

## Acetic acid (Vinegar Syndrome) detection in Cellulose Triacetate (CTA) motion picture film materials

### Introduction

One of the most significant failure mechanisms of CTA film support is its degradation due to exposure to hydrolysis inducing storage temperature and relative humidity (RH).<sup>1</sup> The rate at which this degradation occurs varies with storage environment, manufacture, efficiency of laboratory processes, the coating on the film, i.e. magnetic sound coating doubles the rate of degradation as compared with film materials with a photographic emulsion. It is also influenced by the material of which the container (link to STIL page) is made, and whether it traps the acetic acid (vinegar) or allows its evacuation.

### Detecting it

It is possible to detect an active vinegar syndrome state inside a film container by briefly opening it. If a vinegar smell is present, active degradation is taking place. If the material is still stored in the tin-coated metal raw film stock can supplied by the film stock manufacturer, the interior may exhibit brown powder and may even be corroded. This indicates that active film base degradation started some time ago.

It is recommended to use a diagnostic tool to assess the degree of degradation,

referred to as Acid Detection (A-D) strips.<sup>2</sup> These monitoring and indicator strips, when inserted in the film storage container, may change color. If the strip remains blue (level 0), its pH is 5.0 or higher and it remains "fresh". If the color turns dark green (level 1), light green (level 2), or yellow (level 3) it is gradually more seriously degraded. The sampling procedures enclosed with the A-D strips outline the measures to be taken, ranging from cool to freezing storage temperatures to immediate duplication or copying.

Degraded film typically shrinks and may also curl. Because the magnetic sound film elements degrade faster, it will be increasingly difficult to match picture and its associated magnetic sound in terms of synchronization and length.

If triacetate film acidity evaluation is required for a collection, it is recommended to sample the film inside several containers for each year represented in the collection, to delineate the extent of the problem. It may not be possible to immediately implement the recommendations intended to slow down or halt film base degradation.

Nevertheless, it is strongly recommended to separate "degraded" film elements from "fresh" film elements. Film inside metal cans with a rusted interior, should be transferred to archival quality and inert storage containers (link to STIL page).

If the air circulating and entering film storage vaults is filtered effectively to remove acetic acid vapor and other airborne pollutants, store "fresh" film as well as "degraded" film

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<sup>1</sup> Other forms of degradation include color dye fading, silver image fading, wear, torn or stretched perforations, generational duplicating quality loss, mold, etc.

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<sup>2</sup> Available from Image Permanence Institute (IPI), tel. +1-716-475-5199, or fax. +1-716-475-7230.

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### FOR FURTHER INFORMATION, PLEASE DO NOT HESITATE TO CONTACT US :

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in ventilated storage containers (link to STIL page). This prevents a damaging level of acetic acid vapor build-up inside them and reduces the effect of accelerated auto-catalysis. If the film storage vault is not temperature and humidity controlled and unfiltered, non-ventilated inert containers may be used with molecular sieves enclosed inside. Molecular sieves absorb excessive humidity, acetic acid and other harmful contaminants and slow down degradation of the film base as well as the film color dyes.

To determine the conditions required to meet film life expectancy requirements, use the "IPI Storage Guide for Acetate Film" and consult the associated ranges of storage conditions and the approximate number of years before acetic acid degradation onset. Selection wheels are included for "fresh" film and "degraded" CTA film. When ordering duplicates to replace degraded film elements, request polyester film stock to be used, rather than cellulose triacetate (CTA) materials.

In order to periodically monitor the level of degradation in terms of the vinegar syndrome, color dye fading, damage, etc., it is highly recommended to record the evaluation results in a database related to each film element. In time, it will serve to indicate the speed of degradation and will enable verification of the assumptions made about ways to halt degradation, remaining life, etc.

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<sup>3</sup> See:

<http://www.fpcfilm.com/US/en/motion/FPC/fpc/mole.html> and

<http://www.kodak.com/country/US/en/motion/support/technical/vinegar.shtml>