

Another text by Ed H. Zwaneveld taken in the Archives of the AMIA-List. This one about vented film cans.

Greetings,

At the AMIA Preservation Committee meeting during the AMIA 2000 Conference in Los Angeles, CA, in 2000, Mick Newnham of ScreenSound Australia impressed us with a thoroughly done piece of original research to determine how ventilation of film cans can be optimized.

His work has recently been published in the January 2002 SMPTE Journal, (pp.29-33) entitled: "Ventilated Film Cans-Their Effect on the Diffusion of Decomposition By-products from Motion Picture Film". It is recommended reading and as intended will provoke reflection and discussion among his peers about the meaning and applicability of his findings.

Having specified and evaluated ventilated film containers for archival storage of our substantial film collection at the National Film Board of Canada some years ago, that resulted in the STIL Design archival containers, (<http://www.stildesign.com>) a few constructive comments about the findings and their meaning may be appropriate at this time.

To do the ScreenSound tests, holes were cut into various positions in the lower bottom half of the film cans tested. Tests indicated to obtain maximum flow, that two slots at opposite sides of the film pancake are most effective for maximum ventilation. Such ventilation is made possible by the free space above the film pancake, and also below it. Ridged matting was placed on the floor of the lower half of the container, which encourages airflow below the film pancake to be channelled between the slots. This enables complete air circulation around the film pancake and effective venting of vinegar syndrome out gassing products from rolls of triacetate film. Acid concentration gradients plotted show that the head or outer side of the film and the middle of the roll measured decreased free acid, while the inside or tail part of the roll remained virtually equal to that in an unvented container.

Discussion: The work proves that effective ventilation of vinegar syndrome out gassing products in the initial amount of >100 ppm is feasible in the presence of a storage environment air circulation airspeed of 0.3 m/sec (approximately 1 km/h or 0.675 mi/h), that is capable of reducing acetic acid concentration in a vented can to 4 ppm. It should be noted that this level of efficiency would probably not apply when there is no air circulation in the storage vault. It would also depend on the size of the slots or holes in the sides of the container. Also, the presence of open holes or slots in the side of film storage containers in Archives, is not expected to provide adequate protection in case of sprinkler or fire extinguishing water gushing down the racks. It is also understood that the presence of free acid is unequal between the head, middle and tail of a roll of degrading film. Hence sample measurements of film shrinkage should also be made at the head, middle and tail of a roll of film to be trustworthy.

To appreciate what happens when triacetate materials degrade, let's review what we know about it. I quote from John Morgan, "Conservation of Plastics-An introduction to their history, manufacture, deterioration, identification and care", published by the Plastics Historical Society and The Conservation Unit, Museums & Galleries Commission, London, UK, 1991 (ISBN: 0 948630 14 0) pp. 23-24:

"Cellulose acetate plastics generally contain a relatively large proportion of liquid plasticizer which readily migrates to the surface and is easily lost. Shrinkage follows plasticizer loss and causes stress and distortion, and eventually leads to splitting. Hollow objects and containers lose plasticizer more quickly from external surfaces and are especially prone to distortion. ...because of its susceptibility to plasticizer loss, cellulose acetate should not be stored under such well ventilated conditions as cellulose nitrate. To minimize plasticizer loss do not wrap in very absorbent materials. A loosely wrapped single tissue is recommended."

On the other hand, we cannot permit the build-up or 'trapping' of acetic acid that outgases from degrading triacetate film either. I quote from the Image Permanence Institute "Storage Guide for Acetate Film", p. 3, under the heading "Importance of Acid Trapping by Enclosures":

"There is another important fact to know about vinegar syndrome besides its temperature and RH dependence: the "acid trapping" factor. The process of deterioration generates acetic acid (vinegar) inside the plastic film base.

Under some circumstances, acidity either can leave the film by evaporating into the air, or can become absorbed into storage enclosures. In other situations it can be trapped-prevented from escaping by the storage container. If trapped, it greatly accelerates the rate of deterioration".

We now note that 'too much ventilation' will actually increase film shrinkage, and from what we noted before, such shrinkage will be uneven between the head, center and tail of a roll of film. That means that the YCM pan separations made for protection against color dye fading when made on triacetate film, due to uneven shrinkage, may not match up anymore with the expected and required precision. Obviously, we should not make them anymore on triacetate film, but on polyester stock instead. But worse, uneven shrinkage within a single roll of film is impossible to correct when printing with an adjustable sprocket pitch on the printer, which is unlikely to be variable within a roll of film. Another observation is appropriate here, which relates to the use of zeolite molecular sieves which are known to effectively reduce the presence of humidity (and evaporated plasticizer and acetic acid) from the part of the material where it can do its job, to as low as 15%. Again, a means of encouraging uneven shrinkage, unless the film is wound once periodically and is left rather slack and not tightly packed!

At the same AMIA Preservation Committee meeting, we were shown a slide of a badly shrunken piece of degraded triacetate film. It revealed a disturbing problem for which we have no solution in the motion picture industry; it is not even a candidate for digital restoration either. It showed what happens when the film emulsion which has not shrunken as much as the triacetate film base from which plasticizer and acetic acid have evaporated, tries to hold onto the reduced piece of film base. It wrinkles up, forming ridges of increasingly unrecognizable 'creased' picture information.

The phenomenon of rapid shrinkage is also encountered with triacetate-based photographic sheet film (which is not usually as tightly 'packed' as the wraps in a roll of motion picture film), and therefore enjoys more ventilation or absorption of the evaporated plasticizer and acetic acid into the paper storage box. When such shrinkage occurs, or when the glass support is cracked and efforts are required to save the emulsion itself, very careful separation of the emulsion from the film base is attempted to save the photograph, and is then applied to a new clear film base. About this hairy procedure I quote A.H.S. Craeybeckx, in the "Gevaert

Fotohandboek (in Dutch)". First, with a small knife cut into the sides of the sheet of film negative, then leave it immersed for at least half an hour in a solution of 800 cubic cm of water, 30-40 g of sodium carbonate (dry), 50 cubic cm of Formol, 10 cubic cm of glycerine and top it off to obtain 1000 cubic cm or 1 litre.

Next take the negative out of the solution, quickly removing excess liquid and then hang it up to dry without further rinsing. When dry, place the film sheet in a 5% solution of hydrochloric acid that will do its work immediately. The gelatine layer will detach from its broken glass or shrunken triacetate film base. After the receiving substrate has been pre-treated with an adhesive layer, the emulsion is placed on it. Before or after its application, the new film needs to be washed, (without tearing it of course) to eliminate the salts used to remove it from its previous base.

I am only quoting this procedure from the photographic world and presenting it to the motion picture world to illustrate that this is no mean task, and hardly likely to ever be used, but it is the only approach we know of to find a new non-shrunken base on which a wrinkling emulsion may find a new support.

Which leads me to conclude, that we have an excellent instance of how excessive ventilation can be a new risk? We should plan to encounter the consequences of it as late as possible, while avoiding a damaging build-up of acetic acid. Whatever we do, and I paraphrase Jean-Louis Bigourdan at the Image Permanence Institute, cold and dry storage are the most effective means to reduce degradation of both acetic acid (and plasticizer) loss and color dye fading. Hopefully the eventually unavoidable state of the film support will take yet a very long time to arrive at your doorstep!

I hope that this will be a helpful perspective on this most interesting work.

Best regards,

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