

1 CHEMICALS AND CHEMICAL HANDLING

Chemicals

High-quality customer orders begin with proper chemical handling. Chemical handling includes how you store chemicals and your attention to chemical safety.

This section describes:

- Chemical terms
- Processing solution effects
- Safe handling of photographic chemicals
- Chemicals for your SM Minilab
- Chemical mixing
- Solution storage
- Compensating for evaporation
- Processor maintenance
- How to dispose of effluent and chemicals
- Solid waste disposal

Chemical Terms

To help you understand the terms we've used to describe the chemicals in this manual, here are some definitions:

Chemical Concentrates or Concentrates—Chemicals contained in the SM Processing Units, or in bottles of the SM tank mixes, that are used to replenish the tank solutions or to make the tank solutions in the processor.

F1—First of two replenishment units for Process C-41SM.

F2—Second of two replenishment units for Process C-41SM.

P1—First of two replenishment units for Process RA-2SM.

P2—Second of two replenishment units for Process RA-2SM.

Tank Solution—The solution used in the processor tank; often referred to as “working solution.”

Seasoned Solution—A tank solution that has been used and replenished for a period of time. The chemical components and seasoning by-products of a seasoned solution are at an optimum level for processing.

Processing Solution Effects

How Each Processing Solution Affects Your Results

Each solution affects the emulsion differently.

Understanding the reaction of each solution can help you diagnose processing problems.

Developer—contained in SM Processing Units F1 and P1—The developer chemically reduces the exposed silver halide in the film or paper to form a metallic silver image. At the same time, the color developing agent in the developer oxidizes and combines with the dye couplers at the site of the silver image in each of the dye-forming emulsion layers to form a color image. Once the dye image has formed, there is no need for the silver image. It is removed by bleaching and fixing.

The amount of cyan, magenta, and yellow dye formed depends on exposure and developer activity. Temperature, time, replenishment rate, agitation, and the rate at which solutions diffuse into the emulsion affect developer activity. Time, temperature, and agitation affect the diffusion rate. With *too much* developer activity, too much dye forms; with *too little* activity, not enough dye forms.

Bleach—contained in SM Processing Unit F2—In the film process, the bleach stops developer activity and converts metallic silver into silver halide. The silver halide is dissolved in the fixer. Most paper processes combine the chemical reactions of bleaching and fixing in a single bleach-fix solution

Bleach concentration and the rate at which the solution diffuses into the emulsion affect bleach activity. Time, agitation, and temperature affect the rate of diffusion. Replenishment rate and aeration efficiency affect the chemical concentrations. Bleach aeration adds oxygen needed to convert the reduced bleaching agent to an active form.

If bleaching is inadequate, less than the normal amount of cyan dye is formed because some of the dye remains in the leuco (colorless) condition. This affects the color balance. Bleach time that is too short, bleach that is too dilute, or insufficient bleach aeration can cause leuco-cyan dye to form.

Inadequate bleaching can also cause retained silver because not all the metallic silver is converted to silver halide. Leuco-cyan dye and retained silver adversely affect image quality, but you can correct both conditions by rebleaching and refixing the film in good solutions.

Fixer—contained in SM Processing Unit F2—In a film process, the fixer converts silver halide into soluble silver complexes. Most of these silver complexes remain in the fixer solution; you can recover them with electrolytic silver-recovery units and/or chemical-recovery cartridges. Fixing efficiency depends on fixer activity and the diffusion rate into the emulsion. Temperature and replenishment rate affect fixer activity. Time and agitation affect the diffusion rate.

Inadequate fixing may not remove all of the sensitizing dyes and silver halide. An increase in the red and green D-min densities of the control plot is one sign of incomplete fixing. Another sign is a milky appearance in the D-min areas of control strips and processed film. If this problem occurs, you can test the fixer by refixing the control strip (or film) in a fixer that you are sure is good. If refixing the strip corrects the control plot, the original fixer is probably exhausted. You can correct inadequately fixed film by refixing it.

The most probable causes of inadequate fixing are fixer that is diluted by excessive solution carryover, an inadequate fixing time, underreplenishment, and fixer sulfurization. Temperature has very little effect on the fixing rate if other fixer conditions are within tolerances. Agitation is necessary primarily for uniform fixing.

Bleach-Fix—contained in SM Processing Unit P2—The paper process uses a bleach-fix instead of a separate bleach and fixer. A bleach-fix has three primary purposes: to stop the action of the developer, to convert metallic silver into silver halide, and to dissolve the silver halide.

Bleach-fix performance depends on the concentration and the diffusion rate of the solution into the emulsion. Time, agitation, and temperature affect the diffusion rate. Incorrect bleach-fix conditions or an abnormal bleach-fix can affect the amount of dye formed.

Inadequate bleach-fixing may not convert all of the metallic silver to silver halide. A sign of retained silver is an increase in the black-patch (BP) densities and a desaturation of the yellow patch on the control strip (giving it a brown appearance). Retained silver degrades image quality by desaturating the colors—especially yellow—and is most apparent in higher-density areas where there is more silver to convert. You can remove retained silver by reprocessing the paper in a good bleach-fix.

Final Rinse/Stabilizer—contained in SM Processing Unit F1, Version 2.0, is final rinse. Contained in SM Processing Unit P1, is stabilizer. Both solutions are used to remove residual chemicals from the processed film or paper. In the film process, the final rinse step is also used to provide uniform drying for prevention of drying marks.

Note: The final rinse in SM Processing Unit F1, Version 2.0 contains no stabilizing agent for image stability of older technology films. *Do not* process KODAK VERICOLOR Slide Film, S0-279 / 5072, through Process C-41SM.

SM Chemicals

Chemicals for Your SM Minilab

Kodak is committed to providing minilabs with chemicals that are safe, economical, and easy to use—true SiMplicity. The chemicals designed for SM Minilabs are supplied in liquid concentrates for easy handling. We designed these chemicals to be as safe as possible for our environment.

Table 1-1 KODAK SM Chemicals for SM Minilabs

FEATURES	BENEFITS
Unique, patented packaging	- No operator exposure to chemicals - Less effluent discharged—less environmental impact
No replenisher mixing	- Saves time - Less operator training - Less labor required - No mixing errors
High-quality chemicals optimized for all levels of process utilization	Little to no process change between peak seasons and times of low utilization
Process RA-2SM cycle—fast access time	- Prints obtained in less time than Process RA-4 - Quicker results from printer tests and paper process control tests

SM chemical concentrates are supplied in processing units that fit directly into the minilab; no mixing is required. Each of the four units—F1, F2, P1, and P2—can **only** fit onto the minilabs in the correct location. The units are also color-coded with corresponding colored labels on the minilab, and each unit has a unique symbol that also matches the minilab, to make operations simple for the operator.

**Table 1-2 KODAK SM Chemicals for
Process C-41SM and Process RA-2SM**

Replenishment Chemicals		
SM Processing Unit	CAT No*	Description
FLEXICOLOR / F1 V 2.0	874 0110	Each SM Processing Unit provides enough chemicals to process 900 rolls of 135-24 size film, when paired with an F2 SM Processing Unit. Available in sales units of, 2 SM Processing Units per shipping case.
FLEXICOLOR / F2 V 2.0	135 7557	Each F2 SM Processing Unit, Version 2.0, provides enough chemicals to process 150 rolls of 135-24 size film. Available in sales units of 4 SM Processing Units packed per shipping case.
FLEXICOLOR / F2 V 2.1	117 3319	Each F2 SM Processing Unit, Version 2.1, provides enough chemicals to process 260 rolls of 135-24 size film. Available in sales units of 2 SM Processing Units packed per shipping case.
EKTACOLOR / P1	178 2713	Each SM Processing Unit provides enough chemicals to process 10,000 4 x 6-inch (4R) prints, when paired with a P2 SM Processing Unit. Available in sales units of 2 SM Processing Units per shipping case.
EKTACOLOR / P2	130 0201	Each P2 SM Processing Unit provides enough chemicals to process 5,000 4 x 6-inch (4R) prints. Available in sales units of 4 SM Processing Units packed per shipping case.
EKTACOLOR / P2 V 2.1	170 1325	Each P2 SM Processing Unit, Version 2.1, provides enough chemicals to process 8,650 4 x 6-inch (4R) prints. Available in sales units of 2 SM Processing Units packed per shipping case.

* Conversion to F2 and P2 Version 2.1 will begin in mid 2002. At that time, we will discontinue the original catalog numbers.

Working Tank Chemicals / Process C-41SM		
KODAK Chemical	CAT No.	Description
FLEXICOLOR SM Tank Developer	175 6337	Each unit contains six kits to produce 12 litres of tank solution.
FLEXICOLOR SM Tank Bleach	882 4690	Each package contains two units to produce 5.4 litres of tank solution.
FLEXICOLOR SM Tank Fixer	846 2681	Each package contains two units to produce 7.8 litres of tank solution.
FLEXICOLOR SM Tank Final Rinse	192 5254	Each package contains twelve units to produce 18 litres of tank solution.

Working Tank Chemicals / Process RA-2SM		
KODAK Chemical	CAT No.	Description
EKTACOLOR SM Tank Developer	861 9769	Each package contains four kits to produce 8 litres of tank solution.
EKTACOLOR SM Tank Bleach-Fix	891 5753	Each package contains two units to produce 12.6 litres of tank solution.
EKTACOLOR SM Tank Stabilizer	872 9956	Each package contains twelve units to produce 36 litres of tank solution.

Chemical Handling

Safe Handling of Photographic Chemicals

Handle all chemicals carefully. For more information about potential health hazards and safe handling of specific Kodak chemicals, see the label and the Material Safety Data Sheet (MSDS) for the chemical or call the Kodak health, safety, and environmental information line at (716) 722-5151, 24 hours a day, 365 days a year.

Follow Instructions Carefully—Kodak chemical packages have precautionary information on the labels. Always follow the label instructions. Read the Material Safety Data Sheets (MSDSs) for more handling information. If you need Material Safety Data Sheets for KODAK Chemicals in the U.S. or Canada, call (800) 242-2424, or ask your Kodak sales representative. Please supply the catalog (CAT) numbers for the chemicals when you request MSDSs. In other regions, contact Kodak in your country.

Store Chemicals and Processing Solutions Safely—

Keep chemicals and processing solutions out of the reach of children and pets. **Do not** store chemicals where you handle or store food. **Do not** eat, drink, or smoke in chemical-handling areas. Always wash your hands thoroughly after handling chemicals, especially before eating or drinking.

Label All Chemicals Properly—In the U.S., the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard requires employers to inform employees about hazardous chemicals in the workplace. This standard requires that all containers of hazardous chemicals, including processor tanks, be labeled. You can obtain self-adhesive KODAK Chemical labels for your processor tanks from your Kodak sales representative or you can order them from your Kodak price catalog (see the information in the “Chemicals” section). These labels give the chemical hazard, handling instructions, and the action to take in case of accidental contact. Use these labels *only* for KODAK Chemicals; use with other manufacturers’ chemicals is an incorrect use under the OSHA standard. Other countries may have similar requirements, so check with local authorities or Kodak in your country.

Wear Protective Clothing—Wear goggles or a face shield and an apron (made of PVC) and protective gloves (made of nitrile rubber) when you clean processor racks or tanks. Clean protective clothing after use to remove any chemical residue that can cause contamination.

Handle Chemicals Carefully—Avoid contact of any chemicals with your skin; some photographic solutions, particularly developers, can cause skin irritation and an allergic skin reaction. In case of accidental chemical contact, wash your skin with running tap water and a non-alkaline (slightly acid) hand cleaner. If symptoms persist, get medical attention. If chemicals splash into your eyes, rinse them at once with running water; continue for at least 15 minutes. Get immediate medical attention. There must be an eyewash station handy to all employees. The station must be capable of providing a 15-minute flush of water or eye-wash fluid at a rate of 1.5 L/minute. All employees must know the location of the eyewash station, as well as the location of fire extinguishers and first-aid kits.

Ventilate the Area Properly—Some photographic chemicals and solutions give off vapors or gases. For safety and comfort, keep the concentration of these vapors and gases to a minimum. To minimize the concentration of vapors and gases, provide good ventilation (about 10 changes of room air per hour). Also, keep the processing tanks enclosed and vent the dryer according to the manufacturer’s specifications.

Working Tank Chemical Mixing / Processing Unit Storage

Working Tank Chemical Mixing

For the most current information, follow the mixing instructions on the package. Follow all safety precautions and handling recommendations given on the package and in *Safe Handling of Photographic Chemicals*.

Processing Unit Storage

Store SM *chemical concentrates* at 5 to 30°C (40° to 86°F) in a dry location. At temperatures lower than 5°C (40°F), parts may come out of solution or crystallize. Temperatures higher than 30°C (86°F) will accelerate chemical reactions and cause the concentrates to deteriorate.

Compensating for Evaporation

When water evaporates from processing solutions, the chemical components remain and the solutions become overconcentrated. Evaporation occurs naturally to some degree, but it is more likely to occur when tank solutions are up to temperature, or when solutions are cooling down after shutdown. Follow the procedure described below as a guideline for compensating for evaporation. *Do not use cold water to top-off solutions.*

1. *At daily start-up*—With the recirculation system on, check the level of the tank solutions. If the tank solution level is not up to the top of the overflow tube, add water—at approximately operating temperature—to bring the solution level up to the top of the overflow tube. Some processors do this automatically when prompted.
2. *At shutdown*—Squirt the top edges of the tank, the top of the rack, and the rollers at the top of the rack lightly with warm water to avoid the buildup of dried chemicals. Do not use too much water to avoid severely diluting the tank solution. Clean and rinse crossovers thoroughly to minimize chemical buildup.

Clean Your Processor Tanks and Racks Regularly

Always wear splash-proof goggles, protective gloves and an apron when you clean racks and tanks.

Routine Cleaning—Follow the recommendations described below. **Be sure to follow your equipment manufacturer's recommendations for regular maintenance procedures.**

1. Remove crossovers, squeegee rollers, or squeegees daily at shutdown, and rinse them with hot water.
2. Once a week, remove each rack from the processor, clean it with hot water and a soft, non-abrasive brush, and rinse thoroughly. Inspect the racks for non-moving rollers, deformities in rollers, worn or broken springs, loose screws, deteriorated retaining clips, etc, to ensure smooth transport of film.
3. On a periodic basis (every 6 to 12 months), clean racks and tanks with a non-abrasive brush, and remove stains from racks and tank walls with a cleaner such as KODAK Liquid Developer Systems Cleaner and Neutralizer (follow the instructions provided with this product). Rinse racks and tanks thoroughly before you refill the tanks.

Removing Biological Growth from Tanks and Racks

Biological growth can occur in stabilizer tanks, and is a potential source of dirt. Check stabilizer tanks weekly, and clean if necessary. Wear protective gloves and splash-proof goggles when you follow this procedure. To remove biological growth:

1. Empty the processing solution tank. Dispose of waste solutions according to local disposal regulations.
2. Rinse the tanks and racks with hot water; drain the rinse water and repeat.

DANGER! The addition of cleaning agents that contain strong acids or oxidizing agents (e.g., chlorine-containing bleaches) to thiocyanate-containing photoprocessing solutions (i.e., some fixer solutions), may release poisonous and flammable hydrogen cyanide gas, as well as other irritating and toxic gases, such as cyanogen chloride and sulfur dioxide. **Do not** add cleaning agents to processing tanks unless the tanks, racks, and recirculation system have been completely drained and thoroughly flushed and rinsed with water. Read the Material Safety Data Sheet for information on the potential hazards of the working tank solution.

3. Fill the tank with sodium hypochlorite (NaOCl) solution, such as 2 mL Clorox (5.25 percent NaOCl) or 1 mL Sunny Sol (12.5 percent NaOCl) per litre of water.
4. Allow the hypochlorite solution to remain in the tanks for up to 30 minutes. Longer dwell times can damage plastic or rubber materials. After treatment, dispose of the hypochlorite solution according to local or state disposal regulations.
5. Brush foreign matter from the tanks and racks.
6. Before refilling the tanks, flush them *thoroughly* with water. Small amounts of remaining hypochlorite can have an adverse effect on processing solution activity. *Be sure to recirculate rinse water through the recirculation system to remove traces of hypochlorite.*

Note: For more information on the recommended methods for cleaning processing tanks in the U.S., contact Kodak Service and Support at (866) 352-4367. In Canada, call (800) 465-6325. For information on controlling biological growth, request a copy of KODAK Publication CIS-3, *Biocides for Photographic Solution Tanks and Wash Water*.

Effluent Disposal

Disposing of processing effluent is an important operation of your minilab. Effluent from processes using FLEXICOLOR SM and EKTACOLOR SM Chemicals consists of developer and bleach solutions, as well as desilvered bleach-fix, fixer, and stabilizer solutions. This effluent is compatible with and can be effectively treated by a municipal secondary wastewater treatment plant.

Because regulations define photographic effluent as an industrial waste discharge, you may need a permit to discharge it to a municipal sewer system.

After efficient silver recovery, the combined effluent from a minilab that is in control and using Processes C-41SM and RA-2SM has these characteristics:

pH	6.5 to 9
Temperature	Less than 30°C (90°F)
Silver	Less than 5 mg/L
Suspended solids	Less than 50 mg/L
Oils, greases, or detergents	None
Flammable, explosive, or toxic materials	None

Concentration of other materials depends on a number of factors. For more information on the composition of photographic solutions that you use, see the Material Safety Data Sheets or contact Kodak in your country.

Reduce Processing Effluent—To reduce the environmental impact, keep the discharge of photographic chemicals as low as possible. Some ways that you can accomplish that include:

- Use the correct replenishment rates and check them often
- Avoid making batch discharges, such as tank dumps
- Discharge processing effluent to your sewer slowly by trickling it in with normal non-processing effluent
- Desilver bleach-fix, fixer, and stabilizer overflow before you discharge it

Other Effluent Disposal Methods—Although most minilabs discharge their effluent to a municipal wastewater treatment plant, restrictions or lack of access to a treatment plant may require some minilabs to use an off-site disposal service, such as the KODAK RELAY Program, for effluent disposal.

Off-Site Disposal—You can have your processing effluent removed by a licensed disposal company. The KODAK RELAY Program is a disposal service for customers who use Kodak photographic chemicals. It is offered in conjunction with the Safety-Kleen Corporation. You can participate in the RELAY Program to help you comply with waste-management regulations, especially when you cannot discharge processing effluent to a sewer.

The RELAY Program is currently available only throughout the continental United States and Puerto Rico. Canadian customers who need help with waste-management options can call (800) 465-6325; other customers can call (716) 477-9428.

To participate in the RELAY Program, contact your Kodak sales representative or call Kodak Environmental Services at (716) 477-3194.

Septic-Tank Systems—The disposal of photo-processing effluent to a septic-tank system requires regulatory approval. Contact your state regulatory agency responsible for ground-water discharges to determine if you can discharge effluent to your septic system and how it should be monitored.

Note: If you have specific environmental questions about FLEXICOLOR SM and EKTACOLOR SM Chemicals in the U.S., call the Kodak Information Center at (800) 242-2424. In Canada, call (800) 465-6325; in other regions, contact Kodak in your country.

Silver Recovery

Silver is a seasoning product of processing photographic films and papers. Sewer codes may limit the concentration of silver in effluent that may be discharged. To reduce the amount of silver in the effluent, you can desilver used fixer, bleach-fix, and stabilizer solutions with electrolytic silver-recovery cells and/or silver-recovery cartridges.

To increase electrolytic-silver recovery efficiency, adjust the pH of your bleach-fix solution to 7.5 to 8.0 before desilvering it.

Note: Use **one** of the chemicals in the following table to adjust the pH of the bleach-fix.

Chemical	To Adjust the pH to 7.5 to 8.0, Add to Each Litre of Bleach-Fix Overflow
28% Ammonium Hydroxide	10 mL
10N Sodium Hydroxide	13 mL
45% Potassium Hydroxide	14 mL
10% Sodium Carbonate	200 mL
10% Potassium Carbonate	300 mL

Operate your electrolytic-recovery cell according to the manufacturer's instructions. Use as long an operation time as possible. Adjust the amperage to get a firm brown plate. After efficient electrolytic silver recovery followed by two silver-recovery cartridges (in series), the silver concentration should be less than 5 mg/L. Discharge the desilvered effluent with other processing effluent.

For more information about silver recovery, see KODAK Publication No. J-212, *The Technology of Silver Recovery for Photographic Processing Facilities*, or visit the Kodak website at www.kodak.com/go/kes.

Solid Waste Recycling

Recycling Programs Offered Through Kodak

In the U.S., Kodak has established a series of recycling programs designed to help minilabs minimize the amount of solid waste that they send to landfills. These programs, administered by Kodak include—

- KODAK Film Container Recycling Program
- KODAK One-Time-Use Camera Recycling Program
- Paper Core Recycling Program

The terms and conditions of each program are different. For more information about these programs, contact your Kodak sales representative, or call the Kodak Information Center at (800) 242-2424 in the U.S.; in Canada, call (800) 465-6325. In other regions, contact Kodak in your country.

For additional information on waste prevention and Kodak recycling programs, refer to Kodak Publication J-412, *Waste Prevention and Recycling for Photographic Processing Facilities*, or visit the Kodak website at www.kodak.com/go/kes.

