

Tanning of Animal Hides Using Silicone Oils

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Numerous methods have been used for the conservation and stabilization of archaeological leather samples which have been recovered from marine excavations at Port Royal, Jamaica. Under the direction of Dr. D. L. Hamilton, the most widely accepted conservation strategies at the Conservation Research Laboratory (CRL) for the conservation of leather artifacts from Port Royal have included the use of polyethylene glycol (PEG), freeze-drying and the British Museum Leather dressing treatment (BML). Alternative methods such as the use of heated Vaseline and controlled air-drying have not been used at the CRL.

Noting the high degree of success achieved in consolidating and stabilizing badly waterlogged archaeological leather samples from the Port Royal Project, a series of small experiments was devised to test the feasibility of "tanning" fresh cow hide with silicone oils. A large sample of hide was taken from a freshly slaughtered animal; after de-fleshing, the hide was portioned into smaller sections. Because each treatment was to be assessed on its singular merits, maintaining equal dimensions between samples was not critically important.

Before treatment, three samples were placed into a running freshwater bath for a period of three hours and then they were allowed to stand in a bath of fresh tap water for twelve hours. Samples A and B were dehydrated for 8 hours in an acetone bath, which was mounted in a freezer at a constant temperature of -20.5° C. Throughout the dehydration process, a vacuum of 28 Torr was applied to the samples. Sample C was dehydrated in an acetone bath in the same fashion as samples A and B; however, because the purpose of sample C was to observe the effects of ethyltrimethoxysilane on driving off free water in the sample, the dehydration process was designed to be shorter, lasting for only three hours.

After dehydration, sample A was bulked in a 80/20% solution of PS343/PS340 silicone oils. Throughout the bulking process, the sample was immersed in the silicone solution and placed into a freezer-mounted vacuum chamber. A vacuum of 28 Torr was applied to

the chamber throughout the bulking process. Bulking was determined to be complete after eight hours of applied vacuum. The evolution of bubbles from the leather sample indicated that the escaping water had been replaced with silicone oils. The sample was then moved to a warming oven, preheated to 52° C , to complete the polymerization process. A containment chamber was created inside the oven by inverting a polyethylene container so that its lid formed a base. A shallow dish containing 50 ml of CT-32 catalyst was placed in the center of the lid. As a means of determining potential shrinkage during the polymerization process, hide sample A was laid flat on a small section of wood and fastened into a flat position using push pins. This method of mounting assured that the hide sample remained flat throughout the treatment process; if any shrinkage occurred during polymerization, distortion and pulling at each of the pin points would indicate stresses on the hide. The blocked and mounted hide sample was then placed on the mesh screen, directly over the catalyst dish in the containment chamber. With the main body of the container inverted and positioned on top of the lid, a relatively air-tight containment chamber was created that housed the leather sample in the concentrated fumes of the catalyst which were formed as the CT-32 solution was warmed to 52° C. Sample A was exposed to the catalyst for a total of 48 hours.

Hide sample B was bulked with a 50/50% solution of PS343/341 silicone oils. As with sample A, sample B was immersed in the silicone solution and placed into a freezer-mounted vacuum chamber. A vacuum of 28 Torr was applied to the chamber throughout the bulking process. While the bulking process for sample A was completed with the cessation of bubbling from the hide sample after approximately eight hours of applied vacuum, bulking of sample B was continued for an additional four hours. In total, sample B was bulked under vacuum for twelve

hours and then the sample was allowed to sit in the silicone solution for an additional twelve hours. After removal from the solution, sample B was mounted with push pins to a wooden block and placed on the mesh screen above the catalyst dish in the containment chamber. In addition to the use of CT-32 catalyst in the catalyst dish (passive application), catalyst fumes were introduced into the containment chamber using an aquarium pump and heat lamp to create vaporized catalyst fumes in a beaker located on a stand next to the warming oven (active application). This additional source of directed catalyst fumes was applied to sample B in an attempt to determine if heavily concentrated catalyst fumes accelerated the polymerization process. Hide sample B was left in the containment chamber for twenty-four hours.

As a means of determining the ability of ethyltrimethoxysilane to drive off free-water in a hide sample, sample C was initially bulked with the chemical for a four-hour period in the freezer-mounted vacuum chamber. Once completed, the sample was placed directly into a 50/50% solution of PS341/PS343 silicone oils and then bulked for six hours in the same freezer mounted vacuum chamber. A vacuum of 28 Torr was applied.

After bulking, sample C was mounted onto the wooden block and placed in the containment chamber. Like sample A, it was exposed to 50 ml of CT-32 catalyst fumes for a period of 48 hours. After treatment, all three samples were taken from the

containment chamber and individually sealed in polyethylene bags for storage and observation for 48 hours.

Observations

The hide used for this experiment was fresh hide from the nose and facial areas of a butchered steer. Noting the somewhat irregular shape of the hide and its wide variance in thickness before de-fleshing and cleaning, it was determined that acquiring samples identical in size and weight would be impossible. Rather, each sample would be evaluated on the basis of appearance and structural changes before and after each of the individually-prescribed conservation processes.

While both samples A and B appear to have both been well-conserved, differences in post-treatment hair loss suggest that the treatment method used for sample B was more effective in consolidating and preserving the characteristics of the hide. Sample A, which was polymerized using only passive processes, appears to have shed a small amount of hair. Aesthetically, the sample looks natural and both the fur and flesh surfaces of the hide do not feel greasy. The only marked difference between samples A and B was that sample B had a greater accumulation of flecks of polymerized silicone on its surface after treatment. Once both samples were lightly shaken and brushed, both looked equally natural and have retained their supple and flexible feel. Inspection of the pin holes in both samples suggests that no shrinkage occurred in either sample. The flesh surfaces of both samples remained white in coloration and soft in texture.

The post treatment texture of sample C, which had incorporated the use of ethyltrimethoxysilane to drive off free-water in the hide, was radically different than samples A and B. Apart from losing its flexibility and suppleness, the fur surface of this sample appeared natural. Inspection of the flesh surface of this sample, however, revealed that this surface is hard in texture and translucent in appearance. Distortion and disfigurement were associated with each of the areas where push pins had been used to fasten the hide to the wooden block during the polymerization process, indicating the great degree of shrinkage that occurred in the sample. While there appeared to have been less hair loss in sample C than in sample A, the process used for curing sample C produced a conserved hide sample that is harder and less flexible.

The combination of active and passive catalyzation may account for the difference in hair loss between samples A and B. It is suggested that this combined process produces a more rapid polymerization of the silicone, which in turn prevents hair loss caused by post-treatment handling. Although both samples were totally dry and non-greasy to the touch, sample B was slightly fluffier in appearance. Apart from the high degree of shrinkage that occurred in sample C, the sample exhibited many beneficial qualities. The fleshed surface of this sample was aesthetically pleasing and although the hide was less supple than samples A and B, the hardness of sample C suggests that it is very durable.

The short time period and simple preparation processes used to conserve hide samples for silicone bulking are obvious benefits when compared to conventional tanning processes.

Continued experimentation must be conducted as a means of refining the process, but the combination of active and passive catalyzation appears to produce the most aesthetically pleasing results. Throughout the catalyzation process, no observations were made regarding differences in the rate of catalyzation between samples A and B. Future experimentation will address these issues in an effort to determine the optimum treatment time for "tanning" untreated hides using silicone bulking processes.

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