

## Preparation of 2 x 2 Inch Slides or 35 mm. Filmstrips by a Rapid and Inexpensive Method

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Visual education has firmly entrenched itself among modern pedagogical methods. The added interest which it evokes, the ease with which the unknown is made familiar, the clarity achieved comparable only with that of actual experience, and the simplicity of presentation of complex data make it invaluable. This method would be much more widely used were it not for the expense and time involved and the lack of storage space for sets of illustrations for daily lectures. Since the advent of 35 mm. film, these problems are much more easily solved. In addition, the projector for these small slides is less bulky and more easily handled and transported from place to place. There are a number of inexpensive projectors on the market suitable for this purpose.

The following is an inexpensive method whereby slides or film strips can be made in one series of operations with the expenditure of relatively little time and money. The time spent in first making a negative and then printing a positive is eliminated, since the positives are made directly. There are several films manufactured specifically for this purpose on the market, such as Eastman's Panchromatic Positive film, but they are very expensive to use. The method described here is the one which Eastman advocates for its Panchromatic Positive film, but the length of time in certain of the steps in processing is changed so that it is applicable to Eastman Kodak Safety Positive film, which is extremely inexpensive in comparison with the cost of the former.

The various steps in the process together with the necessary formulas follows:

1. Develop for 8 minutes with agitation in a film tank at 68° F. The solution used here is Kodak D-67, which consists of:

Water (50° C.)	500 cc.
Elon	2.2 grams
Sodium Sulfite, desiccated	96.0 grams
Hydroquinone	8.8 grams
Sodium Carbonate, monohydrated	56.1 grams
Potassium Bromide	5.0 grams
Sodium Thiocyanate	2.0 grams
Water to make	1.0 liter

2. Rinse in water for 30 seconds. It is advisable after the use of each of the following solutions up to the sixth step to rinse in water for 30 seconds.

3. Harden for 5 minutes (10 min. above 75° F.): Kodak SB-4

Water	1.0 liter
Potassium Chrome Alum	30.0 grams
Sodium Sulfate, desiccated	60.0 grams

4. Bleach for 3 minutes: Kodak R-9
 

Water	1.0 liter
Potassium Bichromate	9.4 grams
Sulfuric Acid, C. P.	12.0 cc.
5. Clear for 2 minutes: Kodak CB-1
 

Water	1.0 liter
Sodium Sulfitc, desiccated	90.0 grams
6. Redevelop with a chemical fogging developer for 5 minutes at 68° F.: Kodak FD-68
 

Water (50° C.)	500.0 cc.
Elon	2.2 grams
Sodium Sulfitc, desiccated	96.0 grams
Hydroquinone	8.8 grams
Sodium Carbonate, monohydrated	56.1 grams
Sodium Hydroxide	10.0 grams
Hydrazine Sulfate	1.0 grams
Water to make	1.0 liter
7. Use short stop bath for one minute: SB-1
 

Water	1.0 liter
Acetic Acid (28%)	48.0 cc.
8. Fix in any film fixing bath for twice the time to clear. When fresh, Eastman's F-6 used for 5 minutes is very satisfactory.
9. Wash in water for 20 minutes.
10. Wipe off excess water with photographic sponge and dry.

For each two degrees of increase in temperature the time of development should be decreased by one minute and vice versa. It is preferable, however, to develop at 68° F. The other baths need not be kept at this temperature but should all be kept constant at any given temperature. Preferably this temperature should be between 65-75° F. The redeveloper is very susceptible to oxidation and should be protected from it. The quality of the final positive, assuming correct exposure, depends largely upon the time and temperature used in the first development. Should any backing remain on the film after processing, place the film in a 5% solution of desiccated sodium sulphite and then rewash. As in Kodachrome, overexposure or overdevelopment results in the positive being too light, while underdevelopment or underexposure causes the transparency to be too dark. For purposes of projection, as with any lantern slide, it is preferable to have the transparency on the light side rather than to have it too dark.

All processes can be carried on in the darkroom under a Wratten Series OA safelight. It may be desirable to follow through the entire process with the aid of the safelight until the technique has become familiar. If one purchases a daylight developing tank the whole process from start to finish can be carried out in the light.

The use of the Eastman Kodak Safety Positive Film for a purpose not intended by the manufacturer necessarily requires the recognition of certain limitations and the observation of certain precautions if one is to be successful.

First of all, the film is not a panchromatic one and therefore is not color sensitive. As a result the film can be used only for copying printed matter, black and white line drawings and half tones.

Second, the latitude of the film is very narrow since with the reverse processing there is little chance to compensate for over- or underexposure. Consequently the exposure, as for Kodachrome, must be nearly correct to give good results.

Third, the manufacturers' film ratings can not be used in calculating exposure to photofloods. Safety Positive Film is very sensitive to the blue light in photofloods and when they are used as the light source the film is faster. With two No. 2 photofloods in reflectors that cast 150 foot candles on the material to be copied and with the camera ten inches away an exposure of 1/25 of a second with the diaphragm set halfway between the stops f11 and f8 is about right. This would indicate a film rating of 12 on a General Electric exposure meter. For dark pictures or ones with dark backgrounds f8 is best. While not necessary, yet for speed and convenience in the actual copying, a constant focusing device that at the same time delineates the field is very helpful. The one described by Alyea<sup>1</sup> was found to be excellent and although originally designed for a Leica it can be easily modified to fit an Eastman Kodak 35, a Perflex, or an Argus.

The expense involved in this method is slight as compared with that of the usual method of first making a negative and then a positive, since the cost of the film for the negative is eliminated. One cartridge of Eastman's Panchromatic Direct Positive Film, containing 36 exposures, costs \$1.35 and is not available in bulk, whereas a hundred-foot roll of Safety positive film used in this method costs about \$2.00 and contains enough film for 18 rolls each of which has 36 exposures. This makes the film cost of the individual slide negligible.

There are several types of slide binders on the market. The ones put out by the Society for Visual Education called SVE slide binders that cost \$3.25 per hundred have been found to be excellent. These can be rapidly and easily used and have space on which may be written pertinent information about the slide. Using these, the cost complete of a 2 x 2 inch slide is less than four cents as compared with a partial cost of at least eight cents for the large 3¼ x 4 inch slide, which does not count the cost of the binding tape or the original negative.

Lastly, there is the time factor. By the use of this method, slides can be made in an hour from the time the picture is copied to the finished transparency, including a 20-minute washing period. The biggest difference between this method and the one described by Milne<sup>2</sup> is that the latter uses an eclectic assortment of photographic formulas, some of which are made up immediately before use and are then discarded, while the method here described uses solutions all of which may be reutilized.

Facility in the use of this method can be obtained relatively easily and will well repay one for the time spent in perfecting his technique.

<sup>1</sup>Alyea, Hubert N. Lantern Slide Technics. *Journal of Chemical Education*, 16:308-312, 1939.

<sup>2</sup>Milne, Lorus J. Rapid preparation of direct positive filmstrips for lecture aids. *Journal of the Biological Photographic Association*, 9:200-202, 1941.