The Research on Recovery for the Shrinkage of the Film

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Abstract

The shrinkage of acetate films is often take place during storage .however why this happens easily is not clearly. This article discusses that temperature and humidity of storage effects on acetate films .the result is that acetate film is kept in low humidity for long time, shrinkage will take place. The researchers analyzed the situation that the lengths of different kinds of acetate film had changed with different treatment and tried to find some pattern which could explain how the length of film changed. The researchers try to find a way to recover the shrinkage film through experiment .4 recovering treatment have variation affection on shrinkage recovering as well as the density of film. From this research, we also know recovering of film will finish quickly.

Introduction

In order to ensure the durability of the film, in the long-term storage process, the film is generally stored at low temperature and relative humidity conditions. This low temperature and humidity conditions have contributed a lot to maintain the stability of the chemical properties of the film, as well as reduce the occurrence of the Acetic Acid Syndrome [1]. However, it also gives rise to the physical shrinkage of the film, which reflects in the shrinking of film-base, and causes the film perforations become smaller, which limit the normal screening on the film projector. This research aims to look for the recovery methods on those already-shortened film-bases, and observe the impact of those various methods on film images, with expectation on finding out ways to re-use the deformed film. The film-base composition is such complex [2], in addition to acetate, gelatin and other basic components, the diverse manufactures will use different types of additives in the process of production, and the proportion of each component various as well. After long-term storage, composition in the film-base will take change, resulting in its shrinkage and being brittle [1].

Acetate film will change in longitude and orientation. Average distance of every two sprocket holes will change from 4.75 mm (form) to 4.69-4.72 mm (deform), width of film will change from 35mm to 34.5mm [3][4]. It will not finish copying or playing if the film has serious shrinkage. For not serious shrinkage film, sprocket holes will be broken or damaged.

Experimental methods and conditions

Experimental 1

Select 3 kinds of acetate film which is produced by diverse manufactures and with different perforations. The acetate films are marked with the film A, film B, as well as film C. Meanwhile, put the three kinds of film into 20℃/32%，keep in different time(90 days, 180 days, 270 days、360 day, 450 days),observe the change of sprocket holes length for 3 kinds of film .

Experimental 2

The experimental material used in the research included: acetone, glycerol, sodium distilled water and wet towel.

Four treatments were used to approach the different deformed film, and observation and measurement occurred towards the recovery of the size of film at different times. Group 1 is with distilled water, Group 2 is with sodium chloride solution, Group 3 is with the mixed solution of acetone, glycerol and water, as well as Group 4 is with a wet towel. Among them, the concentration of sodium chloride solution is 0.9g/100ml. The preparation of mixed solution of acetone, glycerol and water is to take 60ml acetone, 100ml glycerol, and 240ml water, and then mix them into a beaker. The preparation of wet towel is to fully soak those towels in distilled water, and control the water droplets until it doesn't shed up.

The film is immersed in its natural curl in the above-mentioned 3 kinds of solutions. And the film is wrapped and separated by the wet towel, with the one end of the towel immersed in distilled water to ensure maintain its' moist. All of the container that soaking or carrying the film will be isolated with outside, and the temperature of treatment is also constant at 25℃.

Experimental 3

Select 3 kinds of form and deform film ,put them into room temperature /99% ，observe change of average distance of every two sprocket holes in different time(0.5hour ,one hour, 4 hours,21hours) ，we can get appropriate treatment time for recover the shrinkage film and avoid treatment in high humidity for long time .

Each film will be intercepted into 4 paragraph of length 25CM. Measurement should be taken the length among 5 perforations of the film, and their mean value will be treated as the initial value.

Results

Experiment 1

Observe the length changes of form film under 20℃/32% in different time. Analyze the shrinkage of different film.

Form above result ,3 kinds of films have different shrinkage under 20℃/32%,due to different structure and different ration of material .A film shrink at 0.04mm in 450 days .Band C film shrink at 0.05mm in 450 days .different film have different speed of shrinkage .one of reason is that water and different film have different speed of shrinkage .one of reason is that water and volatile among the film are different between films, even if they are kept in same condition .

From above experiment, there is basic tendency, the longer storage, the more shrinkage in low humidity. Although there is only small change in short time .high temperature and low humidity will lead to shrinkage for acetate film.

Table 1. The changes of average distance of every two sprocket holes under 20□/32% in different time(mm)

Time / Film	0days	90days	180days	270days	360days	450days
A	4.740	4.730	4.730	4.720	4.710	4.700
B	4.730	4.720	4.700	4.700	4.690	4.680
C	4.750	4.730	4.720	4.720	4.710	4.700

Experiment 2

Observe the condition of film recovery under different processing conditions and times.

Record the value among 5 perforations of the film through regularly observation, and calculate their mean value. At the same time, measurement of film density should also be recorded as well as their mean value be calculated. 96 hours later, take the film into pure acetone, and then record its changes in the length. The observation results are showing in Table 2.

Table 2. The records of length and density values of 3 kinds of film under 4 treatments

Processing Materials	Film types	Measurement properties	The initial value	0.5 hour	1hour	4hours	21hours
Instilled water	Film A	Value among perforations（mm）	4.755	4.775	4.775	4.775	4.775
		Density	1.350	1.344	1.360	1.333	1.343
	Film B	Value among perforations（mm）	4.705	4.720	4.725	4.725	4.725
		Density	1.160	1.159	1.158	1.158	1.154
	Film C	Value among perforations（mm）	4.720	4.760	4.760	4.760	4.765
		Density	1.390	1.385	1.384	1.384	1.383
Sodium chloride solution	Film A	Value among perforations（mm）	4.755	4.775	4.775	4.775	4.775
		Density	1.350	1.352	1.346	1.347	1.343
	Film B	Value among perforations（mm）	4.705	4.720	4.725	4.725	4.720
		Density	1.160	1.162	1.157	1.159	1.163
	Film C	Value among perforations（mm）	4.720	4.760	4.760	4.765	4.765
		Density	1.390	1.388	1.386	1.387	1.385
Mixed solution	Film A	Value among perforations（mm）	4.755	4.770	4.775	>4.775	>4.775
		Density	1.350	1.346	1.332	1.320	1.253
	Film B	Value among perforations（mm）	4.705	4.720	4.725	4.745	4.745
		Density	1.160	1.158	1.156	1.155	1.153
	Film C	Value among perforations（mm）	4.720	4.760	4.775	4.775	4.775
		Density	1.390	1.350	1.320	1.310	1.321
Wet towel	Film A	Value among perforations（mm）	4.755	4.770	4.770	4.770	4.775
		Density	1.350	1.330	1.326	1.275	1.264
	Film B	Value among perforations（mm）	4.705	4.720	4.720	4.725	4.725
		Density	1.160	1.157	1.158	1.156	1.155
	Film C	Value among perforations（mm）	4.720	4.760	4.760	4.760	4.765
		Density	1.39	1.31	1.24	1.22	0.84

Based on the above values change, the length film perforations have increased while the film density has gradually became smaller in 4 treatments. And the increasing in the length of film-base while decreasing in the density of image layer also proves this conclusion. According to the time changes, the length of the film change most obviously in the initial 0.5hour to 1hour. As time goes on, the rate of film elongation decrease, or even approach to zero.

After 21 hours, the 3 kinds of film, under 4 different treatment methods, show distinctive results in different times. In the 24th hour of observation, film A and film C have curl shrinkage in the mixed solution, while film B did not change significantly. In the 48th hour of the observation, the overlying emulsion layer of film C, which was wrapped in the wet towel, has fallen off, while film A and film B not change obviously. In the 15th day observation, film A, film B, as well as film C in the distilled water has grew mildew. And the film shows no changes except in the length among perforations.

2.3 Experiment 3

The observation of the appropriate time of film recovery

After experiment 2, we have found that the length of the perforations of film has increased in varying degrees after 4 kinds of treatments, and it's quite important for us to recognize that water treatment is good way that neither bring any damage for film nor left any chemical material on film. It will recover the shrinkage film in length .experiment 3 will set 4 points of time .and make sure which time is best for recover shrinkage film. From figure 3,we can find that form film A have not any change after high humidity treatment ,but B and C have obvious elongate after treatment during 0.5 hour .as treatment time prolonging ,there is only less change .from this result we know that shrinkage film can recover in short time rather than the long time treatment .in other words ,the longer treatment time does not mean the better result .

After 21 hours of laying up of the recovered film in water, all of the 3 kinds of film show evidential damage. The length of perforations of recovered film C has best recover .

Acetate film is polymer of macromolecule. Macromolecule arrange orderly through elongate .if they are kept in low humidity and high temperature for long time , Macromolecule order will change , as water and volatile's volatilization in film .distance between Macromolecule will shorten .It leads to shrinkage of film. This research proves same point:3 kinds of film kept in 20℃/32% have shrinkage in someway .the longer it was kept in ,the more serious shrinkage is . so the dimension of acetate film will change and the average distance of every two sprocket holes will shorten .

From this research, the optional recover method is increasing the water and keeping the film moisture, so as to make the film elongation and soften .shrinkage film will change obviously in 0.5 hour. We should take care of the film in treatment and avoid touch and damage the image layer .it is very important to reduce treatment time as much as possible .for other point is different shrinkage film or different kinds of film have different recover ability. Treatment method or treatment time will be different.

Film cleaning is regularity work .cleaning and recovering can be finished in one process. When film is cleaning , we can increase cleaning time or add water or recovering solution into cleaning solution. It is easy to implement in hand wash. Especially for damage of perforation film or under 4.69mm of average distance of every two sprocket holes .the good recover way is make use of hand washing.

Film shrinkage mechanism involves many factors .this research focuses on temperature and humidity .we have not done research on structure and additive of film. we also have not get some points about how to keep the recovering shrinkage film for long time .

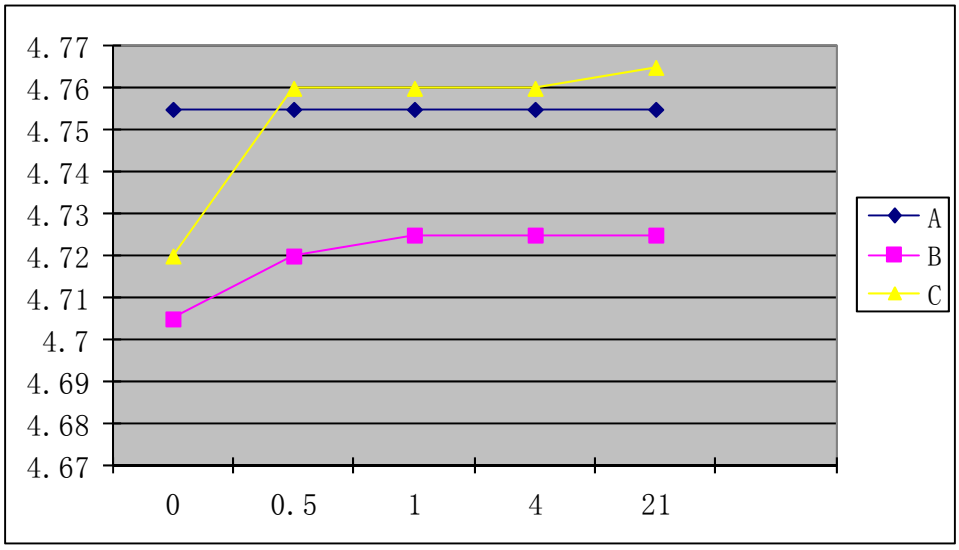

***Figure 3**. Time of Film change after treatment by room temperature /99%*

Conclusion

The shrinkage of acetate film will take place at low humidity and high temperature for long time. For the long-term storage of the deformed film, the recovery ability is related to film types, which also cause the difference among various manufacturers. The smaller of the shrinkage, the more stronger its ability to recover, while conversely, more weaker.4 kinds of treatment methods play a certain role in the recovery of the shrinkage film, and it shows most obviously in the first 2 hours. The exposure to the image layer should be reduced in the treatment; otherwise it will cause great damage to image quality.

The film after severe shrinkage cannot be used or copied. And the mechanism of contraction of film perforations and its recovery is related to many factors. Although it has been got some concern in recent years, it still lack of systematic research.

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