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PARCHMENT, THE FAMOUS WRITTING SUPPORT: FROM ANCIENT TIMES TO PRESENT

MIU Lucreția[1*], BADEA Elena [1,2], PĂUNESCU Simona-Maria[1], ȘENDREA Claudiu[1], MICU (LUPAȘ) Maria-Cristina[1], CANIOLA Iulia-Maria[1], MOLDOVAN Angelica[3]

[1] National Research & Development Institute for Textiles and Leather - ICPI Division,
93 Ion Minulescu, 031215, sector 3, Bucharest, Romania, E-mail: icpi@icpi.ro

[2] Department of Chemistry, Faculty of Sciences, University of Craiova,
107 I Calea București, 200478, Craiova, Romania, e-mail: elena.badea@unito.it

[3] OSCAR PRINT SRL, 71 Regina Elisabeta Blvd, floor 3, sector 5, Bucharest, Romania,
E-mail: angi.moldovan@gmail.com

*Corresponding author: Miu Lucreția, e-mail: lucretia.miu@icpi.ro

***Abstract**: The parchment is an unparalleled writing medium, to which humanity is dependent on most of the written testimonies of our history and culture. Parchment is much more resistant to breakage and water action compared to papyrus, which was the quintessentially used writing material for the entire Greek and Latin world and the Near and Middle East since the third century AD. Parchment reached its peak during the Middle Ages, but then set slowly due to the advent of printing and the introduction in Europe of papermaking technology, a much more economical and suitable material for printing, but also much less durable. However, the use of parchment has not completely disappeared, it continues to be used for restoration, for diplomas and government documents (laws are still transcribed on parchment in the UK). The centers where parchment is still manufactured in Europe are only a few, and within the Bucharest Leather and Footwear Research Institute Division is the only place in Eastern Europe where this craft has been revived. In addition to the use of this material in the restoration activity, parchment is a necessity to make products with innovative design, strategic development of production to meet consumer preferences at affordable prices.*

***Key words:** parchment, physico-chemical analyzes*

1. INTRODUCTION

Europe and the whole world are on the verge of a collapse of resources, a collapse that can only be overcome through a new, more pragmatic approach, more adapted to this increasingly globalized world. In response to this challenge, in 2012 the European Commission adopted a strategy for the transition of the European economy to a more sustainable use of renewable resources: "Innovation for sustainable growth: a bioeconomy for Europe".

Traditional sectors such as the processing of animal skins allow the ecological conversion of production processes and the reinterpretation of innovative bio-materials on innovative principles to ensure an added value of secondary biological resources, by-products from slaughterhouses and small animal farms, which, in Romania, are currently not used, requiring only costs for disposal.

In this context, several researchers from the Leather Research Department of INCDTP - ICPI Division are studying the exceptional properties of ancient materials such as leather and parchment and how they have been conservated over the centuries to decipher the secrets of old technologies that can inspires the creation of innovative, durable, recyclable materials.

These types of paleo-inspired research are very current because many of the ancient materials that have survived for millennia such as parchment were obtained relatively simply, process chemistry

being elementary, with limited energy resources and rudimentary manufacturing equipment.

The development of ecological and innovative collagen materials of parchment type with new properties and functions will allow the creation of hand-made products / objects, personalized, ecological, with artistic content, design, for niche sectors such as the market of personalized and promotional eco-labbeled, exclusive and luxurious objects.

2. GENERAL INFORMATION

Compared to untanned leather, the processing of raw hide for parchment brings radical physical and chemical changes in the structure of fibers and collagen molecules. [1],[2],[3],[4],[5],[6],[7],[8].

During soaking in lime milk, the epidermis, hair and fat layer come off and can be mechanically cleaned. The other effect of this operation is that the organic substances dissolve and are eliminated almost completely during rinsing in water. In the case of calf and goat skins during fleshing, the fats in the sebaceous glands are pressed between the fibers, and in the case of fatter, furrier sheepskins, a layer of lime milk is applied to them, which removes the fat during drying.

When rinsing with water, lime cannot be completely removed from the fibers, being retained in the tissue in the form of calcium carbonate, contributing to the flexibility and opacity of the parchment. For raw hide to turn into a thin, smooth sheet, it has to go through drastic transformations. In the reticular layer the natural orientation of the fibers changes, in horizontal parallel layers, by their stretching.

The treatment with lime (pH 12.5) changes the molecular structure, the collagen is partially destabilized, a fact signaled by the decrease of the value of the contraction temperature by (5 -10) ° C, depending on the duration of the treatment. Collagen in an alkaline environment swells more than in a neutral environment, and the process of swelling of the fibers subsequently destabilizes the already chemically weakened structure. In this state the skin is stretched on a frame and tensioned.

The destabilization of the fiber structure allows the tension to shape the tissue in horizontal parallel layers. Drying is the most critical stage of the entire process, and determines the final quality of the parchment.

The purpose of drying is to provide a free space between the fibers, which provides flexibility and opacity, but a degree of cohesion between the fibers is also needed to obtain a thin and smooth sheet. During slow drying, by evaporating the water, the cross section of the fibers is reduced, allowing the formation of thin sheets. Old, traditional parchment-making recipes emphasize that drying must be slow. The faster the drying, the greater the contraction and the skin becomes translucent, even if it is completely stretched.

Thus, the opacity, color and density of the finished parchment depend on the amount of residual calcium carbonate and the alignment of the fibers.

A good quality writing parchment (thin, white, flexible, opaque) contains: 86% collagen, 13% water, 1-2% residual calcium carbonate. By varying the concentration of lime milk and the drying process, parchment with different properties can be obtained, suitable for bookbinding or as a raw material for other valuable works.

2.1. The results of the physico-chemical analyzes

The results of the physico-chemical analyzes confirm the behavior of the parchment materials obtained through the technologies elaborated and tested in the ***National Research & Development Institute for Textiles and Leather - ICPI Division*** projects.

3. FIGURES AND TABLES

3.1. Figures

Examples of parchment for design and promotional items:

Fig. *Coloured and nativ parchment -*

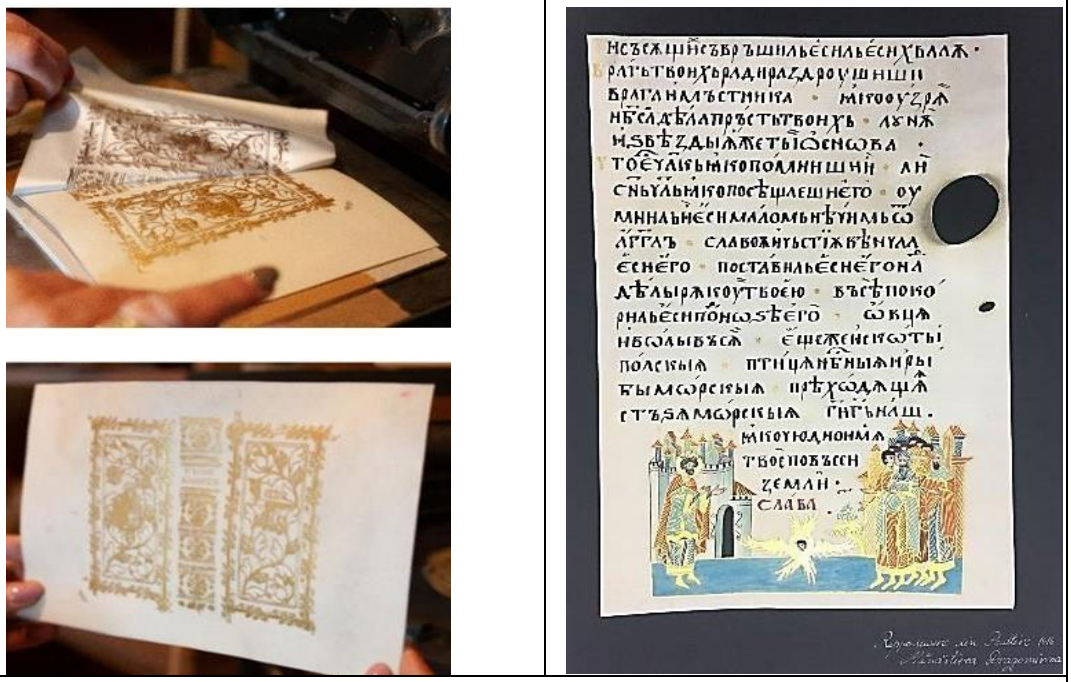

Fig. 2 *Reproduction on parchment in accordance with the original: Realization of a folio type decoration for a parchment cover, from the Greek manuscript 1294 kept at the Library of the Romanian Academy and a miniature from the Psalter from Dragomirna, 1616*

Fig. 3 *Diplomas on modern parchments*

Fig.4 *Reproductions of historical documents on parchment, MNIR*

Fig. 5 *Coloured parchments used for lampshades / floor lamps*

3.2. Tables

Table 1: *Physico-chemical analyzes - Lamb parchment (Option I)*

Characteristics	UM	Sample code / Values			Measure error	The standard method
		Sample 1	Sample 2	Sample 3		
Volatile matter	%	14.7	14.4	13.7	± 0.4	SR EN ISO 4684-2006
Extractable substances	%	3.7	5.8	8.8	± 0.9	SR EN ISO 4048-2008
Ash	%	5.6	4.2	4.8	± 0.3	SR EN ISO 4047-2002
Total nitrogen	%	14.4	14.5	14.2	± 0.6	SR ISO 5397-1996
Dermal substance	%	84.1	84.7	84.4	± 2.3	SR ISO 5397-1996
Shrinkage temperature	^{o}C	58	57	57	± 2.0	SR EN ISO 3380: 2003
Contact angle (Hydrophilia)		55	56	59		
Dimensional stability after 5 cycles (504 h) of aging at 70 ^{0}C	%	5	5	5		SR EN 12800:2000
Water vapor absorption at 8 h	%	6.4	6.7	6.2		

Table 2*: Physico-chemical analyzes - Goat parchment (Option I)*

Characteristics	UM	Sample code / Values			Measure error	The standard method
		Sample 1	Sample 2	Sample 3		
Volatile matter	%	18.0	17.1	12.6	± 0.4	SR EN ISO 4684-2006
Extractable substances	%	4.4	6.8	6.2	± 0.9	SRENISO 4048-2008
Ash	%	2.8	2.4	2.6	± 0.3	SR EN ISO 4047-2002
Total nitrogen	%	15.2	15.9	15.2	± 0.6	SR ISO 5397-1996
Dermal substance	%	85.6	89.2	85.3	± 2.3	SR ISO 5397-1996
Shrinkage temperature	^{o}C	60	60	59	± 2.0	SR EN ISO 3380: 2003
Contact angle (Hydrophilia)		48	53	52		
Dimensional stability after 5 cycles (504 h) of aging at 70 ^{0}C	%	5	5	5		SR EN 12800:2000
Water vapor absorption at 8 h	%	8.4	8.7	8.2		

***Table 3**: Physico-chemical analyzes - Calf parchment (option II)*

Characteristics	UM	Sample code / Values			Measure error	The standard method
		Sample 1	Sample 2	Sample 3		
Volatile matter	%	17.2	18.2	14.5	± 0.4	SR EN ISO 4684-2006
Extractable substances	%	1.5	2.0	1.6	± 0.9	SR EN ISO 4048-2008
Ash	%	3.9	2.1	28	± 0.3	SR EN ISO 4047-2002
Total nitrogen	%	16.8	16.8	15.0	± 0.6	SR ISO 5397-1996
Dermal substance	%	94.6	94.5	83.7	± 2.3	SR ISO 5397-1996
Shrinkage temperature	^{o}C	53	51	66	± 2.0	SR EN ISO 3380:2003
Contact angle (Hydrophilia)		78	84	82		
Dimensional stability after 5 cycles (504 h) of aging at 70 ^{0}C	%	5	5	5		SR EN 12800:2000
Water vapor absorption at 8 h	%	5.4	5.7	5.2		

***Table 4:** Physico-chemical analyzes - Goat parchment (option III)*

Characteristics	UM	Sample code / Values			Measure error	The standard method
		Sample 1	Sample 2	Sample 3		
Volatile matter	%	20.1	19.8		± 0.4	SR EN ISO 4684-2006
Extractable substances	%	2.2	2.6		± 0.9	SR EN ISO 4048-2008
Ash	%	4.3	3.2		± 0.3	SR EN ISO 4047-2002
Total nitrogen	%	16.2	16.3		± 0.6	SR ISO 5397-1996
Dermal substance	%	93.4	93.5		± 2.3	SR ISO 5397-1996
Shrinkage temperature	o C	65	69		± 2.0	SR EN ISO 3380: 2003
Contact angle (Hydrophilia)		63	65	68		
Dimensional stability after 5 cycles (504 h) of aging at 70 ^{0}C	%	5	5	5		SR EN 12800:2000
Water vapor absorption at 8 h	%	7.1	6.9	7.2		

4. CONCLUSIONS

Experimental batches of parchment materials made of lambskin, goat, calf and goat were made for different applications. The results of the test reports confirmed the obtaining of the desired characteristics for the various applications.

The use of parchment materials for different applications was tested.

The applied technologies allow the revitalization of some traditional trades such as raising sheep and goats, the craft of processing sheep and goat skins and handicrafts made of natural materials.

- ✓ Increasing the quality and attractiveness of products through the innovative nature of materials that offer new functions and guarantee a sustainable performance;
- ✓ Possibility to quickly introduce new products on the market without a high consumption of resources in the launch using the existing communication, promotion and distribution channels;
- ✓ Orientation towards meeting the requirements of the new generations of conscious and responsible consumers, a community in continuous growth, with great purchasing power;

- ✓ Community orientation by promoting the sustainable use of local biological resources and reducing the anthropogenic impact on the environment by making products with a long life cycle, recyclable and biodegradable;
- ✓ Cultivating the values of the multidisciplinary partnership in the design of new products.

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