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## Introduction

This work includes the optimization of the process of consolidation in paper, using a blanket of cellulose membrane, composed of pure cellulose microfibrils, forming a material of excellent printing quality.

The laboratory NUCLEM / Senai in partnership with Bionext developed a revolutionary technology in the conservation of movable cultural property, optimizing the process of consolidation in paper, using a blanket of cellulose membrane.

## Presentation

The restricted access to physical and financial papers for the consolidation of support prompted us to start a search for new options and technologies. The laboratory restoration NUCLEM / Senai, in partnership with Bionext through design innovation developed a revolutionary technology for the preservation of graphical documentation, the project consists in optimizing the process of consolidation of papers, using a membrane based on cellulose - the Biofilm.

The project aimed to find materials that correspond with the desired characteristics in the area of preservation of papers, such as physical and chemical qualities stable archival quality, reversibility and aesthetics.

The biofilm is produced in appropriate culture medium without the need for control of relative humidity and air change in the environment during cultivation. Uses a small amount of water in their preparation, the amount of generation of waste water used is less and is completely handled before returning to nature.

The production technology of cellulose by bacteria is known and documented since the nineteenth century, at least, the first publication date of 1886 in the Journal of the Chemical Society.

The covers cellulose from *Acetobacter xylinum*, are composed of pure cellulose microfibrils randomly arranged without chromophores and oxidizing agents. After the manufacturing process are chemically cleaned and dried, yielding membranes of cellulose microfibrils

The material presented is inert, does not possess lignin, stands out for its high mechanical strength, flexibility, plasticity, high temperature resistant, large crystallinity and gas permeability.

## Materials and Methods

For decades, bacterial cellulose was produced in the East, is an extremely versatile material and can use it as food for the production of sweets and drinks, as well as in medical activities, currently being used in the recovery of skin damage.

The Biofilm *Acetobacter xylinum* cellulose microfibrils structures are pure, continuous fiber, randomly arranged at a high level physical and chemical resistance..

The methodology for the analysis of the substrates was done under controlled conditions specific, according to ISO standards in order to verify the effectiveness of their use in accordance with the needs required for the treatment of cultural heritage.

In collaboration with the Laboratory Analyses Role of school Senai Theobald de Nigris and Technology Research Institute, analyzed more than 300 samples. Were observed structural features, dimensions, strength and appearance, before and after accelerated aging.

The tests consisted of the systematic application of adhesives Neutral pH Mashed Wheat Starch © and Neutral pH Mashed Methyl Cellulose © in standard samples Offset paper with film Biofilm and Offset paper with Japanese paper, impregnated with adhesives above.

Tests were also made on samples of papers from chemical pulp, mechanical pulp and rag paper.

The application method used was the same used for traditional applications consolidation support. Using the adhesive preparation of the cited 3% to 5% concentration prepared with water deionizada pH 7.0, and applied with the aid of a soft brush with natural bristles  
 Per not have a fiber direction, the method of application of the material in the work, it becomes more agile and easy to apply.

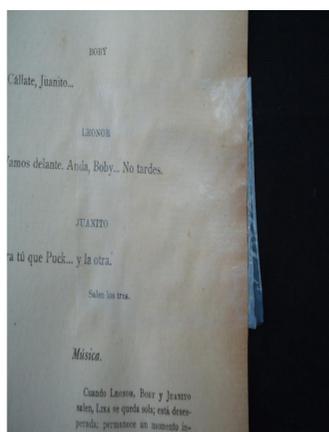
All tests listed by resistance and appearance were made in the bodies of the test piece before and after exposure to damp heat in a chamber properly calibrated to 80% relative humidity and 65 ° C for 24 hours.

We analyzed the changes in relation to the mechanical performance of three types of samples (Biofilm, Japanese paper and Offset paper), as well as changes over appearance.

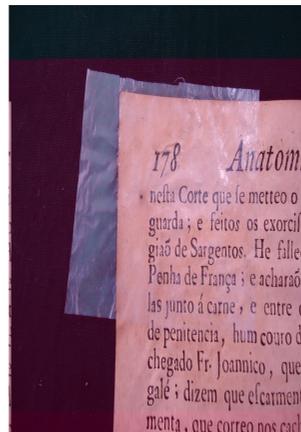
The table below shows the results:

Parameter	Sample	Average value (original)	Average value (post-test)
Tensile strength - dry	Japanese paper	0,32	0,37
	Biofilm	1,83	0,31
	Offset	5,99	2,24
Tensile strength - wet	Japanese paper	0,03	0,01
	Biofilm	1,28	0,80
	Offset	0,15	0,00
Tensile index	Japanese paper	28,68	11,33
	Offset	258,01	170,04

Results Parameter Drift: (Characterization on the performance of resistance)



Detail Biofilm applied



Detail Biofilm applied

This study aims, therefore, to prove the chemical and physical stability of the biofilm, opposite specification already known Japanese paper traditionally used in consolidation support.

## Final Considerations

This study is aimed, therefore, to check the physical and chemical stability of the biofilm and matched with the specifications of Japanese traditional paper.

The membrane Biofilm is neutral, possess stable physical and chemical properties, and a high degree of readability when applied to the text has great physical strength, especially when wet and a high degree of flexibility.

The product developed has become able to supply the needs of the stage of reconstitution of the support for conservators, aimed at extending the life of movable cultural property on paper.

Technological innovation developed in this project will ace libraries and institutions that contain textual documentation, in which an increasing number of collections, joining another treatment option, which uses a national technology, which proved to be extremely effective at a cost accessible.

The Biofilm shows that it is possible to develop and use sustainable materials while using a correct and safe method for the treatment of works on paper.

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