

Research on the Necessity of Room Temperature and Humidity Control in University Archives

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ABSTRACT: *The temperature and humidity control of university archives was studied. First, the test of the compressive strength and flexible strength in the laboratory were carried out to discuss the necessity of humidity control in the archives. Then the necessity of temperature control is discussed. The results show that the compressive strength decreases with the increase of humidity, but the flexible strength first increases and then decreases. The research conclusion shows that the temperature and humidity specified by the government are reasonable.*

Date of Submission: 14-01-2023

Date of acceptance: 29-01-2023

I. INTRODUCTION

The universities archives are the management organization for storing universities archives, which undertakes the important task of the cultural inheritance and development of colleges and universities[1]. It not only needs to save all kinds of teachers and students' archives data, but also needs to undertake the transmission of the excellent courses of colleges and universities. At present, university archives store extremely valuable and even unique archives such as school history, audio and video, and teaching plans. However, these archives are likely to be affected or even damaged by many harmful factors, such as temperature, humidity, light, harmful gases, harmful organisms and dust. Among these factors, temperature and humidity are the most serious and major factors that lead to the damage of archives. Therefore, this paper studies the room temperature and humidity control of university archives in depth.

The "interim provisions on the management of temperature and humidity in archives" issued by the National Archives Administration in 1985 and the "regulations for institutions of higher learning" issued by the General Office of the National Education Commission in 1994 required that the relative humidity of archives should be controlled at 45~60%, the temperature should be controlled at 14~24 °C. This means that the temperature and humidity of the archive room should be controlled within this range. This paper aims to prove the rationality of the temperature and humidity range.

Archives, especially paper archives, require proper humidity. When the humidity is too high, the file will absorb more water, which will reduce the strength of the file, which will easily lead to the hydrolysis of the file data, blurred handwriting, and even lead to the occurrence of mold, and may also lead to the breeding of insect eggs. When the humidity is too low, the archive data becomes brittle, the toughness decreases, and is easy to fracture. The most suitable water content in the archives is 7%, which is known as "safe water" in the industry. The main purpose of controlling the relative humidity between 45% and 60% is to maintain the water content of the archives at a safe level. In addition, general file pests or molds prefer to grow in places with high humidity and dark light environment. When the humidity of the archive room is controlled between 45% and 60%, most of the archive pests or molds are inhibited[2].

II. Methods

In order to test the strength of the paper, the project team made experiments on the relative humidity. In the constant temperature and humidity laboratory of Zhongyuan University of Technology, control the temperature at 14 °C± 0.5 °C, 20 °C± 0.5 °C and 24 °C± 0.5 °C respectively, change the relative humidity of the laboratory (30%~90%), and measure the compressive strength and flexible strength of the paper. To measure compressive strength, the standard weight is used to pull 70g of standard A4 paper (Deli 7753 is uniformly used for paper) until the paper breaks. To measure the flexible strength, the paper was repeatedly fold the paper until it broke.

III. Results and discussions

COMPRESSIVE STRENGTH

The compressive strength test results are shown in Fig.1. It can be seen from Fig.1 that under the three temperature conditions, the compressive strength of the paper decreases with the increase of humidity. The temperature is 14 °C, the compressive strength of the paper is the lowest. However, the difference of compressive strength at three temperatures is not obvious.

Under the three temperature conditions, when the relative humidity is 30%~60%, the compressive strength is above 1.5kg, which indicates that it is feasible to set the humidity in the archive room at 45~60% from the perspective of compressive strength.

To determine the significant situation of compressive strength at three temperatures, paired t-sample test[3] was carried out, as shown in Table 1. It can be seen from the table that the average compressive strength at 20 °C is higher than 14 °C, but lower than 24 °C. However, the p value between the three is higher than 0.05, which means that the difference between the three is not significant.

Table 1. Paired t-sample test for compressive strength by three temperatures

	Paired difference				T	Sig. (2-tailed)
	Mean	Std. Deviation	95% Confidence Interval of the Difference			
			Lower	Upper		
14°C - 20°C	-.52857	.68730	-1.16422	.10707	-2.035	.088
20°C - 24°C	-.08571	.62029	-.65939	.48796	-.366	.727
14°C - 24°C	-.61429	.73355	-1.29271	.06413	-2.216	.069

FLEXIBLE STRENGTH

The experimental results of flexible strength are shown in Fig.2. As can be seen from Fig. 2, under the three temperature conditions, the flexible strength of the paper increases first and then decreases with the increase of humidity. When the humidity reaches about 60% - 70%, the flexible strength of the paper reaches its peak. At 20 °C, the flexible strength is higher than 14 °C, but lower than 24 °C.

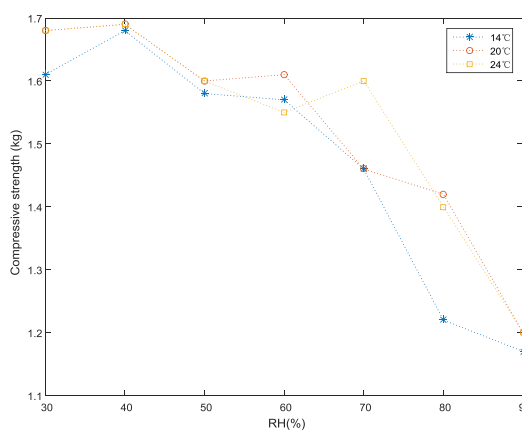


Fig.1 Compressive strength vs. RH

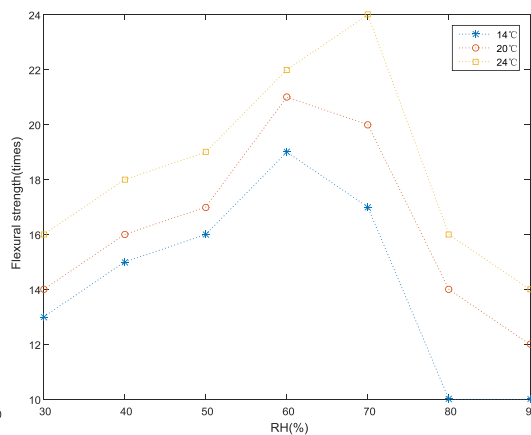


Fig.2 Flexible strength vs. RH

Under the three temperature conditions, when the relative humidity is 30%~60%, the flexible strength is more than 15 times, which shows that from the perspective of flexible strength, it is feasible to set the humidity in the archive room at 45~60%

To determine the significant situation of flexible strength at three temperatures, paired t-sample test was carried out, as shown in Table 2. It can be seen from the Table 2 that the p value between the three is lower than 0.05, which means that the difference between the three temperatures is significant.

Table 2. Paired t-sample test for flexible strength by three temperatures

	Paired difference				T	Sig. (2-tailed)
	Mean	Std. Deviation	95% Confidence Interval of the Difference			
			Lower	Upper		
14°C - 20°C	-2.00000	1.15470	-3.06792	-.93208	-4.583	.004
20°C - 24°C	-2.14286	.89974	-2.97497	-1.31074	-6.301	.001
14°C - 24°C	-4.14286	1.67616	-5.69305	-2.59266	-6.539	.001

NECESSITY OF TEMPERATURE CONTROL

When the indoor temperature is high, especially over 35 °C, the file data will accelerate the aging exponentially[2]. In general, low temperature is conducive to the preservation of archives. In low temperature environment, it also helps to inhibit the growth of archival pests or molds. When the file temperature is controlled below 10 °C, basically all file pests are forced to hibernate, and their growth is greatly inhibited. For the mucor, rhizopus and penicillium, which are common in the archives, when the temperature is controlled below 25 °C, their growth is basically inhibited. It can be seen from the perspective of insect and mildew prevention that the temperature of the archive room should be continuously controlled below 10 °C, or even lower. However, keeping the temperature of the archive room too low is not conducive to energy conservation. Especially in the summer of China, the outdoor temperature may be as high as 40 °C. It may require a lot of energy to control the temperature of the archive room below 10 °C. And in winter, the temperature of the archive room can be low, but the archive room may have staff or people who borrow files to check the files. If the temperature is too low, it may cause great cold injury to people. In consideration of the above, the government specified the temperature at 14~24 °C, which can be lower in winter and higher in summer.

IV. Conclusions

The temperature and humidity control of university archives was studied. The following conclusions can be drawn:

The compressive strength of the paper decreases with the increase of humidity. The temperature is 14 °C, the compressive strength of the paper is the lowest. However, the difference of compressive strength at three temperatures is not obvious.

Under the three temperature conditions, the flexible strength of the paper increases first and then decreases with the increase of humidity. When the humidity reaches about 60% - 70%, the flexible strength of the paper reaches its peak. Furthermore, the difference between the three temperatures is significant.

From the point of view of compressive strength, flexible strength and temperature, the temperature and humidity specified by the government are reasonable.

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