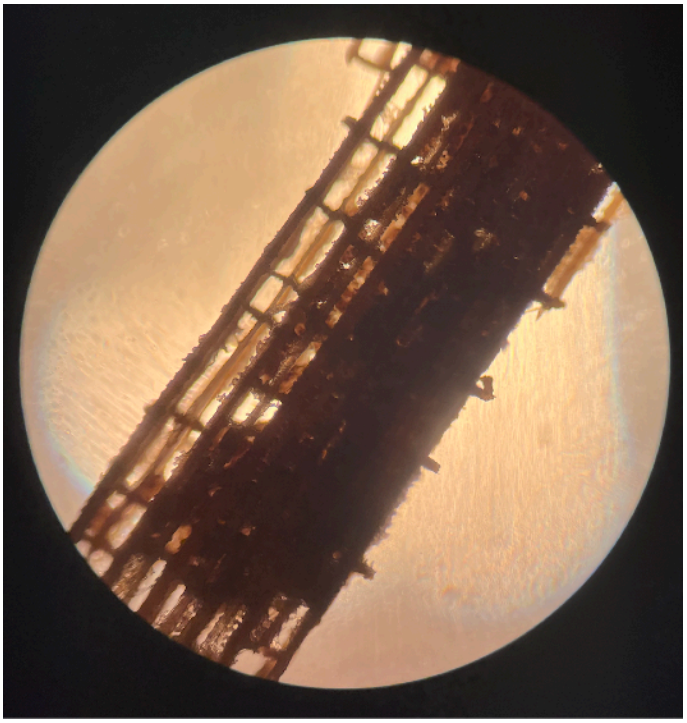
REPORT: SANITIZATION TREATMENT ON SAMPLES OF PALM LEAF PAPER

INTRODUCTION:

In these days of computers, online full-text databases, and almost instant everything, it is easy to forget that the spread of information was not always so immediate. Palm leaf manuscripts are an example of the efforts that sometimes went into the preservation and spread of knowledge. Palm leaves were among the first writing materials to be used, and some sources say that Sanskrit was first written on this material more than 6,000 years ago.

Many of these documents are Buddhist religious texts, though other subjects are also found. Palm leaf manuscripts originate predominantly from the southern and south-eastern areas of Asia, including India, Thailand, Indonesia, Cambodia and Laos. The cultural variety in these areas is reflected in the various techniques of preparing the palm leaves and writing on them. Generally, however, the first step is to divide each palm leaf into two pieces by cutting out the rib that runs down the center.



The leaves are pressed flat, trimmed, and sanded smooth. The leaves are held in one hand and:: inscribed with lettering from left to right by using a needle-like instrument that actually cuts into the surface of the leaf. The result is nearly invisible, but the writing is made clearer by covering the leaf with soot or other pigment, sometimes mixed with oil. When the leaf is cleaned of the excess pigment, the dark residue remains behind in the scratches carved into the surface. The leaves may be decorated with gilding or illustrations. They are made into "books" by stringing them together through holes in the leaves. Sometimes, the leaves are connected at only one point so that the book can be fanned out for reading. Otherwise, they are connected through two holes. Often, the "book" is covered with panels of wood, ivory, or other hard material. This material may be left unadorned or elaborately decorated with carving, inlays, painting, or precious stones.

* Text e*xtracted from:* https://www.lib.usm.edu/spcol/exhibitions/item_of_the_month/iotm_nov_08.html

- *Microscopic Photo from Preservation Technologies LP*

SCOPE OF THE WORK

- Several dusty and moldy pieces of Indonesian palm leaf paper were cleaned, disinfected and tested about the efficacy of the treatment for their future preservation.

- The sanitization treatment was performed in Italy by the preservation company Frati & Livi Srl.

- For the treatment it was used the machine DOCURSAN1. One cycle under temperature control and a non diluted biocide solution based on quaternary ammonium was used (Mikrozid Sensitive Liquid).

- The testing before and after the cleaning and disinfection treatment was performed as follow:

Date of the biological testing before the sanitization treatment:	01/25/2023
Date of the sanitization treatment:	01/25/2023
Date of the biological testing after the sanitization treatment:	03/15/2023

- The samples were tested before and after the treatment under environmental temperature.
- The sanitized samples were under storage in a preservation box and controlled environmental conditions for 21 days before the testing post treatment.
- The testing before and after the treatment was performed by the Italian company **BioRes,** Biodeteriorarion of Cultural Heritage: Research & Service. Via Osoppo 38, 40139, Bologna, Italy

PHOTOGRAPHIC GALLERY FROM THE POINT OF SAMPLING:

SAMPLE 03

MATERIALS AND METHODS:

MODALITY OF THE REMEDIATION TREATMENT

TEST 1: Dedusting + thermal treatment with non diluted biocide (Mikrozid Sensitive Liquid)

MODALITY OF THE SAMPLING (pre and post treatment)

To detect the following parameters, the sampling was performed using non-invasive techniques:

1. For the detection of fungal load levels sterile cotton swab on 2x2 cm surface.

Analytical method

Evaluation of the fungi load level (Method 1)

The samples taken with sterile swab are broken and homogenized in a physiological solution (Ringer solution with glycerol 20%) Each sample is diluted in 2 ml of the same solution. For each dilution, double replicates 100 µl aliquots are seeded on mold specific agar media, i.e. DRBC (*Dichloran Rose bengale Clorophorm*) for total molds and DG18 (*Dichloran glycerol 18%*) for xerophytic molds. The colony-forming fungal units are determined after an incubation period in a thermostat at 22° for about 6 days.

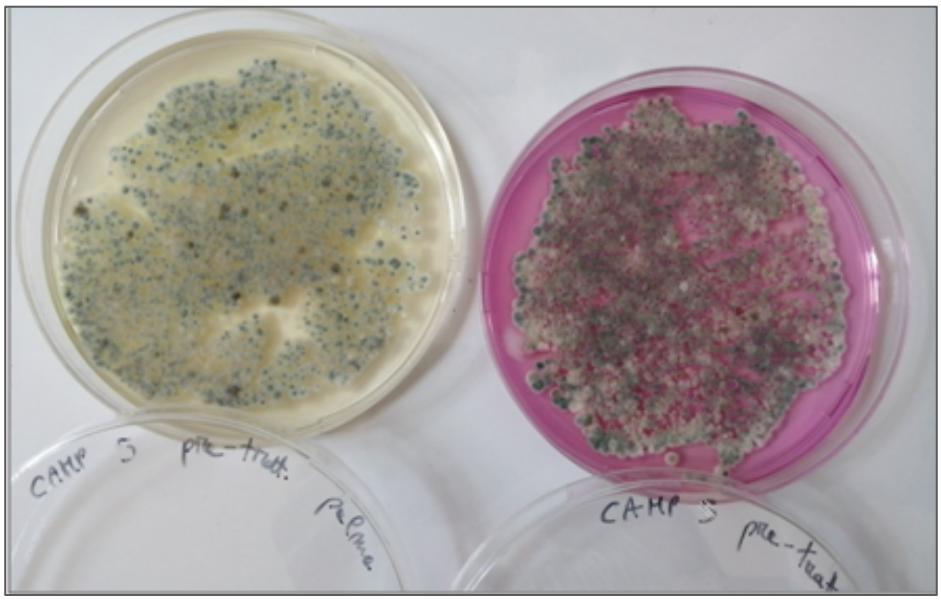
RESULTS

SURFACE MICROBIOLOGICAL ANALYSIS

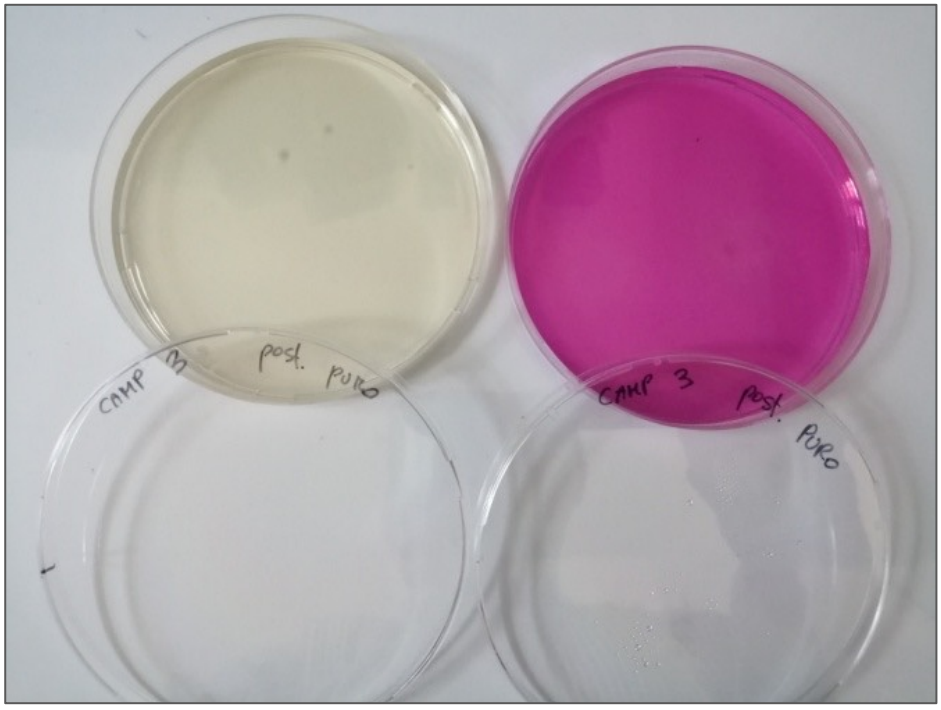
- *CFU Analysis (Colony Forming Unit)*- Method 1

The test performed before the treatment shows a very high level of viable germinating colonies on both growth nutrient media.

From Test 1 the colonies on the DG18 selective medium for xerophilic molds are still hight



SAMPLE 03: pre-treatment



SAMPLE 03: post-treatment

CFU Analysis (Colony Forming Unit)- Method 1

SAMPLE	CFU	
	PRE-TREATMENT	POST-TREATMENT TEST 1
03	NC	0

NC: Uncountable

CONCLUSIONS:

The images and the reported table show that the sanitization treatment made with non diluted biocide (Test 1) had a good efficiency in the elimination of existing microorganism on the selected artifact. The obtained efficiency is confirmed by the cultures: The dates obtained from the cultures show that the test 1 obtained a determinant effect on the reduction of the microbial load. In fact, the growing of fungal colonies on the selected nutritive medio is null.

After the obtained results, it is possible to assert that the artifacts exposed to the sanitization treatment with non diluted biocide are regenerated and free of threats. However, it is recommended to preserve the artifacts in an appropriate location. Specifically, it is recommended a relative humidity non above 65% and a routinely maintenance to keep under control the levels of superficial dust.