products.

APRON AND CLOSED-TOE SHOES

First thing I put on is my apron. It covers my chest, stomach, and the front of my legs, generally where dye and paint will splash. I always customize my apron to crisscross my back for comfort. Also, if you are going to be in the dye room long periods, sewing some ripstop/lightweight vinyl to the inside bottom half of the apron to repel dye and water transfer to clothes is a smart idea. My apron happens to be plastered with paint and glue, so it already has a waterproof barrier. I love having pockets in my apron where I can shove my mask and gloves if I have to run to a fitting! Don't forget about closed-toe shoes. You really don't want chemicals or paint splashing on your toes. Trust me.

Figure 1.4 I put on this crusty apron when gearing up to paint and dye. I have customized the straps to cross over my shoulders instead of hanging from my neck. Fifteen pieces of flair optional.

GLOVES

Gloves are the first line of defense against contact with dye in powder and solution. The skin, our beautiful protective organ that covers our bodies, actually absorbs chemicals and delivers them directly to our bloodstream. Gloves are available in several types of materials, lengths, and thicknesses that vary in price. I personally like my gloves to fit very tight so I don't accidentally transfer paint or dye with a baggy glove finger unknowingly to a place that I don't want it! Gloves have different resistances to a variety of chemicals – so check the box for the level (poor or good) resistance to the chemicals you are going to use.

Figure 1.5 Nitrile gloves are great for a shared dye space to avoid allergens found in latex. Powder free eliminates the mess that happens when you handle your project after taking off powdered gloves!

DISPOSABLE GLOVES: LATEX VS. NITRILE

Many people have abandoned the traditional powdered latex glove due to latex allergies and the need to buy gloves in bulk. Also, powder can become a messy nuisance when an artist is taking gloves on and off all day and transfer to the piece you are working on, creating more work for you to remove the powder. Nitrile is a common choice of dye shops, but it does not stand up well to acetone, a substance often used in changing shoe color (see Chapter 6 for more information). Glove materials have a variety of degradation and breakthrough times from chemicals,

depending on the glove material and chemicals used. For example, my favorite nitrile gloves only have a 4-minute breakthrough time with acetone. Will I finish removing the color from those shoes in 4 minutes? Nope. Therefore, I need to use another glove like latex (10-minute breakthrough time) or butyl gloves, when using acetone (which poisons your nervous system BTW). These gloves are given the designation of disposable but you can reuse them if you are careful. With lightly used gloves (used with water-based products and washed before removing), turn them outside in by blowing like a balloon into the wrist area. This should pop the fingers out and make the glove ready for a second go around. It's time to throw them out when there are holes and or they are covered in dye.

BUTYL GLOVES

These gloves are considered the go-to for using chemicals. They are black, and come in a variety of textures, lengths (up to 32"!), thicknesses, and sizes. It is always best to choose the correct size for your hands so you do not spill the chemicals you are handling, which can happen if your hands are swimming in the wrong-size glove. Order these from Grainger.com, who also happens to have store fronts in many cities that will allow you to try gloves on in person.

Figure 1.6 Cotton-lined full-sleeve gloves will keep you cool(ish) and covered when immersed in a hot dye bath.

THERMAL GLOVES

There are several brands of thermal gloves and many sources from whom purchase the gloves. Many people prefer the neoprene thermal gloves for vat dyeing so they can grab and manipulate the fabric by hand while withstanding the high heat of the vat. Others like the butyl gloves that are thicker than the disposable gloves but thinner than the neoprene ones, because they can feel the fabric through the gloves. Generally, the more thermal resistance the glove has, the higher the cost. They are sold in a range of glove sizes, some numbered and some small through extra-large. Fit is very personal, so make sure to try a few pairs to discover the size you prefer.

Masks

As we all know, there are a large number of masks on the market with have varying levels of protection against particulates, chemicals, and splashed chemicals. I will discuss two types used most frequently in the dye-craft area: dust particle masks and half-face cartridge respirators.

DISPOSABLE DUST PARTICLE MASKS

I know over the last few years we have all become experts on masks related to COVID particles. Masks used to filter dye particles are very similar to the best COVID masks. They feature a fantastic seal on the face and a bendy wire at the nose to create a custom fit. There are many brands and types of dust particle masks. They range from the surgeon-like over-the-ear kind to the charcoal filter ultra-seal $20-a-mask type. The cheap over-the-ear and around-

the-head types are usually not adequate to filter out large amounts of particulate matter. The seals are terrible and usually the fit is strange at best. Masks of all types need a good seal and excellent airflow. For this reason, sampling many masks, I always choose N95 8511 by 3M (Figure 1.7) dust particle masks. There is a metal bar you can pinch above the nose and a foam rubber seal 360° around and it includes a generous valve on the front for ease of breathing. There are many other types of particulate masks on the market, some even charcoal lined for nuisance odors. In my opinion, you need two masks: an N95 dust particle mask as mentioned previously, and a half-face cartridge respirator.

Figure 1.7 3M N95 8511 dust particle masks. I feel like I can actually breathe in these!

Figure 1.8 A north half-face respirator and P100 cartridges – my personal favorite.

RESPIRATORS

When using products that contain volatile organic compounds (VOCs) or other chemicals for which the SDS requires use of a respirator, research which chemicals you are protecting yourself from, then order the cartridge accordingly. Every cartridge filters out different chemicals, vapors, or gases. This is indicated on the side of the cartridge by color and number. I have always preferred North respirators and the P100 cartridge has usually protected me from harm from any products in my dye room stock. If you work in a theatre or university, you should have to have the resident safety person come and do a fit test whenever you buy a new respirator or if this is your first time using one. A link to a DIY fit test can be found here: www.gemplers.com/tech/respfitcheck.htm.

GOGGLES

There are many types of goggles to choose from and you will choose the type that corresponds to what you are working on. While the safety-glasses style is usually the most comfortable, the goggles from your 10th grade biology class with a seal around the edge are the best protection against splashes and powder. If you are working with something very toxic and worried about splashing your face, there are face shields that will create a full barrier window in front of your face, although it will most likely fog up over a vat.

GETTING THAT DYE OFF OF YOUR HANDS!

For ages many dyers have used a dye reducer called Reduran; Kresto Kolor is the exact same thing (just a different name). It literally feels like sandy paste and smells like burning hair. It works better than hand soap but it is kind of expensive. A long-time dyer, teacher, author, and artist, Elin Noble, introduced me to using the orange scented mechanic soap – Gojo. It also feels like sand but doesn't smell like burning hair and REALLY washes that dye and paint off of your hands! It's also cheap because you can buy it in huge bottles. There are other brands of this type of soap that also work great. Try it out!

THE DYE ROOM SETUP

Dye room and paint space setup is really important to the artist's health and efficiency in the space. There must be a sink with water source, stove for heating dye, a ventilation system, surface for painting, washer and dryer, clothesline (which may be located outside), and storage for all paint dye products. There are many other important tools like a mixing box, computer for research, and spray booth to name a few, but these can be costly and there are workarounds for many of these tools. A fire extinguisher is always good to have around but check your SDS for fire extinguishing methods if you are using a unique product that requires a high level of safety protection; a normal fire extinguisher may not put out fires from certain chemicals.

DYE STORAGE

Most dye requires dark, cool storage. Many dyes are photosensitive and can be damaged by being exposed to light regularly, natural UV light being the worst. If you would like to store dye, like Rit that comes in a bag, in a wide-mouth container and your dye storage on a shelf is exposed to light every day, I like to use opaque containers (Figure 1.9) to store dye. These can be found at McMaster Carr and Grainger as well as other lab-equipment companies. I write the month and year on the top and side of the containers when I refill them with dye so I know how fresh the dye is. Always make sure to label dye color, color number, and dye company at the very least. This will make reordering so much easier.

Figure 1.9 Wide-mouth jars are perfect for storing powdered dyes and auxiliaries. I always add the date to the lid on a piece of tape when I add new products to the containers so I know how old the products are.

Figure 1.10 The Oregon Shakespeare Festival dye room. From top left to bottom right: a large steam-jacketed dye vat with ramp to push dyed articles directly into sink, ventilated mixing box, bullet steamer, spray booth for airbrushing, computer setup for creating computer-printed fabric, and a small portion of their paint and dye storage.

VENTILATION

Proper ventilation will save brain cells! Noxious gasses and continual exposure to chemicals can and will affect your central nervous system! It is your responsibility to require appropriate ventilation for your workspace and to read the safety data sheets to understand what level of ventilation and protective personal equipment is needed.

ELIN NOBLE'S AT-HOME MIXING BOX!

Elin Noble, a seasoned dyer and textile artist, wrote a wonderful book on painting and dyeing called *Dyes and Paints: A Hands on Guide to Coloring Fabric*, that includes a description of a DIY powder mixing box. "Use a mixing box to limit airborne exposure to chemical powders. Cut off the top and one side of a 12" x 12" (30cm x 30cm) cardboard box, leaving a small 'room' for mixing. Set the mixing box on top of a drop cloth. Cut a small stack of newspaper to the inside dimension of the box. Place the newspapers on the bottom of the mixing box and spray them with water. If you spill any of the powder during the mixing process it will stick to the damp paper."[2]

Figure 1.11 Elin Noble's homemade mixing box.

Perhaps the most important tool you will have in your space is one that aids in room ventilation. I could really go down a rabbit hole describing the different levels and types of ventilation systems available but will focus on the 3 most commonly used in a dye room: mechanical hood, wall, and box systems. These systems and their uses can be somewhat interchangeable, but I will describe what I consider to be the safest setup.

Mechanical vents have a mechanism that actively processes the surrounding air through a changeable filter and discharges filtered air to the outside or back into the room. There are many levels of these – starting with vents that may be found above your kitchen stove, to those found in factories and laboratories. The ideal level of ventilation in a dye room will actively filter air particles resulting from mixing dye powder and spraying airbrush paint. Permanent vent hoods usually live above dye vats or mixing areas, venting off steam and any chemical vapor or gases from the products you are using. An example of when these are really helpful is when you are using color removers, as these products can be harmful to breathe in large quantities (think how huffing bleach over the sink can make you feel and triple that feeling! Yuck!). Wall vents may be adjacent to your dye powder mixing area, effectively pulling dye away from you. A **vent box** and its larger counterpart a **vent booth** (or spray booth) are the best line of defense when using toxic materials like leather paint, FEV, or anything with high VOC content.

DYE VATS

There are two major types of dye vats used in a dye shop: steam-jacketed dye vats and a large stove-top pot. Both are very useful for larger dye jobs that cannot be accomplished in the

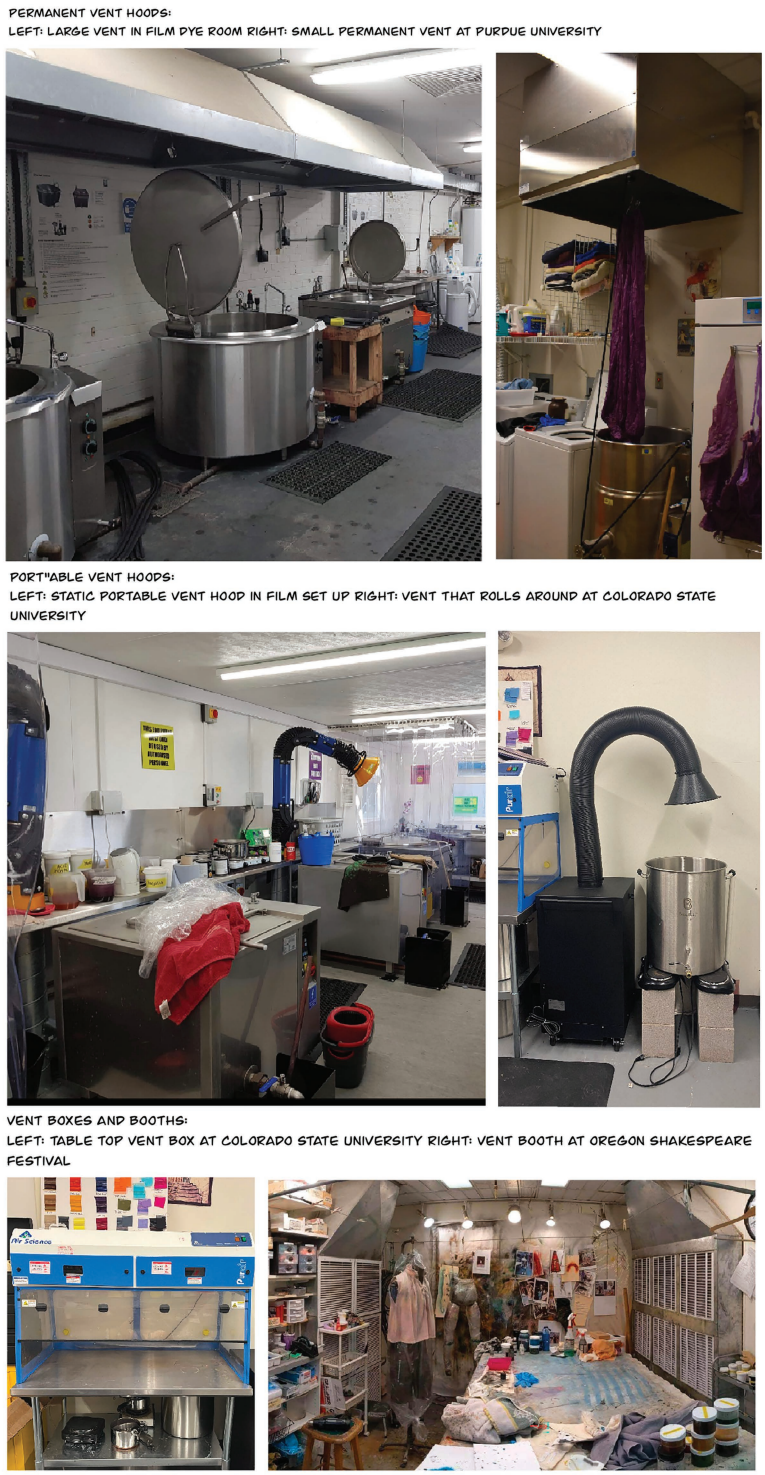

Figure 1.12 An example of a variety of ventilation systems ranging from large to small scale.
Photo credit: Beth Herd, Erin Carignan, Farrah Southam.

washing machine or in a smaller pot on the stove top. Both have pros and cons, and usually money and space dictate which type of vat you choose. Both types of vats require a water source above the vat as no one wants to lift that much liquid! Remember, water weighs 8.35 pounds per gallon (1 kilogram per liter) and to dye a large amount of material may take, at minimum, 10 gallons, which would be 83 pounds! If your spigot cannot swing directly over the vat, you can use a short detachable hose to lead the water to the vat. These can also be handy in spraying down the vat after use.

STEAM-JACKETED DYE VATS

Steam-jacketed vats are the ideal choice for dyeing large lots of material and can be purchased through commercial kitchen supply companies as soup kettles. There are two types of kettles: direct steam or self-contained and they are available in gas or electric models. Most models can be plugged in directly to the steam service if you happen to be in a large institution. Both generate steam inside a "jacket" that surrounds the kettle or vat to keep the contents in the vat at a consistent temperature. Capacity ranges from a few gallons to 200 gallons and are almost always bolted to the ground to avoid tipping. Some have agitators, others are mounted on a swivel that allows one to pour liquid out of the vat, but most used in theatre have a dedicated place, bolted to the floor and with a permanent drain set up. If the drain is near your vat but not under, which is very common, you can rig the drainage shunt to a longer pipe to expel spent dyebaths. Some universities and theatrical companies have an easier time justifying the purchase of a soup kettle to purchasing, rather than a dye vat, the latter, which can bring up chemical disposal concerns or a red flag hindering the ordering process. Steam-jacketed vats also require a special breaker box and steam pressure gauge; the vat company can help you decide what you will need based on the size of the vat you are ordering, and your building superintendent can help you figure out what you need in terms of a breaker in your building.

Figure 1.13 A 40-gallon steam-jacketed dye vat. Depending on the scale of the work you do, size up or down accordingly.

These vats come with lids that can be easily removed for greater availability of space around the vat and constant access to goods in the vat. Since the dyer should be hovering over the vat and most likely constantly stirring, there is no need to close that vat and walk away like you would if you were cooking a pot of soup. The major manufacturers are Groen, Hubert, Hamilton, Dover, Vulcan, and Lee.

STOVE-TOP POTS AND KETTLES

Having a variety of small and large pots are a must in the dye shop. Pot material will depend on the type of burner your shop uses; for gas or electric burners, almost any material will do, but for

Figure 1.14 A kettle used for brewing beer is a great makeshift dye vat. These kettles have a spout and valve that can be attached to a hose in order to drain the spent bath.

induction burners, you must use stainless, carbon steel, or cast iron. I like to buy old Revere Ware pots at thrift stores in 1/2 pint, pint, quart, and 2 quart sizes to set up a shop. 8-gallon and 10-gallon pots are handy when working with more yardage.

I have found that brew kettles (see Figure 1.16) are the most useful as a stand-in for a dye vat as they have an option to come with a spigot and a valve to drain water. These pots come in 8-, 10-, 15-, 20-, and 30-gallon sizes. If you have little space or have a modular set up that is on the move, this option is the best for you. There are optional pipe fittings you can buy that go from pipe thread to hose thread (did you know those thread systems were different from each other???) so you can attach a hose to the spigot to drain the vat. The best burners for these pots are large gas single burners like the ones marketed by kitchen supply stores as "backyard burners". They will support a pretty large brew pot as the burners are about 20" in diameter. In our shop at Colorado State, we do not have gas, so we have two double burners – that's 4 burners total, sitting under a 30-gallon brew pot. It works but if the kettle is halfway full, it takes over three hours to get the water to 180 degrees. Not ideal but it works.

ACCESSORIES AND TOOLS FOR VAT AND KETTLE DYEING

You will want to invest in or create **a paddle** to stir your fabric or garments in the vat. Plastic will bend with the heat of the water so wood is a better choice. I recommend creating an oar-shaped paddle and shellack the heck out of that thing! That way, it won't become water logged or accept dye and transfer onto the next thing you dye. There are metal stirrers available specifically for vats but I find them heavy to use over a long period of time. If you find you have to screw two objects together to create the paddle shape, make sure there are no screw ends or pokey bits that will damage your fabric. Another useful tool for the vat, which can be found at restaurant supply stores, is a long-handled steel spoon or long-handled tongs. These can be useful when using large pots too (Figure 1.15).

Figure 1.15 Long-handled spoon and long tongs! Sharpie for scale.

Another very cool item that a scene shop or metal fabricator can make for you is a little **metal ramp** that allows you to slide the fabric out of the vat and directly into the sink next to the vat. This is super helpful if you dye a large quantity of fabric like a Broadway shop or large Lort theatre.

THERMOMETERS

You can use old mercury thermometers or digital thermometers, just make sure the temperature range is high enough! I have fried a few temperature/pH monitors in my time from putting them in nearly boiling water. pH monitors do not generally rate high enough to stick directly into a vat or pot of hot water; you will want to remove water from the bath, let it cool, then test the pH. One of the best ways to quickly and safely measure temperature is with infrared thermometers – they are so easy to use – you just "aim and shoot" at the surface of the water to check your temperature!

Figure 1.16 Thermo Pro Infrared Thermometer, around $30 at Home Depot.

THE SINK!

This is one of the most important tools in your shop. A stainless steel kitchen sink with two deep basins and a work area is ideal. These can often be found at university surplus or on different marketplace apps. The idea is that the basins are deep enough to hold bussing tubs that you can soak fabric/garments in, or use to thoroughly wash out dyed fabric. A restaurant grade pre-rinse spray (Figure 1.19) valve is an ideal part of your sink setup. It will allow you to hose out silk screens and other stubbornly stuck products.

Figure 1.17 Deb Dryden's studio sink is a perfect dye sink because it has flat spots on both ends to dry bins and pots or store overnight baths!

Photo courtesy of Deborah Dryden.

Figure 1.18 A restaurant pre-rinse sprayer and eyewash station on dye sink at Colorado State University.

LARGE BUSSING TUBS

The kind of bussing tubs used in restaurants work best. They are tough, cheap, and can be found at restaurant supply stores. They are larger than the ones used for a kitchen sink and can be bought in a variety of depths. My personal favorite size is around 15″ x 21″ x 5″ deep. They accommodate more fabric and can be used to do low water immersion dyeing for larger pieces. They can also handle very hot water and don't bend or melt easily.

Figure 1.19 A variety of sizes of bussing tubs always come in handy in a dye room. Even cat boxes work great!

WASHERS AND DRYERS

Top-loading washers are the very best. Usually older-model washers work the best but you can disable the auto lock by putting magnets on specific areas of the washer. The old ones don't lock when you close the lid and they don't stop agitating when you want to open them to check your work. I often dye in the washer if I am toning something or just teching a bunch of white shirts, so the ideal washer is like a vat but with a spindle in the middle to agitate the fabric for you. Personally, I think one of those old-timey washers that have a ringer attached would be the coolest dye washer, ever.

Figure 1.20 Ideal washing machine properties and setup for dyeing!

INDUSTRIAL DRYER

An industrial dryer is huge and gets really hot! They have temperature controls but if you want to set Fiber Etch or fabric paint, you can set the temp on high and let it do the work for you – but only if the fiber etch or fabric paint is dry!

DRYING CABINET

A drying cabinet is one of my favorite tools for so many applications! This can quickly dry any fabric and it features 3–4 shelves that fold up to create a huge 6' drying space! Maximum temperature is 150° so it will not shrink or burn anything. These are great for wardrobe too – to dry corsets or bulky costumes more quickly. I use them to dry wigs, hat sizing, glue, sky's the limit!!! I have a Staber domestic drying cabinet. They retail around 2K and usually delivery is free. It is deeper than a traditional wig dryer so it can accommodate more items and of a larger scale.

Figure 1.21 A Staber drying cabinet is an excellent addition to any costume shop! As you can see, the stainless collects finger prints; get white instead!

A FLAT SURFACE

You will require a large flat surface that can be covered in brown paper and/or plastic for painting and dyeing horizontally. So much breakdown is done this way, using the table for leverage when sanding or rubbing paint and dye into garments being distressed. A table that can become a vertical surface is also amazing as a vertical surface is fabulous for airbrushing or using gravity to paint or dye textiles.

MEASURING TOOLS

Certain dyes are mixed by weight and thus require a scale to measure them. A digital scale that weighs in ounces and grams is preferable. Other dyers, especially ones that use union dyes regularly, like to use measuring spoons. Either way, it is good to have a variety of measuring cups, spoons, and a digital scale. I love these tiny spoons that measure down to 1/64th of a teaspoon and I've included a picture in Figure 1.22. These are also sold as pinch, smidge, and dash.

Figure 1.22 Tiny measuring spoons that measure 1/4, 1/8, 1/16, 1/32, and 1/64th teaspoon (left) and a digital scale (right).

Figure 1.23 Bodysuit painted on a mannequin specifically reserved for paint/dye projects. Bodysuit designed for *Mahagony*; costume design by Ann Hould-Ward for the LA Opera.

A CLOTHESLINE

So many options here. We have to have clotheslines. Those little drying racks that become a pile of sticks will not do. They pool dye where the cross bars touch the fabric, they are weak and have difficulty holding heavy fabric, and are very tricky to use to paint or spray with dye. I like to have clothes lines in a variety of places ranging from inside to outside. The dye room must have at least one line hung at least 6 feet from the floor. If space is an issue, a heavyweight retractable clothes line can be fantastic, you just have to realize it will have a stretching out period when you first use it, and you will need to tighten it a bunch. This stretching does stop, and when you want to use dress forms and mannequins in the dye shop and don't want to be encumbered by a line, you can stow it away!

A MANNEQUIN IN A FULL LEOTARD (LONG SLEEVE FULL LEG IF POSSIBLE)

These are better than dress forms for many reasons. One being that they can stay in the dye room and you don't have to worry about distressing them like you would about a shop dress form. Also, they have legs so you don't have to feel like you're hogging one of the two hanging forms from the costume shop! I like to cover my mannequin in a full body leotard, preferably knit or something somewhat absorbent, so the paint or dye does not pool on the plastic/plaster of the mannequin. Also, the leotard is a handy way to keep the mannequin clean, and can be thrown in the wash. A rayon or cotton Zenti suit would be the ultimate!!!

BULLET STEAMER

Bullet steamers are long metal tubes mounted to a heating element that create steam in an enclosed space. These are used for setting painted or printed dyes on fiber. Please see Chapter 9 on making your own steamer and steaming instructions; commercial steamers are almost totally unavailable for purchase. To see a commercially made bullet steamer see the images of Oregon Shakespeare Festival's dye shop (Figure 1.10). Check out Chapter 9 for detailed steaming instructions.

A FIRST AID KIT AND EYEWASH STATION

This is self-explanatory but if you are the head/master dyer you should make sure your first aid kit is stocked with burn salve, Band-Aids, and a quick-break ice pack.

THE BOTTOM LINE

In the same way Smokey the Bear says that "Only YOU can prevent forest fires", only YOU can allow yourself to be exposed to dangerous fumes and chemicals. Please make sure to protect yourself and **demand** appropriate protective equipment, spaces, tools, and ventilation in your workspaces!

NOTES

1 Rossol, Mona. *The Artist's Complete Guide to Health and Safety Guide*. New York, NY: Allworth Press, 2001.

2 Noble, Elin. *A Hands-on Guide to Coloring Fabric*. East Freetown, MA: Elin Noble, 1998.