Film Processor/Chemistry

- **Film Processor**
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Exposure -

- Light -> film (silver halide crystal suspended in a gelatin , an atomic change occurs, which converts the crystals to a group of free silver ions)
- Many thousands of these free silver ion groups produce an invisible " latent image "

Development -

- Converts the free silver ions to black metallic silver .
- Increased development will increase both Dmax. and Dmin. .

- Dmin. is increase because of the development process, it is known as “ chemical fog “ .

- **Developer Composition**

Developer is composed of six main ingredients :

- Developing agent
  - Converts exposed silver halide crystal to metallic silver
  - Two types of developing agent chemicals must be added together in the correct proportions
    - High energy developing agents - are quick acting and provide low contrast .
    - Low energy developing agents - are slow acting and provide high contrast .

- **Alkaline Substance**
  - Keep PH and activity constant
  - Normal PH of developer is about 10 to 10.5
  - Too high PH (> 12) will cause the gelatin to swell too much , Low PH will produce a sluggish developer action .

- **Anti-oxidant**
  - Decreases the rate oxidation of the developer solution .
  - Developer agents easily oxidize, causing a decrease in efficiency.
  - Developer replenisher has been mixed, shelf life is less than 10 days .
  - Oxidized developer replenisher turns brown in color (fresh is light yellow color)

- **Anti-foggant**
  - Reduce development of unexposed silver halide crystals (chemical fog) .
  - Bromide is released by he film during development, also acts as anti-foggant and slows down the development process.

- **Anti-Calcium**

- Reduced deposits and sediments.
- When hard water is used to mix developer replenisher solutions, sediments or sludge may from in the developer tank.

- **Hardener**
  - prevent undue emulsion swelling, and shorten drying time .

Energy (or strength) of the developer is affected by :

- **PH value**
  Low PH will produce a sluggish developer action.

- Developer agent concentration
  The chemical that converts exposed silver halide crystal to black metallic silver.

- **Bromide Concentration**
  - Bromide which acts as an anti-foggant is released during film development.
  - Excess bromide will inhibit the development process.

- **Temperature of the developer**
  Best developer chemical work temperature range : 93 - 95° F .

- **Length of time**
  - Increasing development time, at the same temperature will increase :
    - Sensitivity
    - Contrast
    - Chemical Fog

- **Agitation of film in the developer tank**
  - Allow the developer to be changed continuously on the surface of the film emulsion .
  - Poor circulation will result in poor development .

Developer Replenishment

- Developer solution replenishment is necessary because of exhaustion of the development bath, which is caused by :
    - Developer agent concentration decreasing due to
        - Reaction with silver halides
        - Oxidation
    - Bromide increase
      Coming from the developed film
    - Alkalinity reduction
      Decrease of the PH value due to the increase of bromide .
- Concentration of the developing agent in the replenisher solution will be higher than in the developer tank .
- Generally, the replenisher will contain no bromide . replenishment will therefore lower the bromide level .

Developer starter

- Developer starter solution will ***add bromide*** to the developer bath .
- If starter solution is not added, image quality will not be consistent unit **50 or more films developed** .

Developer Contamination

- Fixer solution splashed into developer .
- Exposure film should be black , brown or light film indicates developer contamination .

Fixer

- **Dissolves unexposed crystals** which remain in the emulsion.
- Unexposed silver crystal must be reduced to very low level on film for long term storage. If t**hey remain on film they will darken when exposure to light.**
- **Neutralized** remaining developer to stop development process.
- Test fixer solution by dipping film into solution for **15 seconds** should become clear.

Hardens Emulsion

- Improper fixing will be most noticeable in the clear areas of the image (**“milky clear”**)

Wash

- Raises away any chemical residue .
- Algae (bio-slime)
  - Most common problem with the wash .
  - Will leave specks of dried algae on the film
  - Bromide and/or chlorine is often added to the wash water to control the growth of algae.
  - To much bromide and/or chlorine will leave wash streaks.

Drying

- Dries away water remaining on film enabling customer handle film immediately.
- Prevents water spotting
- Differential **“ sticky “** problem
  - If the problem is drying the emulsion will harden after the film is allowed to dry.
  - If the problem is poor fixing the emulsion will not harden after drying (or require an extended drying time)