

## Potential Applications of Isinglass Adhesive for Paper Conservation

Tatyana Petukhova\*

With new developments in science conservators are exposed to various new materials that help improve the quality of their work and simplify the conservation process. Nevertheless old traditional materials and techniques also may offer something "new" to learn from the past.

Some natural adhesives have been used for conservation in different countries for centuries but have not been introduced widely enough to the international arena. In Russia fish gelatin and isinglass have been traditionally used as adhesives in painting and icon restoration. The application of fish glue as an adhesive and consolidant for the restoration of Russian icons is documented as early as the seventeenth century, in the Siiskii chronicle.

In nineteenth-century Europe domestic isinglass and isinglass imported from Russia were broadly available and were used for sizing paper in book and paper restoration, for gilding of glass and wood, and as a fixative for pastel drawings. In historic documents of Western Europe the use of isinglass has been traced to medieval times in connection with illumination of books, where isinglass was used as a size on which pigments or gold leaf were laid and occasionally as a medium.

*Fish glue* is an adhesive prepared from the waste products of fish such as the head, skin, and bones. *Isinglass* is defined as a superior fish gelatin product, produced from the swim bladders of certain species of fish; the quality of the isinglass depends on the chosen species of fish, the manufacturing process, and additives. Because isinglass has been used in Russia for centuries, methods of its manufacture were developed to produce an extremely pure product suitable for conservation. The best grade of isinglass produced today is Russian isinglass, which is prepared from *sevrüga* and *assëtr* (English "sturgeon").

This isinglass fulfills the most important conservation requirements: it is readily reversible with moisture and heat; it is non-toxic; and it is easy to prepare and apply. It makes a highly viscous adhesive that can be prepared in dilute solutions; a thin film produces a strong bond even if there is very little moisture present when contact is made. In Russian paper conservation isinglass is used as an adhesive for pre-made hinges that can be easily stored and used when needed, and for lining pastel drawings executed on board or heavy paper with canvas. But outside of the Soviet Union the use of isinglass as an adhesive and its advantages when applied to conservation are generally unknown.

In collaboration with specialists in Food Science and Chemistry at Cornell University the author is working on a project to develop a pure fish gelatin adhesive suitable for conservation with qualities similar to Russian isinglass. The author has been familiar with the uses of isinglass since 1973, when she worked in the Painting Conservation Department at the State Hermitage Museum in Leningrad, where isinglass is regularly used for consolidation and lining. Compared to other kinds of isinglass the Russian product is tackier, produces a clear aqueous solution, and behaves quite differently from other grades during lining. Unfortunately Russian isinglass was impossible to obtain

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\* Paper Conservator, Conservation Lab, 701 Olin Library, Cornell University, Ithaca, NY, 14850.

and the product used for the experiments described here was obtained from a West German company, Kremer Pigments, in Aichstetten.

The pH of this dry isinglass is around 6 to 6.5. To prepare a solution of isinglass in water, the thin transparent sheets of dry isinglass were broken into small pieces and soaked in distilled water for an hour or more. Isinglass, like all collagen, is insoluble in cold water but can be gradually dissolved by introducing heat. Once the pieces of isinglass had swelled, they were melted in a double boiler over moderate heat. The temperature of the solution should not exceed 60° C; above this level the glue begins to degrade rapidly and loses its adhesive properties. The hot solution then was strained several times through cheesecloth. The West German isinglass has a milky cast and quite a strong odor that a purer grade does not have. Several solutions of isinglass in water were used (2.5%, 5%, 7%) so the consistency could be varied depending on the purpose of the conservation procedure. A light-weight Japanese tissue such as tengujo was placed on a sheet of Plexiglas and a hot solution of isinglass in water, plasticized with glycerin, was applied evenly with a brush. After this procedure the Japanese tissue was dried for several days and then peeled off the Plexiglas.

This pre-made isinglass film was found most practical for the repairing of archival material that cannot be washed prior to repairing. Over 70 oversized 19th-century engineering prints by Cooper from the History of Science Department collection were repaired and hinged with pre-made isinglass film by the technician and interns under the paper conservator's supervision at the Cornell University Library conservation lab. A sheet of pre-made isinglass film was cut into appropriate strips. A strip was placed on the verso of the area to be repaired, shiny side towards the paper object, and a slight amount of moisture was applied by brushing through the verso of the isinglass film. A bone folder was used to fix the strip into place and the area was dried with a tacking iron through silicon release paper.

The technique described above is simple and efficient, and might be used by non-conservators such as librarians, archivists, or curators with a little training. Hinges made of isinglass film can be used where it is difficult to cook a starch paste.

The author also experimented with isinglass and fish gelatin adhesives for lining tracing papers.

Transparent papers are usually quite thin and brittle by nature: they are impregnated with oils, resins, etc., which effect physical and chemical changes of the paper over time. Most tracing papers are extremely sensitive to light and temperature. Tracing papers with water-soluble media are particularly unpredictable during conservation. Often they do not accept starch paste, which may not be strong enough or may be too moist for this kind of paper. Synthetic adhesives are not readily reversible or present problems of toxicity.

For experimental purposes a poor-quality, machine-made transparent paper was used as a primary support and Japanese machine-made tengujo tissue was chosen as a secondary support paper.

The first technique: The experimental tracing paper was relaxed between Gore-tex and moistened blotters. The hot solution of isinglass in water was applied to the Japanese tissue. Once the adhesive was slightly moist and developed its greatest tack, the lining was performed. After lining, the experimental paper object was dried between polyester web and dry blotters in a press.

The second technique: A pre-made dry isinglass film made with tengujo tissue was activated with moisture during pressing. The experimental tracing paper was placed dry on the dry isinglass film and then pressed between Gore-tex and slightly moistened blotters for less than three minutes.

The third technique: The tracing paper sample was slightly moistened and relaxed before being set on the pre-made dry isinglass film and pressed.

In each of these trials the experimental sheets of tracing paper were successfully attached to the isinglass film and a strong adhesion was obtained even when very low levels of moisture were used. However, all these lining variations need some further development and an appropriate investigation of the adhesive before they are applied to actual conservation treatments.

The author is continuing her investigations of fish gelatins and isinglass in the hope that a suitable high-grade product may be found and made available to conservators in this country. The experiments described above show that for paper conservators isinglass has potentials as a useful alternative adhesive to paste for certain applications, including: lining and repairing of archival paper material that can not be repaired with starch paste; conservation of tracing papers or other papers that require a strong, low-moisture adhesive; or as pre-made isinglass or fish gelatin film for hinging various paper objects.

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