

PHOTOGRAPHERS' FORMULARY

JD-4 (JARB) HOLOGRAPHY PROCESSING KIT

All the chemicals needed for making both transmission and reflection holograms using Slavich PFG-03M plate or film.

To process up to 30 2.5x2.5 inch holograms or 10 4x5 inch plates

MAKES 1 LITER EACH OF 3 STOCK SOLUTIONS

The discovery of using JD-4 for quick processing of holograms recorded on Slavich PFG-03M plates and film was made by Tung H. Jeong, Riley Aumiller, Raymond Ro, and Jeff Blyth; thus it is called the *JARB* processing regime.

JD-4 is an alternative for GP-2 developer. The GP-2 has been used for decades for making excellent reflection holograms on the PFG-03M emulsion. Using GP-2, the sensitivity of PFG-03M is 1.5 mj/cm² (milli-joules per square centimeter); the one-step processing takes 12-15 minutes; and the hologram requires natural drying, often takes over an hour. Also, using GP-2, the emulsion is extremely soft during development and washing, like jello; and can easily float off the glass. Thus, if time and patience is not a problem, GP-2 can be used to make excellent reflection holograms.

The advantage of JD-4 is that it increases the sensitivity of the PFG-03M to .15 mj/cm². Thus the exposure time for holograms is one-tenth as long when processed in GP-2. Also, drying time is drastically reduced by using warm air (from a hair dryer) because the JD-4 development hardens the emulsion. The total processing time using JD-4 can be as short as three minutes, from developing to drying!

Thus, JD-4 is ideal for making holograms during a lecture demonstration or for laboratory exercises or workshops where many students must make holograms in a limited time. For diehards who are accustomed to GP-2, they can continue to use it.

The composition of JD-4 is a modified version of what was originally intended for processing "BB" plates manufactured in Germany. It is mixed using three glass (or plastic) containers marked A, B, Bleach, each with 1 liter of distilled or de-ionized water. Disposable plastic bottles used for drinking water can be used (exercise extreme caution in re-labeling the bottles and their placements to prevent accidental ingestion of the contents).

FOR YOUR CHEMICAL SAFETY

All chemicals are dangerous and must be treated with respect. Please read all the warning labels on each package.

It is good practice to use eye goggles, dust mask, apron and rubber gloves when mixing chemicals.

SODIUM HYDROXIDE: Although your kit contains only a small amount of solid Sodium Hydroxide, it must be treated with special care. Sodium Hydroxide, as a solid or in solution, is a dangerous chemical. It is a corrosive and when spilled on the skin, will cause a chemical burn. Its action is insidious because the burn occurs without pain. When working with Sodium Hydroxide wash your hands frequently and without soap. If you detect a soapy feeling while washing, Sodium Hydroxide is present. In such a case, wash thoroughly with soap and water.

Beads or pellets of solid Sodium Hydroxide are easily spilled during solution preparation. If spillage occurs outside of a sink, all of the spilled solid must be cleaned up, use a damp disposable towel. If the solid is not cleaned up, it will absorb the moisture from the air and form a puddle of very caustic hydroxide which will not evaporate. We strongly urge you to wear both safety glasses and rubber gloves when working with solid Sodium Hydroxide or its solutions.

We strongly urge you to wear both safety glasses and rubber gloves when working with solid sodium hydroxide and its solutions.

METOL: Some individuals become sensitized (develop allergic symptoms or rashes) when using metol. If this should occur, discontinue use and consult a physician.

All other chemicals contained in this kit are considered non-hazardous, but we ask you to still use care by using a dust mask and rubber gloves.

The user assumes all risks upon accepting these chemicals. IF FOR ANY REASON YOU DO NOT WANT TO ASSUME ALL RISKS PLEASE RETURN THE KIT WITHIN THIRTY (30) DAYS FOR A FULL REFUND.

Consult with local sewer and water authorities regarding proper disposal of darkroom chemicals in your area.

MIXING THE STOCK SOLUTIONS

The chemicals in this kit are used to prepare three solutions.

TO MAKE DEVELOPER PART A

CHEMICAL	AMOUNT
Distilled water	700 ml
Metol or Elon (p-Methylaminophenol sulfate)	4 grams
Ascorbic Acid (powder)	25 grams
ADD Distilled water (40° C/104° F) TO MAKE	1000 ml

TO MAKE DEVELOPER PART B

CHEMICAL	AMOUNT
Distilled water (40° C/104° F)	700 ml
Sodium Carbonate, Anhydrous	70 grams
Sodium Hydroxide	15 grams
ADD Distilled water (40° C/104° F) TO MAKE	1000 ml

TO MAKE BLEACH SOLUTION

CHEMICAL	AMOUNT
Distilled water (40° C/104° F)	700 ml
Copper Sulfate, Pentahydrate	35 grams
Potassium Bromide	100 grams
Sodium bisulfate, crystal	5 grams
ADD Distilled water (40° C/104° F) TO MAKE	1000 ml

Use three 1 liter (or larger) size clean glass or plastic bottles with leak-proof caps. Label them **JD-4-A**, **JD-4-B**, and **JD-4-Bleach** respectively. Warm the distilled or de-ionized water to about 40° C/104° F (warm to the touch).

Fill the bottle marked A with 700 ml of warm distilled water. Dissolve the metol in it, then add the ascorbic acid. Add 300 ml of warm distilled water to make 1 liter of Part A developer. Tightly cap the bottle. Part A will oxidize if it is exposed to oxygen. In time (over a few days to a few weeks), the solution may turn yellow due to the oxidation of the ascorbic acid – the solution is still usable. Once the solution turns dark brown, the potency is lost and it must be discarded. This solution is good for up to one year.

One way of protecting it from oxidation is to subdivide the solution into smaller bottles so that the unused portions are in full-capped bottles, with little or no air space. Refrigeration also slows down oxidation (exercise extreme caution to prevent its mistaken identity as food.)

Follow the same procedure for Part B (add the sodium carbonate and sodium hydroxide in any order). The solution will keep for many months.

Follow the same procedure for mixing the Bleach. This solution has a very long shelf life.

HOLOGRAM EXPOSURE

For detailed instructions on making reflection and transmission holograms, study the article "Simple Holography" found in Integraf's homepage (www.LearnHolography.com).

Using PFG-03M film or plate, expose the hologram so that each square centimeter area receives 150-400 microjoules of energy (there is batch to batch variation). For example, if a 5-milliwatt diode laser without a lens is located 40 cm from the plate, the exposure time is approximately 5-7 seconds.

PREPARATION

Have the following items on hand.:

- JD-4 parts A, B and Bleach
- 1 gallon (4 liters) of distilled or de-ionized water.
- 2 small glass or plastic trays, just large enough so that the hologram you are making can be submerged in a horizontal position.
- 2 large glass or plastic trays to hold 1 liter of distilled water for rinsing.
- 1 (optional, but recommended) large tray to hold 1 liter of distilled water mixed with about 1 ml of photographic wetting agent such as Photoflo or Formaflo (can also use liquid Jet Dry for dishwashers)
- 1 rubber glove

Label one small tray as developer. Mix equal parts of A and B so that the hologram to be developed can be totally submerged.

Next to the developer tray place a tray with one liter of distilled water.

Next, label another small tray as bleach. Put enough bleach into it so that the hologram can be totally submerged.

Next to the bleach place another tray with one liter of distilled water.

Finally, place the tray with the wetting solution in 1 liter of distilled water.

Check the order of the trays: developer, rinse, bleach rinse, wetting agent.

PROCESSING PROCEDURES (at room temperature)

Make and develop holograms in a darkened room illuminated by a minimum of green light. A green bulb such as those from a Christmas tree decoration can be used underneath the counter or table. Place obstructions around the light so that after dark adaptation, enough light remains so that the holographer can safely move around. Make certain that there is no direct light on the holographic plate.

After the holographic plate is exposed, hold it by the edges with your glove hand, with the emulsion (sticky) side facing upwards.

1. **Development:** Quickly submerge the plate into the developer so that all parts get wet evenly. Slush it around for about 10 seconds. The hologram should turn black (at least a density of 2, i.e. about 1% light is transmitted).
2. **Rinse:** Rinse the developed hologram with agitation for about 20 seconds.
3. **Bleaching:** Place the rinsed hologram into the bleaching solution; agitate it until the plate is completely clear (this may take up to 1 minute); bleach for another 10 seconds.
4. **Rinse:** Rinse the bleached hologram with agitation for about 20 seconds.
5. **Wetting agent:** Place the finished hologram in this solution for about 20 seconds.

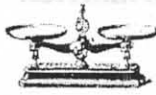
The hologram is finished except for drying. The best way to dry the hologram is to stand it against a vertical surface with the bottom edge resting on a hand-towel or tissue paper. Best results are obtained when it dries naturally in clean, dust-free air. However, if time is limited, the hologram can be quick-dried by holding it vertically and blow warm air across it with a hair dryer. For a reflection hologram, the image can be viewed, after drying, using the laser light that exposed it or an incandescent spotlight

STORING PLATES AND DEVELOPER

To extend their shelf life, both holographic plates and developer should be stored in a refrigerator when not in use. The plate box should be sealed with duct or electrical tape that does not allow moisture to enter the box. Plates should be allowed to reach room temperature before opening in order to prevent condensation.

Keep from children. Label the packages clearly as poisonous materials not to be consumed.

For details on how to make holograms, read "Simple Holography" found on the Integraf homepage (LearnHolography.com or Holokits.com)



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PHOTOGRAPHERS' FORMULARY SAFETY BULLETIN: HYDROXIDES

Hydroxides that are commonly used in photographic practice include Ammonium Hydroxide solution ($\text{NH}_4\text{OH}_2\text{O}$), Lithium hydroxide (LiOH), Potassium Hydroxide (KOH), and Sodium Hydroxide (NaOH)

Each of these chemicals, in solid or liquid form, is extremely caustic. Since caustic materials by definition are capable of dissolving protein, including animal tissue, one should understand the behavior of these materials and the proper techniques for handling them.

Solutions of the hydroxides, if spilled on the skin, will slowly dissolve it, and if splashed in the eye, can cause blindness in a short time. The dry material is hygroscopic, and will absorb water from the air or body to form a caustic liquid very readily.

IF HYDROXIDES CONTACT THE SKIN: Wash the area thoroughly with running water until the slipperiness is no longer present. Slipperiness is due to the hydroxide dissolving the skin. If desired, rinse with vinegar or working strength acid stop bath. Wash thoroughly. Treat damaged tissue as a burn.

IF HYDROXIDES CONTACT THE EYE (dry or wet): Place your head at once under running water (the sink is fine) and wash the eye for 5 to 10 min. Don't bother with eyewashes, etc. Time is all-important. **WASH THE EYE FIRST**, then call a doctor at once.

To dissolve the hydroxide, simply stir the pellets into the solvent. It will dissolve very readily. It will not be necessary to pulverize the pellets or flakes. Large amounts of heat are liberated when hydroxides are dissolved, and if care is not taken, glassware may be broken or spattering may occur. It is prudent to dissolve a portion of the hydroxide, allowing the solution to cool before proceeding. Use cold or ice water when dissolving hydroxides.

Be sure to pick up all the pellets that accidentally spill. The solid material will pick up moisture from the air and in time, a very concentrated, and very caustic solution forms. Dispose of hydroxide solutions by flushing down the sink or toilet with large amounts of water.

Since damage to flesh or eye can be serious, we strongly suggest the use of safety glasses and gloves when handling caustics. The use of beakers with handles is advantageous, as they are less likely to be dropped. The most important safety precaution is to take the time to move deliberately and carefully. Caustics should not be handled in the presence of children or pets.

All substances can be dangerous. Any material can be handled with safety if the correct precautions are followed. In many years of handling caustic solutions and other potentially hazardous chemicals, we have had no serious difficulty, and with a reasonable amount of care, you need have no problems. We counsel respect, but not fear.