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تأثير الحموضة على الخواص الميكانيكية والفيزيائية للمخطوطات الورقية

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مستخلص البحث:

تناول البحث تأثير مواد الصناعة والاحماض على الخواص الطبيعية للورق. وفيه تم تناول التركيب الليفي والكيميائي للورق وتمت دراسة الخواص الميكانيكية للورق من حيث قوة الشد وقوة الطي وقوة التمزق وكذلك دراسة الخواص الفيزيائية من حيث الكثافة ودرجة التمزق والسماكة والوزن وكذلك الخواص البصرية من حيث درجة اللمعان والتعتيم وكذلك الخواص الكيميائية من حيث درجة اللزوجة ودرجة البلمرة. والمواد المضافة أثناء عملية التصنيع (كيماويات – مواد طبيعية) وتأثيرها على المخطوط، و طرق العلاج والمواد، و الشروط أثناء التكوي، تجفيف وتلميع، وتمت دراسة تأثير هذه المواد والمعالجات على عمر المخطوط وكيفية تجنب تأثير هذه المواد في المستقبل ، وكذلك كيفية التعامل مع الأضرار التي تسببها وطرق معالجتها.

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Abstract:

The research deals with the effect of industrial materials and acids on the natural properties of paper. In it, the fibrous and chemical composition of the paper was addressed and the mechanical properties of the paper were studied in terms of tensile strength, folding strength, force of tearing, as well as the study of physical properties in terms of density, degree of thickness and weight, as well as optical properties in terms of the degree of gloss and opacity, as well as the chemical properties in terms of the degree of viscosity and the degree of polymerization. Additives during the manufacturing process (chemicals - natural materials) and their effect on the manuscript, Treatment methods and materials, Conditions during formation, and Drying and polishing. The impact of these substances and treatments on the age of the manuscript and how to avoid the impact of these substances in the future, as well as how to deal with the damage caused by them and the ways in which they are treated, were studied.

Introduction

In ancient civilizations, man was interested in keeping his records using the number or clay slabs and papyrus scrolls, which was common and used in the civilizations of Mesopotamia, the Nile Valley and Chinese civilization.[1,2] The cultural, religious and social factors of these civilizations necessitated the emergence of the first libraries, which were similar to archival centers dealing with the preservation of knowledge records, government laws, religious decrees, etc.[3,4]

In light of the flourishing arab-Islamic civilization, The Arabs took care of their manuscripts in terms of calligraphy and the use of decorative and exquisite motifs,[5] as they were interested in binding and restoring them, and the librarians were very keen in preserving and maintaining the rare and precious

manuscripts that filled the vaults of Arab-Islamic libraries of all kinds,[6] especially the great famous libraries such as the House of Wisdom in the time of the Abbasid caliphate and Dar al-Alam in Cairo at the time of the Fatimid caliph,[7,8] the ruler of The Order of God, the Library of Cordoba in Andalusia and other libraries and the general academy that spread throughout the Islamic world.[9,10]

The methods and types of restoring and maintaining manuscripts and historical documents in the modern era have evolved over time since the mid-nineteenth century,[11,12] and interest in them has grown in the last years of the twentieth century, and special departments of restoration and maintenance have been established in libraries and institutes for the diseases of books and their treatment in many countries of the world to preserve their quality and elegance and restore life to them.[13,14]
The treatment of manuscript monuments and sources has many issues, including:[15,16]

1. The need to retain the features of his monuments and feet while ridding him of all the damage shaded and distortions that have been suffered.[17]
2. The materials used in the treatment and restoration of manuscripts and archaeological materials should not be harmed in the long term in order to ensure their safety and permanent viability for future generations.[18]
3. Creating the conditions for the preservation of this heritage during its display and storage in libraries, information centres and museums.[19]

Given the importance of the preservation and restoration of manuscripts in our Arab libraries and institutions interested in collecting and organizing this national cultural wealth.[20,21]
This study came to achieve the following objectives:

• Introducing manuscripts and how to make a paper manuscript.
• Study the mechanical and physical properties of paper.

• Highlighting the risks to manuscript life such as natural, chemical and biological hazards
• Shed light on the risks resulting from the impact of industry materials on paper properties.
• Shed light on how to avoid these risks and know the best methods of treatment and maintenance.

Research problem

The problem of research is the exposure of many manuscripts to many damage factors resulting from poor supply and storage and neglect of these manuscripts for long periods without attention or attention and also defects resulting from the manufacturing process by adding materials with a harmful effect on paper during the industrial process, which led in the long run to the weakness and decay of paper and other various aspects of damage that are difficult to remove and all these problems lead in the end to the courtyard of the archaeological manuscript paper had to be studied in order to preserve On the rest of this heritage, especially after the emergence of modern techniques in the field of treatment and maintenance.

The aim of the research

1) The research aims to study the archaeological manuscript in detail historically and artistically.
2) Study the different damage factors and the resulting damage and the extent of their impact on the archaeological manuscript
3) Shed light on the natural properties of paper manuscripts.
4) The research also aims to study the properties of materials used in the process of paper processing and the effect of these materials on the natural properties of paper manuscripts.
5) Make a pilot study to find out the effect of the materials involved in the manufacturing process on the paper manuscript and how to treat the effects of adding these materials and how to avoid their damage

6) The research also aims to come up with the best techniques for the restoration and maintenance of paper manuscripts in terms of the best and most suitable materials and methods used in this field.

The importance of research

The importance of research lies in:

1- Study the most important factors of damage, especially the damage caused by defects during the manufacturing process and the resulting damage and its impact on the age of the manuscript.

2- Evaluating the materials involved in the manufacture of paper manuscript and the extent of their impact on the natural properties of paper.

3- How to treat the effects of adding these materials in the manufacturing process.

4- Trying to reach the best and best ways in the treatment and maintenance of archaeological paper manuscripts.

Research methodology

The research is based on the descriptive analytical approach to study the historical development of the paper manuscript industry and the different methods of industry.

The research also takes the experimental approach to study the characteristics of the materials used in the manufacturing process and their impact on the natural properties of paper manuscripts through the work of samples and the conduct of the necessary examinations and analyses in order to reach the most appropriate methods used in the treatment and restoration of the archaeological manuscript.

Experimental study:

This study was carried out to determine the extent to which materials involved in the industry process affect the natural properties of paper.

In this respect, the following:

The researcher addressed the relationship of the natural properties of paper to the chemical composition of cellulose and additives where the researcher explained the chemical composition of cellulose and the difference between cellulose and hemi cellulose, and the specifications of cellulose fiber and then exposed the researcher to materials added to the paper that are closely related to its natural properties.

Then the researcher was exposed to measure the natural properties of paper and precautions to be observed and basic methods of processing paper for measurement and knowledge of the directions of the longitudinal and transverse paper, then the researcher reviewed the natural properties of paper beginning with the property of the basic weight and how to assign it and the measuring device, then the impact of the materials of industry subject to research on this property for all types of paper used was then examined and analyzed the samples subject of the study and write the final results reached.

Applied study:

The necessary tests and analyses were carried out on the manuscript in question, which is part of the Quran, so work was done (examination of the paper fibers - testing of the sensitivity of inks and colors - examination and analysis of the damage found in the manuscript)

A treatment plan has been developed for this manuscript, where the missing parts were completed as well as pasting the cuts and tears with the manuscript and the treatment of fungal stains and cleaning of dirt and other treatment and restoration processes, which the researcher presents in detail in the latest research.

The researcher concluded with the findings and recommendations that are useful in the preservation of manuscripts

Experimental study:

This study aims to influence the properties of paper during the industry process, to evaluate results through optical and microscopy examinations, and to measure mechanical and optical properties.

By scanning using the SEM scanner, mechanical and optical measurements, and evaluating the results obtained.

***First: Paper industry in practical*:**

The experimental aspect of the letter began to make modern papers from the same materials from which the archaeological paper manuscripts were made, namely cotton linen and wood, which are considered raw materials used in the manufacture of handicraft paper in the old, as the basic material of the manuscript, which represents the majority of the types of paper, which was used in the manufacture of archaeological paper manuscripts before the creation of the paper industry automatically.

1. Preparation of laboratory made paper sheets:

First: Pulp processing:

Three types of pulp are equipped:

1- Bleached wood flame.

2- Linen flame.

3- Wood heart + linen.

Image 1) shows the pulp milling agent. - Photographed by Rakta Paper Industry Company.

Image 2) shows the pulp coming out of the manufacturing machine. - Photographed by Rakta Paper Industry Company.

Image 3) of the shape of the pulp before it is manufactured in the form of a spawn. - Photographed by Rakta Paper Industry Company.

Second: Pulp whitening operations:

A pilot study was conducted on the effect of pulp operations on paper properties and this was done within rakta paper making company and was as follows.

Paper samples of wood pulp are processed with mechanical and physical measurement before and after the bleaching processes, and the results were in accordance with the following table:

Rupture resistance	Tensile strength	Explosion	Basic weight g/m^2	Property
6.8	5	18	7.58	Before bleaching
25.6	4.2	12.4	5.98	After bleaching

Table 1) shows the measurement of mechanical properties before and after bleaching.

Analysis of the results:

Through the results of the measurement of mechanical properties this actually affects the strength of the paper, which gives an indication that bleaching processes weaken the properties of mechanical paper.

Third: The process of grinding the pulp:

It is one of the most important mechanical treatments performed in the Beater pulp grinding device, and a laboratory has been studied on the effect of milling degree on paper properties.

• Study the effect of grinding degree on paper properties:

We have processed pulp samples, where the milling process was carried out in the milling machine, where the pulp samples were taken, and the paper spawn was manufactured from these samples, and the mechanical properties of this paper were measured with knowledge of the time of the milling grade, and after measuring the mechanical properties such as tensile, explosion and rupture, it was noted that the paper at the grade of zero gave weak mechanical properties, and when the degree of milling was increased, an improvement was observed in the properties of the paper.

The tensile property is constantly increasing when the grinding degree increases more than the blast property, and the blast

property is also significantly increased by increasing the degree of grinding.

Tensile strength	20	39,7	48,6	58,32	65,76	89,76
force of explosion	23,7	62,7	69,46	72,78	86,73	90,89
Rupture resistance	23,6	22,5	19,2	15,3	12,5	10,4

Table 2) shows the measurement of mechanical properties during the grinding process (Bleached wood pulp).

Tensile strength	-	20,5	41,5	53,6	66,3	70
force of explosion	-	24,62	44,59	59,73	79,55	85,66
Rupture resistance	-	20,5	17,8	16,4	12,4	10,5

Table 3) shows the measurement of mechanical properties during the grinding process (flax flame).

Tensile strength	-	26	52	66.4	68.8	74.5
force of explosion	-	29.8	60.67	79.89	85.99	90.89
Rupture resistance	-	22.7	19.99	143.6	122.6	110

Table 4) shows the measurement of mechanical properties during the grinding process (linen ink + wood pulp).

Tensile strength	11.5	33.4	54.6	66.5	69.9	72.45
force of explosion	13.59	42.57	53.74	79.81	94.4	99,71
Rupture resistance	12	45	55	48	42	40

Table 5) shows the measurement of mechanical properties during the grinding process (Long fiber bleached wood pulp)

Discuss the results:

Through physical and mechanical measurements of paper samples we found that the higher the degree of grinding, the greater the degree of grinding, the greater the tensile and blasting, but we observe a decrease and decrease in the rupture property.

Study the impact of some additions on the properties of paper:

First, the addition of starch: starch was used at a concentration of 4%, where samples of pulp were processed without any additives, then spawned from the pulp free of additives, and then measured the natural properties. Then add the starch to the dough by 4%, make a spawn of paper and then measure the natural properties again.

Test	Before adding starch	After adding starch
Tensile strength	7	5.4
force of explosion	320	400
Rupture resistance	500	600
Porosity	20	9

Table 6) shows the measurement of natural properties before and after the addition of starch.

Discuss the results:

The results indicated an increase in the properties of tensile, blasting and rupture, but on the other hand there is a lack of porosity of the paper, this indicates that the starch material has been connected to the fibers and thus reduced the porosity between the fibers.

Second, Add the qalavonian: The qalavonian was used at a concentration of 3%, where the samples of the pulp were processed without any additives, then the spawn was made from the pulp free of additives, and then the natural properties were measured. Then add the qalavonian to the dough of 3%, make a spawn of paper and then measure the natural properties again.

Test	Before adding the qalavonia	After adding the qalavonia
Tensile strength	5	4,3
force of explosion	300	250
Rupture resistance	490	400
Porosity	23	40

Table 7) shows the properties before and after the addition of the qalavonian.

Discuss the results:

Laboratory experiments have been shown to have played no role in improving the mechanical properties of paper, but these materials improve the anti-drinking properties of different solutions.

Summary of results:

After measuring the mechanical and optical properties of the leaves before and after the accelerated industrial obsolescence, many of the results could be inferred:

1- A decrease in mechanical properties by comparing samples before and after the obsolescence.

2- Increase the degree of opacity of obsolete paper and decrease in the degree of whiteness.

3- Starch is one of the substances that help to increase the degree of opacity of the leaves.

4- Starch did not help by significantly improving the mechanical properties of paper, but led to an increase in the degree of opacity of the paper.

Image4) A device to measure the degree of whiteness.

Image5) shows the measure of the tensile strength of the paper.

Image6) Device to measure the force of the explosion.

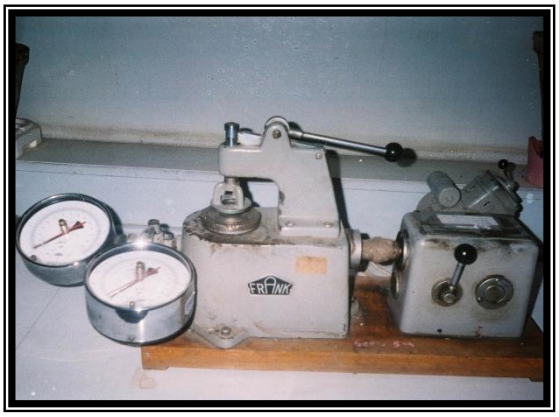

Image7) Device to measure rupture resistance.

Image8) Device to measure the Degree of opacity

Imaging of some samples under the electron microscope scanner:

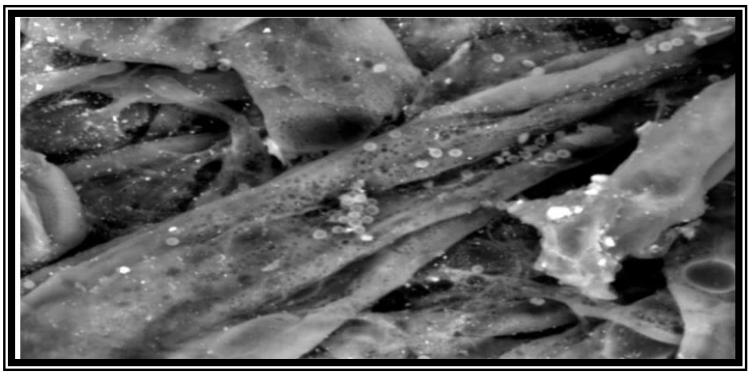

Image9) Wood pulp fibers under the electron microscope scanned before the obsolescence strongly 600x.

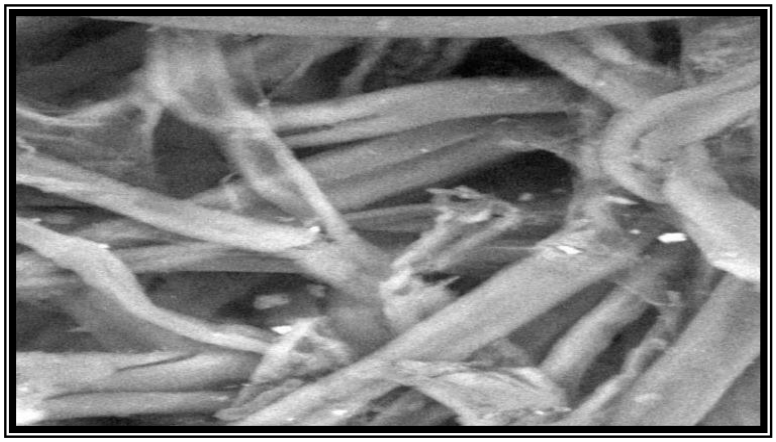

Image10) Wood pulp fibers after obsolescence under the electron microscope scanner.

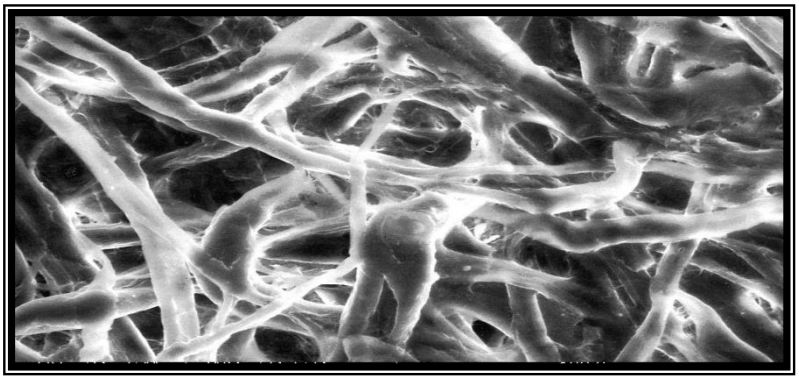

Image11) Linen fibers under the electron microscope scanned before obsolescence.

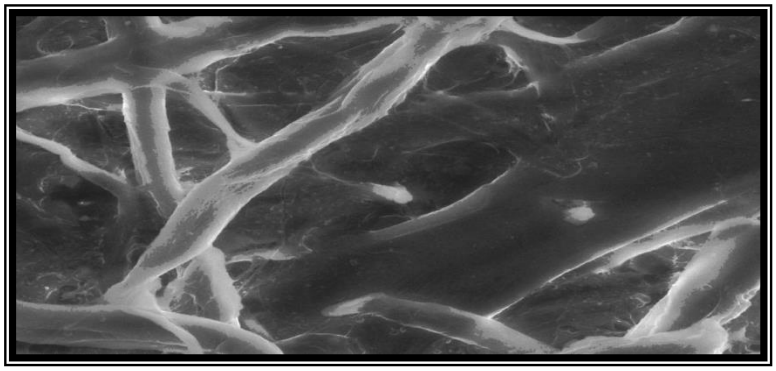

Image12) Linen fibers under the electron microscope scanner after obsolescence.

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