CATALOG NUMBER 04-3040

PHOTOGRAPHERS'
FORMULARY

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JD-4 (JARB) HOLOGRAPHY PROCESSING KIT

All the chemicals needed for making holograms using Slavich PFG-03M plates.

Holographic film plates, supplies, and instructions for holography are available from:
Integraf LLC
Holography Supplies & Resources
(425) 821-0772
http//www.integraf.com

MAKES 1 LITER EACH OF 3 STOCK SOLUTIONS

The JD-4 holography developer and processing kit provides all the chemicals needed for making holograms using Slavich PFG-03M or ColourHolographics BB-640 holographic emulsions. Simply mix the dry chemicals in the JD-4 kit with water to prepare the developer components and bleach solution. This formula has been proven to be most useful for all kinds of holograms. It is relatively safe, even for the home hobbyist.

The optimization of using JD-4 for quick processing of holograms recorded on Slavich PFG-03M plates and film was made by Tung H. ***J***eong, Riley ***A***umiller, Raymond ***R***o, and Jeff ***B***lyth; thus it is called the ***JARB*** processing regime.

JD-4 is a convenient alternative for the GP-2, a developer that has been used for years for making reflection holograms on PFG-03M emulsion. GP-2 has certain limitations, including its long processing time of 12-15 minutes and its natural drying time of over an hour. GP-2 also does not address the fact that the PFG-03M emulsion requires long exposure times (ten times more than PFG-01, for example), and is extremely soft, like gelatin, and often floats off the glass during development and washing.

The introduction of JD-4 increases the sensitivity of the PFG-03M 1.5 mj/cm^2 (milli-joules per square centimeter) to 0.15 mj/cm$^{2.}$ This therefore shortens the exposure time for holograms to one-tenth as long as when processed in GP-2. JD-4 also hardens the emulsion so that the holographic plates is easier to develop and can be dried using warm air, such as that from a hair dryer. As a result, the total processing time using JD-4 can be as short as three minutes, from developing to drying!

Given the above, 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 YOUR CHEMICAL SAFETY

Like many household cleaners, chemicals in general should be considered 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. While the chemicals have low volatility, working in a ventilated area is recommended. Although most chemicals in JD-4 are considered non-hazardous by the EPA, the kit does contain small amounts of chemicals that the EPA does consider hazardous.

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 JD-4 kit are already pre-measured to make approximately 1000ml of each of three solutions. You will need to add de-ionized or distilled water, which can be purchased at your local grocery store. It is best to use distilled water that contains no other chemicals although distilled drinking water, which sometimes contains small but negligible amounts of other chemicals, can also be used. Water from your tap generally contains fluoride and other impurities that may reduce the quality of your hologram. For efficiency and safety, teachers or an adult should pre-mix the solutions for students.

PART A SOLUTION (1000ml)

CHEMICAL	AMOUNT
Metol or Elon (p-Methylaminophenol sulfate)	4 grams
Ascorbic Acid (powder)	25 grams
ADD Distilled water	1000 ml

PART B SOLUTION (1000ml)

CHEMICAL	AMOUNT
Sodium Carbonate, Anhydrous	70 grams
Sodium Hydroxide	15 grams
ADD Distilled water	1000 ml

BLEACH SOLUTION (1000ml)

CHEMICAL	AMOUNT
Copper Sulfate, Pentahydrate	35 grams
Potassium Bromide	100 grams
Sodium Bisulfate, Monohydrate	5 grams
ADD Distilled water	1000 ml

Use three 1 liter (or larger) size clean glass or plastic bottles with leak-proof caps. Label them **Part A, Part B,** and **Bleach** respectively. To help dissolve the chemicals, you can heat the water until it is luke warm. But don't use the solution until it returns to room temperature. Optionally, you can also prepare each solution in a clean beaker and then pour the solution into the bottle.

PART A. Fill the bottle marked Part A with roughly 1000 ml of distilled water. Dissolve the metol first. Then add the ascorbic acid. Tightly cap the bottle. Part A will oxidize if it is exposed to oxygen. In time (over a few weeks to a few months), 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.

Helpful Tip
To extend the shelf-life of Part A , protect it from oxidation. To do so, subdivide the solution into smaller bottles so that the unused portions are in full-capped bottles, with little or no air space. For example, try using two 500ml bottles for Part A instead of one 1000ml bottle. Refrigeration also slows down oxidation. Do not refrigerate Part A with food to prevent possible mistaken identity as food. When stored appropriately, the solution can last for months.

PART B. Follow a similar procedure as above for Part A, dissolving each chemical one-by-one, in any order. This solution will keep for many months at room temperature.

BLEACH. Follow a similar procedure as above for the Bleach, dissolving each chemical one-by-one, in any order. This solution will keep for many months at room temperature.

Store chemicals in a safe place away from food and children.

HOLOGRAM EXPOSURE

For detailed instructions on making holograms, study the article "Simple Holography" found on Integraf's website (www.integraf.com). Before making your exposures, you should mix and prepare your chemicals as follows.

PREPARATION

Have the following items on hand:

- Your pre-mixed JD-4 Part A, Part B and Bleach Solution.
- 1 additional gallon (4 liters) of distilled or de-ionized water for best results. Tap water will also work here but not as well. Avoid hard water. This will be used to rinse the holograms between each processing step.
- 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. Tap water may also work but not as well.
- 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. You can also use a small tray with less wetting agent, but you should replace the solution after a few holograms.
- 1 rubber glove

Now label one small tray as Developer A&B. Then, mix equal portions of Part A and Part B, enough so that the hologram to be developed can be totally submerged. Once mixed, the combined A&B solution can be used to develop several holograms, and can last several hours.

Next to the developer tray place a large tray with one liter of distilled water. This will be used as a rinse.

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 large tray with one liter of distilled water. This will be used as a rinse.

Optionally, place a large tray with the wetting solution in 1 liter of distilled water. Using a wetting solution is optional but recommended. It allows the hologram to dry evenly, thus helping you prevent smudges or streaks.

Check the order of the trays: developer A&B, rinse, bleach, rinse, wetting solution.

PROCESSING PROCEDURES

After the holographic plate is exposed, hold it by the edges with your glove hand (or tongs). Keep the emulsion (sticky) side facing upwards to protect the emulsion from accidentally scraping the bottom of your developer tray. Complete the following steps in a dark room. You can use a green safelight. Alternatively you can use a standard night light without allowing any direct light to the holographic plate. (After the bleaching process, it is safe to turn on the lights, if preferred.)

1. Develop:
Quickly submerge the plate into the developer so that all parts get wet evenly. Slush it around for about 20 seconds until the holographic plate turns uniformly black.

2. Rinse:
Rinse the developed hologram with slight agitation for at least 20-30seconds. For best results and longer lasting holograms, rinse up to 3 minutes to make help ensure that all of Part A has been rinsed off.

3. Bleach:
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 10-20 seconds.

4. Rinse again:
Rinse the bleached hologram with agitation for at least 20-30 seconds (up to 3 minutes).

5. Finish in wetting solution:
Optionally, place the finished hologram in this solution for about 20 to 60 seconds. Then, remove the hologram to dry. For best results, avoid streaks or runs as you remove the hologram from the solution. You can actually do this step under light so you observe if the wetting solution is evenly coated. (After the bleaching process, the hologram is safe to process under regular indoor lighting).

A good 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 blowing warm air across it with a hair dryer.

For a reflection hologram, the image can be viewed after thorough drying, which may take minutes to hours, depending on ambient conditions and technique. Transmission holograms, on the other hand, can be viewed with a laser even when wet.

Keep from children. Always label packages clearly as poisonous materials not to be consumed.

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PHOTOGRAPHERS' FORMULARY SAFETY BULLETIN: HYDROXIDES

Hydroxides that are commonly used in photographic practice include Ammonium Hydroxide solution (NH_4OH_2O), Lithium hydroxide (LiOH), Potassium Hydroxide (KOH), and Sodium Hydroxide (NaOH). Like many common household cleaners, your JD-4 kit contains sodium hydroxide, but in a very small amount (only 15g).

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 hydroscopic, 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 1O 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 in general. (For JD-4, the amount of hydroxide in the kit is not sufficient to create noticeable heat and thus may not require cold water.)

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.