



PHOTOGRAPHS BY YANNICK CHASTANG

Animal glues

Yannick Chastang looks at the range of animal glues available to the furniture maker and how these can be used to their best advantage

I want to start this article by looking at hide, bone and skin glues. An animal glue is created by prolonged boiling of animal tissue. All animal glues are collagen based which is a protein contained in animal bones and skins. The production of hide glue has always been linked to the tanning industries and is principally, in Europe, of cattle origin. Bone and skin glues are prepared from fresh or extracted bones and connective tissues from cattle and pigs. These glues are generally sold as coarse powders, pearls or cubes.

Using animal glue today

Are modern glues truly that much easier to use? Poor mixing of modern two-pack adhesives such as araldite often causes cross-linking and

any minute human error in mixing will result in bad curing and fast degradation. Even though most manufacturers say their adhesives will last forever, their claims are as yet unproven. In my experience, I have come across PVA from the 1970s that has already degraded. All too often the glue no longer has any cohesion or strength and has become a rubbery mess stuck to the wood, which has to be laboriously removed by hand with a scalpel. It is a fact that furniture conservators are seeing increasing demand for restoration of 20th century pieces made of plywood, chipboard and modern adhesives. All these are proving almost impossible to restore compared to their much older counterparts. ➤

History of animal glue & woodworking

The earliest making of animal glue is recorded in ancient Egypt. Stone carvings depict glue preparation and use as early as 1500BC where it was used for wood furnishings, mural painting and for the furniture in the Pharaoh's tomb. Although used by the Greeks and Romans, knowledge of the usefulness of animal glue died out in Europe until the 1400s when woodworking and furniture re-emerged as a craft. The first commercial glue factory began in Holland around 1700, manufacturing animal glue from hides. The use of animal glue in furniture making was at its height from the 1750s to World War II. Since then modern polyvinyl acetates (PVA) and aliphatics have been preferred. Today, animal glue is generally reserved for the restorer or conservator.



Two very specialised glues in dry form. On the left is one made from sturgeon bladders that need to be cooked in water before using. Sturgeon bladders are reserved for conservation as they are very expensive (£300/kg). On the right is old fashioned colle de givet, sourced from the stock of a retired French cabinetmaker and regarded by French makers as the best

Glue glossary

Bloom: In the gelatin world, gel strength is traditionally referred to as bloom. It is the force, expressed in grammes, necessary to depress by 4mm the surface of a gelatin gel with a standard plunger (AOAC). The gel has a concentration of 6.67% and has been kept for 17 hours at 10°C.

Bloom is linked to the mechanical elasticity of the gel and is used to classify gelatin types. It generally ranges from 50 to 300 bloom. We may sometimes refer to low, medium or high bloom, within the following limits:

- 1. Low bloom:** gel strength below 120g
- 2. Medium bloom:** gel strength between 120 and 200g
- 3. High bloom:** gel strength above 200g

Woodworkers can choose between 160 to 200g.

Viscosity is a measure of the resistance of a fluid which is being deformed by either shear or tensile stress. In everyday terms – and for fluids only – viscosity is ‘thickness’ or ‘internal friction’. Thus, water is ‘thin’, having a lower viscosity, while honey is ‘thick’, having a higher viscosity. Put simply, the less viscous the fluid is, the greater its ease of movement (fluidity). Dynamic viscosity is measured in millipoises. A glue ideal for cabinet making will measure 100 to 110 millipoises.

Open time is the amount of time the glue remains liquid and workable. Joining parts after the open time has expired will result in a weak bond.

Modern equivalents

Since the mid 1990s, commercially produced cold animal glues which overcome many of the practical problems of use have become available. These animal pearl glues have been modified with chemicals to a liquid state so they can be used at room temperature. For manufacture I would recommend the excellent Sheppy Cold Glue – called Glutina D3 or fish glue replacement – Gorilla Glue and Titebond Liquid Hide Glue. There is also Sheppy Scotch Glue which I have not tried but is apparently wonderful.

Of course, the exact recipe of any commercially available glue is



On the left pearl glue from bones; on the right nerve glue in powder form; front, a ready-prepared cake from the fridge ready to be remelted when needed. Note the high-alcohol content beer in the background

a closely kept trade secret. The conservator who desires control over his ingredients, and wishes to safeguard his antiques against the fungicides and additives present in ready made glue, has no option but to do things the old way by making up his own glue from reliably sourced dried pearls, mixing them with water and heating.

Modification to improve the glue's properties and its workability has been constantly attempted by makers for many centuries and there are many studies by museums and institutions – led by the Musée Des Arts Decoratifs in Paris 1995 – that research glue composition and the substances added to improve them. Recipes abound suggesting the addition of honey, glycerine, beer, human urine, sulphur, animal fat, oils, resins and garlic, to name but a few. Many of the additives have been the subjects of recent studies and while some have proved effective some have proven to have the opposite effect.

The objectives differ depending on the makers' needs but would include: 1) ease of use at room temperature; 2) more resilience to water, useful if the object glued is to exist in cold and damp atmospheres, e.g. a church; 3) increase the shelf life of the liquid glue; 4) remain flexible by limiting the loss of moisture content. It is clear that point 4 was achieved in the 18th century in order that Riesener's furniture has survived in perfect adhesive condition. The most useful additives have been found to be human urine, now added in the form of scientific urea, and beer.

Quality ingredients

The main priority when making your glue is to obtain a good quality reliable dried source. In the olden days glue was manufactured in slabs and every maker had their own quality that would be consistent from batch to batch. Latterly, hide glue was sold as pearls and nerve glue or skin glue as powder. Both possessed different qualities and careful combination of the two types enabled the woodworker to create his own glues specially adapted to each job.

Bone glue will gelify quickly but is not very flexible when compared to skin glue that will stay open – liquid – longer. Veneering large surfaces that



An electric waterless glue pot. The thermo-control means the glue can reliably be kept at optimum temperature

need to be clamped down requires a glue with a longer opening time so a combination of 2:3 bone/nerve or skin glue. A quick veneer gluing on a smaller surface will allow for five minutes of applied pressure with a veneer hammer, requiring a glue of 2:3 nerve or skin/bone.

Today, to my knowledge, only Laverdure in Paris sells modern animal glues that have been carefully sourced to replicate the old nerve glue and bone glue. Trobas adhesives from Holland also come in a selection of more than 250 different blooms and 80 different viscosities.

Such technical specifications are vital to match an old glue for a conservation; however, in manufacture I find that Liberon and Sheppy both produce decent dried pearl glue.

Adjusting the ingredients

Whatever pearl glue you decide upon the glue then has to be prepared for use. Dried urea or thiourea – though thiourea is highly toxic so I prefer

to use urea – is added to the mix. Adding 20g of urea to 100g of dried pearl glue will dramatically increase the time the glue takes to gelify.

More urea can be added but any more than 40g maximum will have a detrimental effect on glue strength and effective adhesion. The dry ingredients are then mixed with enough cold water to cover them before being left for an hour to swell. After this more cold water is added to a total liquid content of 200ml – to 120g dried. Of this 200ml of liquid, 100ml can be replaced by beer.

The alcohol in the beer – I use high alcohol content Belgian – when added to glue will not only act as a wetting agent that will improve the workability of the glue, but will also add natural sugar and tannin for added flexibility and retention of moisture once dry. This moisture is essential if you want the glue to remain sufficiently flexible to stay cohesive despite slight joint movement. Once the glue loses all its moisture it will revert back to the dry pearl state and be ineffective. The addition of beer is from an 18th century recipe and is one that scientific research has shown to be successful. The resultant liquid then needs to be heated and kept at a constant temperature of 60 to 70°C.

Modern process

Traditionally this was done in copper glue pots based on the principles of a bain-marie cooking pot. The use of copper or iron pots is still common today, however care should be taken of the copper or iron oxide which can detrimentally alter the quality of the glue. It is difficult to control the temperature of the glue with a bain-marie and I prefer to use an electric glue pot with its precise thermo-controlled mechanism. Animal glue should never be boiled or the glue will be irretrievably damaged. If the glue is not sufficiently liquid then more water can be added to the desired consistency. For me, what works is that when I lift the glue with the stirrer it should stretch from the stirrer and



A thermo-controlled heated blanket is the perfect way to keep your woodworking project warm in the course of gluing. It is shown here combined with vacuum clamping, an obvious and simple way of using the heated blanket. The thermo-controlled blanket can also be used in a veneer press

Fish glues

There are two types of fish glue. One is a non-expensive glue derived from non-oily fish and bones and is generally sold in liquid form. It is comparable in consistency and use to liquid hide glue. Its exact composition is not known, however the collagen is highly modified with chemicals, preservatives and, to give it more body, the glue contains a mineral-based thickening agent. As a glue it is convenient but the resulting joint is extremely dry and brittle giving cause for concern. It is also not easily reversible. On the other hand, the other type of fish glue – isinglass – is made from the swim bladders of sturgeon and is usually sold in thin dried strips or as entire bladders. It is not readily available and has to be dissolved in water, and has a very short shelf life once cooked. Despite the very high cost (£300/kg) it is one of the best glues for conservation. It penetrates better than hide glue and, as it is also collagen based, it mixes very well with hide glue. I favour it for the consolidation of antique marquetry, flaking gesso or gilding and flaking lacquer. It is too thin to glue veneer, however.

not drip. Once mixed and cooked, small quantities of ready-made glue can be stored in the fridge for several months. In my workshop I prepare large quantities of glue at once and pour it into several small Tupperware moulds. Once cooled and hardened, the cakes are wrapped in cling film and refrigerated. When needed, these cakes are reheated ensuring little wastage or overcooking.

Up to now the biggest drawback against using animal glue has been the short open time. Heating the wood to extend the workability has always been desirable but not easy to achieve. Today's solution is to cover the glue with a thermo-controlled heating blanket. This flexible heating panel can be used in the veneer press, under clamps or simply placed on top of the vacuum bag.

Conclusion

Preparing and using animal glue might seem a lot of fuss and hard work. For me, however, there is great satisfaction in knowing that my glue is designed to last. I know exactly what I have put in it and I am confident that it will endure longer than most of the modern glues around. I envisage each bespoke piece I make as an antique of the future and knowing that my furniture could easily be restored in two hundred years time is good news. ➤

Advantages & disadvantages of animal glue

Advantages

1. It is the only glue that is easily reversible using water and heat. Although this is not a priority for furniture manufacturers, for conservators, it is essential. Of course it still has its uses in furniture manufacture either to correct a mistake or for the adjustment of prototype furniture. Hide glue is hygroscopic and thermoplastic – i.e. becomes soft when heated and hard when cooled – and gentle warming or warm water will release the joint.

2. New animal glue can be happily mixed with old. Old animal glue will only degrade by drying out and loss of water content, and if exposed to acid, which is very unlikely in most conditions. It can be regenerated or rehydrated by increasing the moisture content of the old glue. If the glue is excessively dry then new glue can easily be added on top of the old. In contrast, modern glues will degrade by cross-linking and cannot be salvaged. Considering that the furniture we make today may become an antique of the future, should not the reparability of the construction be as important as the design?

3. It is the most stable and long lasting of all adhesives. Even objects made in the time of Tutankhamen can easily be reassembled, as the drying out of the glue has not affected the precious woodwork. Indeed, there are pieces of royal French furniture made by Riesener in the 1780s with very thin stable glue joints where the glue has not yet dried out. In most of the Riesener furniture I encounter the marquetry is still perfectly adhered to the wood carcass. It is movement in the 18th century solid wood carcass that generally causes the problems; for example a crack in a drop front caused by movement of the solid wood panel that has forced apart the decorative marquetry veneer. Despite all scientific advances, modern man has not yet recreated Riesener's perfect glue and unfortunately his secret recipe died with him.

Disadvantages

1. Animal glue is not easy to use. It can only be used warm and must be kept at a constant temperature of 60-70°C. It is generally prepared in small batches in a bain-marie glue pot. The length of time it can be kept warm varies between different types of glue.

Immediately after being applied to the wood, the glue will cool and harden leaving no time to clamp the item.

2. Animal glue is water-soluble and there are many projects it is simply not suited to. It is also hygroscopic i.e. it will take up and retain moisture so is susceptible to atmospheric conditions and will react to the relative humidity of its environment. If the RH dips below 10% then the moisture content of the glue will lower and the glue will become brittle.

3. Animal glue cannot be stored in a wet state. It needs to be made up in small batches and has a very short shelf life. Effectively it is gelatine, a food, and is subject to rotting if not properly stored.

4. Animal glue has poor gap filling capacity so, again, there are many jobs it is not suited to.

5. It is no longer widely available. The European demand for gelatine has fallen away drastically in recent years. In the drug industry gelatine has been replaced by vegetable oils to make pill capsules and it is no longer widely used in the photographic and food industries. As the European gelatin industry has declined it has taken the production of glue with it and very few glue factories remain today. Trobas (Holland) and Sheppy Adhesives – Kent, UK, established 1887 – are two of the few to survive. Most animal pearl glue comes from developing countries such as China – see www.alibaba.com world suppliers. It can be hard to ascertain the integrity of the method of these manufactures and guarantee the quality of the glue offered for sale. Even if from a reputable source the addition of preservatives – fungicides and bactericides – is almost inevitable.

Recommended suppliers

Sheppy, for a wide range of excellent adhesives – www.sheppy.ltd.uk

Gorilla Glue – www.gorillaglueonline.co.uk

Trobas animal glue, fish glue, pearls and powders – www.laverdure.fr

AG Woodcare for pearl glue – www.agwoodcare.co.uk

Electric glue pot – www.tilgear.info

Elmer's, for a wide range of excellent adhesives – www.elmersglue.eu



A traditional veneer press that can be used for clamping large surfaces or small items. After years of using vacuum clamping, I find I am more and more returning to traditional clamping because I can obtain a higher degree of pressure. Pressure with vacuum clamping cannot exceed atmospheric pressure while traditional clamping can easily go 3-4 times higher

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