NOTES ON THE TRADE EXPERIENCE OF PROCESS CRI-1
AS GIVEN TO MESSRS MIZERA AND PAWINSKI
BY MESSRS GRENFELL AND CROFT ON 4 AUGUST 1976

- Process CRI-1 is the most challenging of the Eastman processes but it will respond to "common sense" handling.

- The three major chemical variables in order of importance are:
  1. Pre-hardener
  2. First Developer
  3. Colour Developer

- Usually if the pre-hardener is controlled the rest is relatively straightforward.

Chemicals
- Require good chemicals which meet photographic standards; this applies even to chemicals such as $Na_2 CO_3$ and $Na_2 SO_4$ etc.

Mixing
- Consistency of mixing is required!!
- Mixing times for one solution should not vary, - but should be mixed for the same length of time.

Replenishment
- Must be accurate and must be regularly checked.
- Storage life of replenishers is 2 weeks.

Work Load
- As with all photographic processes CRI-1 performs better with a steady work load.
- If possible try to process a minimum of 500 - 750 m/day, rather than 2,500 m in 1 or 2 days and then leaving the process standing.

SOLUTIONS

1. Pre-hardener
   - Biggest variable is the Kodak Antifogging Agent No.6 (AF-6)
   - At the process temp. 35°C (95°F) AF-6 is some what unstable.
   - If work is intermittent, then the amounts of AF-6 are variable and Blue Layer sensitometric variations are obtained.

- Loss of 10% to 15% AF-6 lowers the Blue D Max by 0.2 to 0.6.

- Can have slightly excess AF-6 without problems.

- Because of the problems controlling AF-6 it might be necessary to mix the pre-hardener replenisher more frequently.

* Possibly add AF-6 separately using a microflow meter.

N.B.

One Swedish laboratory currently doing this and getting very consistent results.

Practical Tip

If the machine is stopped for 2-3 days, throw away half the pre-hardener tank and top up with fresh pre-hardener.

Aldehyde In Pre-hardener

- Does require some ventilation.

- But should be ventilated at the lowest possible rate - otherwise oxidation of the aldehydes occurs.

2. First Developer

- Controls the speed of the process, if the pre-hardener is all right.

- Bromide equilibrium is quickly reached.

- However, First Developer is sensitive to changes in Iodide levels (equilibrium is 7 milligrams/litre).

. Small changes in $I^-$ can give large effect in Blue Layer.

- Therefore ensure correct mixing of $I^-$.

Leader

- It is dangerous to overplenish if leader is being run, in fact it is better NOT to replenish at all if this is occuring.

- Also avoid running large amounts of heavy density or fogged CRI as this raises the $I^-$ level. (Better, if possible to stagger the work over a period of days).

Practical Tip

If you have problems in Pre-hardener or First Developer change one solution and then wait 2/3 days before changing other. Don't change both at same time.

3. Colour Developer

- Controls Colour Balance.
- Changes in CD-3, Citrazinic Acid (Competing Coupler) give changes in the Green/Magenta colour balance.
- Each lab. must establish its own activity level for colour developer to give Density and Colour Balance required, and then keep this level as the aim point.
- Activity of the colour developer is controlled by altering the pH.
- Aim pH is 11.65, however in the U.K. labs are running at a pH of 0.10 to 0.15 above aim.

COMMON CONTAMINATION PROBLEMS

(a) Most important is contamination of the First Developer by the Reversal Agent (RA-1) from the Colour Developer.

- RA-1 is highly active and a few micrograms in the First Developer will completely fog and hence ruin the proce
- If personnel get their hands/fingers in Colour Deve they should wash off in 1% - 2% solution of Acetic

  Often worth while having a hand bath already made up.
- Also if work is being done on the machine it should start at the Pre-hardener and work down to the Colour Developer BUT NOT the reverse.
- If RA-1 contamination is suspected, it is very difficult to determine chemically because of the small amounts of RA-1 likely to be present and also because of interferring ions present in the First Developer.
- To remove contamination in First Developer, dump the solution, wash with water and then fill with a 1% - 2% solution of a mineral acid (i.e. HCl) and recirculate for 1 or 2 hours (RA-1 is hydrolyzed by HCl), wash with water and then neutralize with $Na_2 CO_3$ solution.

N.B.

In small labs mixing facilities are at a minimum.

The following mixing order is recommended if only two tanks (one stainless steel, one plastic) are used.

| Tank 1 | Tank 2 |
|---|---|
| (1) First Developer | Pre-hardener |
| (2) Stop | Stabilizer |
| (3) Colour Developer | Bleach |
| (4) Stop | Fix |
| etc. | etc. |

i.e. in Tank 1 mixing of Developers should always be followed by a stop to minimize contamination.

(b) Small concentration of Fixer in First Developer causes similar sensitometric problems as RA-1.

To remove however, dump First Developer wash and fill with water and re-circulate and then put in fresh First Developer.

(c) First Developer in the Colour Developer

At pH of 11.65 Hydroquinone is very reactive and will fog the unexposed Silver Halide. Hence dye development will not take place.

Therefore ensure that Stop Baths are at the correct pH (replenishment) and that the washes after the stops are O.K., otherwise carry over will occur.

To check Washes, check the pH of the wash overflows ($\leq$ pH 4.5 - 5.0) under practical conditions, i.e. running film.

(d) Backing Removal Solution in Neutralizer

Causes loss of all yellow dye.

(e) High Bleach pH

Caused by over-replenishment, will give low Magenta Toe Densities.

MECHANICAL PROBLEMS

Uniformity is one of the biggest problems with CRI-1 more important with 35 mm than 16 mm.

Testing - Use CRI flashed to a N.D. = 1.0 on the printer and then print onto E.C.P. and compare with something that is known to be "good" - i.e. Establish laboratory aims for evenness.

Streaks with a "hard" edge
- Not caused by turbulation.
- Probably due to cross-over squeegees.

Variable Density/Colour Balance
- Looks like "curtains in a breeze or flames
- Usually caused in tanks with turbulation, i.e. pre-hardener to Bleach.

If Streaks Vary In Colour - Check Colour Developer and Stop Bath.

In general to check which batch causes problems, run test strips through the process switching off the agitation of each bath in turn.

Practical Experience

(1) If above check fails to find cause, check Backing Removal working O.K., i.e. jets pointing in correct direction.

(2) Yellow middle/Blue edge on print (i.e. B middle/Y edge on CRI probably due to uneven pre-hardening.

Blocked Nozzles

1 nozzle blocked - not much of a problem

More than one - due to inadequate maintenance.

∴ Clean nozzles every 2 to 3 weeks; period might vary with hardness of water, filter changes etc.

N.B.

One blocked nozzle might cause scratches as film is allowed to touch other nozzles.

Rack Cleaning

Try to clean all the racks at the same time (might be uneconomical) otherwise, might get unbalanced racks, drives etc.

Drilled Headers vs. Nozzles

Currently Drilled Headers are more "fashionable" in labs than nozzles, due to the fact that less maintenance is required, i.e. nozzles can be deformed in cleaning etc.

| | | |
|---|---|---|
| Drilled Headers | - | Larger holes |
| | - | Less maintenance |
| | - | BUT more pumping power required. |
| Plastic Nozzles | - | Easily deformed in cleaning |
| | - | Under pressure holes might deform. |

Whatever system used, always have an excess of power in hand for agitation, i.e.

- when set-up THE machine might function O.K. AND
- as machine runs, THE JETS get build-up of deposits, and excess of power for agitation can prolong the time between maintenance periods.

Squeegees

- Must be correctly aligned, use small gauge to make sure.
- Recommend spring loaded wiper blades.

Suction Squeegees

i.e.

- Solution sucked off film at cross-over point.
- Usually have a common drain line running down the side of processor for all solution being removed.

Problems:

(1) Bleach and fix go to waste; not to reneration Silver recovery etc. Therefore require more replenishment.

(2) Common drain line quickly gets blocked as solutions crystallize out.

(3) If drain lines block this increases the risk of contamination.

| | | |
|---|---|---|
| Top Rollers | - | Submerged top rollers are preferred. |
| | - | With non-submerged rollers you get uneven draining/solution application and also oxidation of solution (i.e. Developers). |