

hp media results



archivable papers:
a report on acid-free
and lignin-free paper

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a report on
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archivable
papers



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Executive summary

The field of paper preservation is constantly changing as new papers are developed and paper manufacturing evolves. Developing new and specialty papers for inkjet printers has created a need to understand the factors that determine if the paper can be archived.

Many consumers are becoming aware of buzzwords like “acidity” and “lignin” content (see Papermaking terms and definitions on page 6), and they understand that these words refer to factors that somehow reduce the longevity of paper. Consumers are also confused by the conflicting messages from paper manufacturers regarding how acid and lignin affect the preservation of paper and the text or images printed on the paper. In addition, a multitude of paper industry organizations use varying standards regarding the effects of acid and lignin on paper preservation. As a result, consumers have many questions about claims that paper is acid-free and lignin-free, including:

- What are these claims based on?
- How long will the document or photograph remain unaffected?
- What other factors influence the permanence of documents and photographs?

As the leader in the field of photo and specialty papers for inkjet printers, Hewlett-Packard’s (HP) position on acidity and lignin content is needed to provide clarity in a confused marketplace. HP recognizes the traditional claims made by the paper industry concerning acid-free paper are based on the alkaline process used to make the base paper (substrate), but does not consider coating that is added to the paper.

In the past, many pulping processes used strong acid treatments to separate the lignin from the cellulose fibers; this created papers that degraded rapidly. As a result, the traditional definition of acid-free paper began to be used to describe papers made by non-acidic papermaking processes; these acid-free substrate papers were less likely to degrade with age. Acid-free materials were considered safe for contact with other materials since they would not cause acid-related degradation. Therefore, “acid-free paper” became a traditional term synonymous with long-lasting or archival-quality paper.

Unfortunately, the traditional definition of acid-free paper may have limited application to many modern coated papers designed for printing purposes and image preservation. Modern papers often use no strong acids in the papermaking process, but may use weak acids in the coating process. These weak acids do not necessarily increase paper degradation, but they do affect the pH value (see Papermaking terms and definitions on page 6) of the paper. Therefore, modern papers may or may not meet the traditional definition of acid-free, but could still be suitable for archival purposes.

A vast majority of HP photo and specialty papers for inkjet printers meet the traditional definition of acid-free and lignin-free because their substrates are produced by alkaline processes and they contain no more than one percent lignin (see *Figure 1 on page five*). While these papers provide a competitive solution for archiving photos and valued documents, HP believes the question of archivability is complex and has not been treated with the proper level of sophistication. HP also concurs with the recommendation of the International Standards Organization (ISO) that paper marketed as lignin-free should contain no more than one percent lignin.

In an effort to help the industry redefine or replace the term "acid-free," HP is continuing aging-simulation studies to provide a better understanding of how modern paper permanence is affected by lignin, various types and amounts of coating acids, and other archival factors. HP's dedication to paper permanence research is a reflection of their commitment to produce the best photo and specialty papers for inkjet printers.

HP papers

The following table is a comparative listing of the acid-free papermaking process and lignin content for many of HP's photo and specialty papers for inkjet printers.

For an explanation of some of the key papermaking terms, see Papermaking terms and definitions on page 6.

Product Name	* Meets traditional industry definition of acid-free?	** Lignin-free?
HP Premium Plus Photo Paper, Glossy	Yes	Yes
HP Premium Plus Photo Paper, Matte	Yes	Yes
HP Premium Plus Photo Paper, Glossy (4 x 6)	Yes	Yes
HP Premium Photo Paper, Glossy	Yes	Yes
HP Photo Paper, Glossy	No	Yes
HP Everyday Photo Paper, Semi-Gloss	Yes	Yes
HP Everyday Photo Paper, Matte	No	Yes
HP Textured Greeting Cards	Yes	Yes
HP Photo Greeting Cards, Half-fold	No	Yes
HP Brochure and Flyer Paper, Gloss	Yes	Yes
HP Brochure and Flyer Paper, Matte	No	Yes
HP Premium Inkjet Paper	No	Yes
HP Premium Inkjet Heavyweight Paper	No	Yes
* Manufactured using an alkaline process.		
** Lignin content of no more than one percent.		

Figure 1: Acid-free and lignin-free designation chart

Introduction

Long before modern printing technologies were developed, people noticed that different types of paper suffered various types of aging such as discoloration and loss of strength. At that time, the difference in aging behavior was largely caused by the different types of pulping methods that were used to convert the raw material (wood, cotton, or other materials) to a pulp that was then formed into paper.

In determining the aging of modern papers, the pulping process is only one consideration. Other key factors—including the acidity of the ink, substrate and coating; the storage conditions; and the lignin content of the paper—also affect the longevity of modern papers. This report deals primarily with two of these key variables associated with paper permanence:

- What percentage of the lignin remains in the paper?
- What residual acids, if any, remain in the paper substrate and coating layers?

This report also discusses key papermaking terms, paper preservation standards, pH testing, and the role of lignin and acid content in paper archivability.

Papermaking terms and definitions

This section defines key papermaking terms.

- **Acid**, as it applies to papermaking, is a water-soluble compound that can be present in paper as a result of the papermaking process. In the presence of moisture, acid may cause paper to degrade.
- **pH** is a symbol that represents the acidity or alkalinity of a substance. A neutral solution has a pH value of seven. The pH value drops toward zero as the acidity increases and rises toward 14 as the alkalinity increases.
- **Coated paper** is any type of paper to which a surface coating has been applied in order to enhance appearance and printability.
- **Kraft (alkaline) process** is the most common chemical pulping process. It uses alkaline-based chemicals—rather than acid-based chemicals—to separate the lignin from the wood fibers.
- **Lignin** is a brown organic substance that binds to cellulose fibers and hardens and strengthens the cell walls of plants. Lignin is the chief non-carbohydrate constituent of wood and is also a major contributor to the chemical degradation of paper. As it deteriorates, lignin gives off acids that cause paper to become brittle and to discolor on exposure to heat and light.

Paper preservation — Where are we now?

The paper industry and paper consumers are interacting constituencies whose goals and roles are quite different, yet both are trying to keep up with a complex and evolving industry. This section explains the present outlook of the paper industry and consumers in regards to paper preservation.

The *paper industry*, including paper manufacturers, has created many organizations to establish paper specifications, standards, and test methods. These organizations sometimes undermine the validity of one another by using different criteria that yield dissimilar conclusions.

Consumers simply want long-lasting documents and photographs, and seek what they hope is helpful information by asking questions like, “Is this acid-free?” Industry leaders such as HP have a responsibility to not only provide answers to questions like this, but perhaps more importantly, to educate the consumers about other information regarding storage conditions, types of ink, and coatings that may be more relevant to the fundamental question “how long will my documents and photos last?”

Confused state of information

The facts regarding paper permanence can dissolve into a complex morass of marketing claims. HP’s competitors have made claims based on varying standards set by the paper industry. Consumers make paper-purchasing decisions based on these claims with only limited knowledge regarding the complex subject of modern papermaking and paper permanence.

Although paper manufacturing methods have evolved, and new specialty papers for inkjet printers have augmented the paper selection beyond uncoated papers, consumers still associate any preservation issues with buzzwords such as “acid-free” and “lignin-free.” However, since these terms originated before the advent of modern coated papers, the terms have diminished relevance to the subject of modern paper archivability.

The uncertainty that exists among both consumers and suppliers regarding paper permanence has to do with the following factors:

- Varying industry standards
- Ambiguous marketing claims
- The complex interaction of new inks
- Changing papermaking techniques
- The impact of environmental factors such as storage temperature and humidity
- The various types of acid, including very weak acids, used in modern paper coatings
- The ramifications of acids on the archivability of paper

What acid-free and lignin-free mean to the paper industry

It is important to note that the traditional paper industry considers paper permanence to be the result of optimizing multiple paper properties, two of which are pH level (acidity) and lignin content. Therefore, specific information about acidity and lignin content is almost always nested within discussions and standards for paper permanence.

In the paper industry, acid-free paper is often tied to longevity. For example, according to International Paper's *Pocket Pal*, creating an acid-free paper is defined as a "process that gives paper over four times the life (200 years) of acid-sized paper (40-50 years)."¹

The following organizations have established the following paper specifications, standards, and test methods:

- National Information Standards Organization (NISO)—(ISO 9706 and ISO 11108)
- American National Standards Industry (ANSI)—(ANSI Z39.48 – revised 1997)
- International Organization of Standardization (ISO)—(ANSI Z39.48 – revised 1997)
- Technical Association of the Pulp and Paper Industry
- Library of Congress (Preservation Directorate: Progress on Monitoring Pub. L)

Based on the ANZI Z39.48 standards, for example, the paper industry defines paper permanence for uncoated or coated writing or printing papers based on a pH value between 7 and 10—(from a cold-water extract) and a lignin content of no more than one percent.

What acid-free and lignin-free mean to paper manufacturers

A survey of consumer Web sites and calls made to customer service centers of eight leading companies reveals a blur of information about the definition of acid-free and lignin-free paper. The Web site for each company was researched for information related to acid-free and lignin-free paper. In addition, the customer service departments were asked which of their papers were acid-free and most suitable for printing photos at home.

Much of the information offered to consumers by customer service representatives is marketing driven rather than scientific. Many representatives used buzz words like "archival" and "archival-safe" regarding acid-free claims, but they could not answer more detailed questions regarding

¹ *Pocket Pal*, Memphis, TN: International Paper, 2000.

testing standards, coating acids, or manufacturing conditions. Most of the company Web sites do not list their papers or make definitive claims regarding their papers' acidity or lignin content.

What acid-free and lignin-free mean to consumers

Millions of consumers who are interested in acid-free and lignin-free paper want to print their photos at home for archival purposes. In their search for paper, they often receive stern guidelines and warnings from third-party suppliers about the need for acid-free paper. Unfortunately, this term can cause confusion and has limited application when applied to many modern papers used for printing or image preservation purposes.

The major advocates of acid-free and lignin-free paper are companies that sell products to genealogists and home historians. Numerous Web sites, such as creativememories.com (a popular scrapbook supplier) are convincing consumers that "generations yet unborn" will cherish their scrapbooks only if archival-quality paper is purchased from a qualified conservation supplier. Other Web sites insist that the only reliable way for consumers to determine the acidity level of a paper is to purchase a pH test pen and test the paper using the pen.

Numerous tests by HP concluded that the most commonly available 'pH test pens' yielded conflicting results depending on the brand of the test pen. These tests also gave misleading information such as the indication that some coated papers contained acid when in fact they did not. If archivability standards were better defined and applied, consumers would only need to refer to the manufacturer's specifications and not rely on third party suppliers.

Adding to the confusion is the fact that many consumers have a limited understanding of the following paper information and characteristics:

- Modern papers are often an intricate composition of base paper (substrate) and coating(s) on which the ink is deposited. Figure 2 shows one example of the intricate layering structure of modern coated paper.

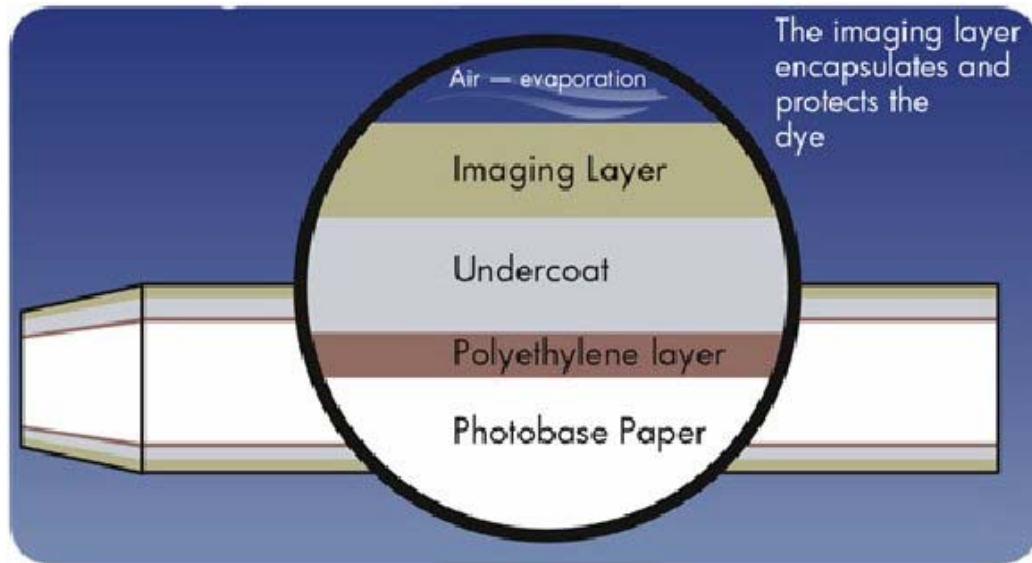


Figure 2: An example of the intricate layering structure of modern coated paper.

- Both the base paper and the coating can have acidic or other properties that may cause degradation. For this reason, the acidic content of the coating is just one critical factor in image and text preservation. Therefore, merely describing the acidic properties of the base paper or just testing the acidic properties of the coating with a pH test pen is not necessarily a comprehensive way to judge the permanence of modern papers.
- Paper archivability is not well defined by the term “acid-free” and should be replaced by a term more capable of predicting the longevity of modern papers.

Archival quality paper

Ultimately, consumers are most concerned with the archivability of their documents and photographs. However, acidity and lignin levels are not the only archivability factors. Other factors that influence paper longevity include the following:

- The permanence of the inks
- The humidity and temperature (or the fluctuation of temperatures) in storage
- External contacts with the paper such as other papers, dust, and excessive light

Furthermore, all these factors are greatly affected by the specific characteristics of the paper, such as the weight of the paper, whether the paper has a coating, what type of coating is present along with the acid and lignin content of the paper.

Conclusion

Consumers are understandably very devoted to preserving their valuable documents and photographs. According to the Photo Marketing Association International (PMAI), in 2002, Americans took approximately 55 million photos per day or more than 20 billion photos per year. Over 75 percent of Americans try to preserve their memorable photographs by putting them into scrapbooks and albums.

For millions of consumers, the introduction of complex contemporary photo and specialty papers for inkjet printers has complicated the issue of paper archivability.

HP's position on acid and lignin content is needed to help clarify the current confusion in the marketplace. Therefore, HP lists its own papers in a paper permanence table (see Figure 1 on page 5) and issues the following position on paper permanence:

- Lignin-free paper — HP supports the recommendations of the ISO/ANSI Z39.48 standard that paper marketed as lignin-free should contain no more than one percent lignin.
- Acid-free paper — Since there is no definitive scientific linkage between surface coating pH results and paper archivability, HP believes the traditional term “acid-free” needs to be redefined or replaced by another measure that better predicts archivability. As an interim solution, HP is providing the information contained in Figure 1.
- Commitment to testing — HP is committed to serving its customers by conducting ongoing aging simulations for several representative papers in its product line.
- Commitment to consumers — HP is committed to providing consumers with a clear message and tested results on the effects of acidity, lignin content, and all other archival factors regarding the preservation of current and future papers as well as educational documents such as this report.
- Commitment to development — HP is dedicated to exploring new paper technologies in order to produce the best photo and specialty papers for inkjet printers.

For more information

To understand how to interpret display-permanence predictions and the factors that affect how long a print will last, see “HP Inkjet Photo Prints: Memories for Generations” at:

http://www.hp.com/sbso/product/supplies/more_media_tech.html.

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