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WATER-RESISTANT GLUES

Water-resistant glues suitable for woodworking are usually of the following general types: Soybean and other vegetable protein; casein; urea, phenol, melamine, or resorcinol resins. Other types of water-resistant glues, suitable for woodworking but less extensively used, are blood albumin, treated animal glues, and thermoplastic resins. These several types of glues vary widely in degree of water resistance.

Early water-resistant glues used commercially were either of casein or blood. Later, methods were developed for imparting some water resistance to animal glue, and for preparing water-resistant glues from soybean meal. In the last decade, highly water-resistant adhesives made from synthetic resins, some of them suitable for permanent outdoor exposure, became available for woodworking.

Several basic formulas for making casein glue, blood albumin glue, and water-resistant animal glue were worked out by the Forest Products Laboratory, but at the present time the various types of water-resistant glues are generally manufactured and distributed by adhesive manufacturers and relatively little is compounded by the glue user. The soybean glues usually require mixing by formula from the raw materials but most of the others may be purchased in forms that are either ready for use or that require only mixing with water or hardener. The resin glues do not lend themselves to manufacture on a small scale and no formulas for their production have been developed for distribution by the Forest Products Laboratory.

In the United States casein glues are ordinarily prepared, spread, and pressed at room temperatures although they are sometimes used in hot-plate presses. By comparatively simple variations in formula, casein glues can be made to vary over a wide range in water resistance and the purchaser should state specifically whether or not a high degree of water resistance is desired. Directions for mixing the prepared casein glues can best be obtained from the respective manufacturers. When properly formulated, casein glues are moderately water-resistant

but are not waterproof. Casein glue joints, if well made, will withstand a certain amount of exposure to moisture but will fail under prolonged exposure to wet conditions. If the glue is not protected by preservatives, casein joints will also deteriorate under conditions that are conducive to the development of molds. When casein glue joints are likely to encounter moist exposure a glue containing preservative against mold should be specified. Casein glues are convenient to prepare and to use under a wide range of temperatures and are capable of forming strong joints. They are suitable for gluing plywood and veneered stock and for joint work involving heavy laminations that will not be subjected to extremes of moisture.

Soybean vegetable protein glue is similar in most of its characteristics to casein glue except that it usually does not produce so strong a joint. Soybean glue is used extensively in the manufacture of softwood plywood.

The development of woodworking adhesives from synthetic resins has continued steadily since about 1935, and constitutes an important advance in the field of glue formulation. Some of these resin glues make possible joints that are dependable when continuously exposed to water and to the weather. Four principal types of synthetic glues are now being used; urea-, phenol-, melamine-, and resorcinol-formaldehyde resins. Some resin glues are prepared in the form of dry films, some in the form of powder to be suspended or dissolved in water, and some in the form of water and alcohol solutions or suspensions.

Urea-resin glues are available that require heating for curing and others that can be cured at temperatures as low as 70° F. The phenol and melamine glues require elevated temperature for adequate curing but the resorcinol resins can be cured at ordinary room temperature. Urea-resin glues are sometimes extended by adding rye or wheat flour. Such extension decreases the resistance of the joints to water and fungi but for some purposes this decrease is considered not to offset the advantage of decreased cost. Urea-resin is sometimes fortified by adding melamine resin or resorcinol to increase its water resistance and durability.

Joints well made with urea resins are highly water resistant under ordinary conditions of use although they are not so durable as the phenol, melamine, and resorcinol resins, especially under conditions involving high temperatures and high

relative humidities. The phenol, melamine, and resorcinol resins produce joints that are very durable under all types of weather and water exposure.

Thermoplastic resins such as polyvinyl acetate and polyvinyl butyral are water-resistant glues that have found limited use.

Animal glues may be made somewhat water resistant by the addition of paraformaldehyde and oxalic acid in the proper proportions. The technic of using treated animal glue is the same as for conventional animal glue except that the glue solution should be held at 110°–115° F., instead of about 140° F. When once solidified, the glue cannot be reliquefied by heating so that the quantity prepared should be sufficient for only a few hours of work and the pots and spreaders should be cleaned before the glue solidifies. Treated animal glue combines a moderate degree of water resistance with high dry strength and freedom from staining.

Blood albumin glues are not widely used in the United States. They require the application of heat and pressure simultaneously for best results and in hot-pressing operations have been largely replaced by the still more water-resistant and durable resin glues.