PAPIER MACHE[1]

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(Report)

As its name indicates, papier mache (French, meaning chewed or mashed paper) is basically mashed or pulped paper made into some form other than the familiar paper sheets. The paper is usually mixed with paste, glue, or sizing to give greater hardness and strength; and various other filler ingredients, such as ground chalk, clay, and lime, may be added to give body. Papier mache is a strong, tough, durable substance, slightly elastic, and not liable to warp or fracture. The articles for which it is used make a long list, including ornamental boxes, bowls, vases, and trays; masks; doll and puppet heads and other toys; anatomical, botanical, and artists' models; mirror and picture frames; and panels and other wall ornaments. Papier mache is frequently used for store window decorations and stage scenery. Because the materials required are so simple, making articles from papier mache is probably one of the most enjoyable and least expensive crafts for home or school.

Preparation of Papier Mache

Any kind of paper, even printed, that is not shiny, glazed, or enameled -- rough, brown paper, wrapping paper, envelopes, letters, old newspapers -- is suitable for papier mache. Newspapers are probably the best because they are easily obtained, thin, easily torn, and disintegrate to pulp when wetted.

The simplest method for making papier mache is to soak the torn paper in water until thoroughly wet, mash the wet paper to a pulp, shape the pulp into the desired form, and allow it to dry. The wet, mashed paper can be partially disintegrated by agitation with an egg beater, an electric mixer, or even a washing machine to obtain a uniform pulp. Some of the pulp should not be so watery that it will not stick together when squeezed out in the hand.

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[1] The information in this report is based on trade literature unverified by Forest Products Laboratory research. A list of references is appended.

[2] Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

For better results, the pulp should be saturated with a water paste, such as flour and water or ordinary paperhanger's paste. When the paste dries, it will become very hard and durable and an excellent surface for paint or lacquer. A suitable paste can be prepared as follows: Mix a teacupful of flour with cold water until the mixture has the consistency of cream. Add boiling water and stir until the paste thickens. To make the paste more adhesive, dissolve and add a teaspoonful of alum, and if it is to be kept for some time, add a few drops of oil of cloves or cinnamon.

Instead of pulp, strong papers, especially wet-strengthened grades, can be used in the form of sheets, strips, or small pieces, which are soaked in water and pasted onto the mold in layers. The paper should be damp, not wet; excess water can be removed by pressing between blotting paper. Sheets or strips are preferable for covering a wire frame. The small pieces should be of even size and torn, not cut, in order that no ridges are formed.

Formulations

Various substances of both mineral and vegetable origin are often added to the paper pulp used in making papier mache, particularly in commercial production. These ingredients may consist of china clay, chalk, lime, gypsum barytes, talc, and mineral and vegetable coloring substances. Viscous adhesives used to form the material into a mass include rosin soap, gelatin, casein, starch or corn paste, gum acacia, dextrin, Irish moss, or wax. If rosin soap (saponified rosin) is not readily available it can be made by boiling 6 parts by weight of powdered rosin with 1 part of washing soda in 2 parts of water until a thick syrup is obtained. Several hours may be required. Five parts of the syrup in 100 parts of water gives a good sizing solution, called rosin soap solution or milk of rosin.

In the following formulas, which contain some of these ingredients, parts by weight are given in parentheses to permit the ingredients to be measured in other units than the metric system units given, such as ounces or pounds, and to permit various quantities of papier mache to be made:

(1) Paper pulp, 750 grams (1 part); clay or talc, 1,250 grams (1-2/3 parts), moistened with 2-1/2 liters (3-1/3 parts) of water; dry casein, 750 grams (1 part). Heat the mixture to the boiling point and stir to make a paste of uniform consistence.

(2) Dry pulp, 750 grams (3 parts); water, 3 liters (12 parts); clay or talc, 1 kilogram (4 parts); saponified rosin, 250 grams (1 part). Boil together to make a smooth paste.

(3) Paper pulp, 1 kilogram (4 parts); finely pulverized talc, 750 grams (3 parts); rye meal, 750 grams (3 parts); unslaked lime, 250 grams (1 part); starch, 500 grams (2 parts). Cook the paper pulp and rye meal together in 5 liters (20 parts) of water and add the unslaked lime. Cook the starch separately in 8 liters (32 parts) of water and add the hot starch solution to the pulp. Stir the mixture vigorously until a smooth paste results. Allow the mixture to stand for several days in order to permit any excess

water to drain off. (Note: Unslaked or quick lime is very caustic and dangerous to the eyes or skin.)

(4) Dry paper pulp, 500 grams (1 part); saponified rosin liquor, 2 liters (4 parts); flour, 500 grams (1 part); china clay or ordinary white earth, 500 grams (1 part); water, 3 to 4 liters (6 to 8 parts). Boil together to make a smooth paste.

(5) Paper pulp, 500 to 1,000 grams (4 to 8 parts); cheese made from milk from which the cream was removed, 750 grams (6 parts), equal to 93 grams (about 3/4 part) of casein; saponified rosin solution, 500 grams (4 parts); soda ash (washing soda), 125 grams (1 part); water, 2 liters (16 parts). Boil together to form a smooth paste.

(6) Sulfite pulp, 1 kilogram (4 parts); thick rosin size, 20 grams (1/10 part; 2 percent, based on weight of pulp); china clay, 250 grams (1 part); water 3 liters (12 parts); starch, 250 grams (1 part), mixed with 1 liter (4 parts) of water to form a paste. Boil the mixture and rub to a mass of uniform consistence. This compound is preferred for the manufacture of architectural ornaments, such as cornices and friezes. For this purpose, a strong adhesive is made by soaking 250 grams (1 part) of glue in 2 liters (8 parts) of water overnight and then boiling the mixture; casein for use as an adhesive is prepared by treating 10 parts of dry casein and 1 part of soda ash with 40 parts of water. The addition of 15 percent of boric acid to the adhesive as a preservative is recommended. Casein is preferred to glue as the adhesive because it combines more readily with the rosin size and the resulting cement adheres more tenaciously.

(7) A procedure for making a lump of papier mache about the size of an ordinary baseball (about 17 ounces) requires the following ingredients: Dry paper, 1 ounce; water, 3 ounces; dry plaster of paris, 8 ounces; and hot glue, 4-1/2 tablespoons.

Make a wet paper pulp from the paper and water and mix the pulp in a bowl with about 3 tablespoons of the hot glue until a soft and very sticky paste is obtained. Add the plaster of paris and mix thoroughly. By the time about 3 ounces of the plaster have been used, the mass is so dry and thick that it can hardly be worked. Add the remainder of the glue, work the mixture up again until it becomes sticky once more, and then add the remainder of the plaster. Thoroughly mix the mass and work it with the fingers until it is free from lumps and sticky enough to adhere to the surface of a board. If it is too dry to stick fast, add a few drops of water or glue and work it up again.

The papier mache should be kept in a lump and used as soon as possible after making. Keep the surface of the lump moist by means of a wet cloth laid over it. If it is to be kept overnight or longer, wrap it up in several thicknesses of wet cloth and put it under an inverted bowl.

Forming Papier Mache Articles

Papier mache articles may be formed by simply pressing the pulp into shape or by coating an object of the desired shape, such as a bowl, vase, or mold, with a thick layer of the pulp. If sheets, strips, or pieces of paper are used, about eight layers pasted over the mold are sufficient for small objects; larger objects need to be thicker according to size. The last layer may be plain white paper or sometimes a very thin muslin to give added strength. Before the papier mache is applied, the mold should be greased with petroleum jelly, lard, or any kind of fat and carefully covered with tissue paper, which is pressed down so well that it fits smoothly without wrinkles. If the article is formed on a wire frame, the wire should be of sufficient strength to remain firm in the position into which it is twisted but not so thick that it cannot be manipulated. Commercially, papier mache articles are commonly formed by forcing the pulp into molds under pressure and allowing it to dry. A warm, not hot, oven is satisfactory for drying papier mache; usually several hours are required.

Finishing Papier Mache Articles

Before the article is completely dry, brush over the outside and inside with paste to waterproof it. When this coating is dry, rub down any unevenness with sandpaper. The surface should then be even and hard, but a good coat of size or wood filler will produce a better surface for decoration.

Papier mache may be given various surface coatings, such as paint, varnish, lacquer, waterproof asphalt, and even sealing wax, to improve its durability and appearance. Suitable paints include dampproof and heat-resisting enamels, which dry quickly and give a pleasant matt surface. For a glossy surface, use a good, clear enamel and apply thinly with a soft brush. Two coats of enamel are usually required. Water colors and similar paints may be used if the article is varnished afterwards.

The following are some formulas for varnishes and lacquers for papier mache:

(1) Shellac, 3 parts; alcohol, 10 parts; lampblack, 2 parts.

(2) Shellac, 2 parts; rosin, 2 parts; alcohol, 10 parts; lampblack, 3 parts.

(3) Shellac, 17 parts; rosin, 9 parts; dragon's blood, 8 parts; spirit of turpentine, 100 parts.

(4) Shellac, 10 parts; gum sandarac, 5 parts; gum mastic, 3 parts; alcohol, 100 parts.

(5) Gum sandarac, 10 parts; gum mastic, 3 parts; heavy turpentine, 2 parts; alcohol, 50 parts. To color 50 parts of alcohol, 1 part of safran is used.

(6) To make a golden varnish, dissolve shellac, 9 parts; and gum gamboge, 10 parts, in alcohol, 50 parts.

Articles cast from papier mache and plaster can be made durable by sealing and glazing them with organic thermosetting resins. Some of the recently developed compounds suitable for this purpose are the thermosetting furan resins, phenolformaldehyde resins, "polyester" resins, alkyl-type cashewnut aldehyde resins, and vinyl resins. The resins often can be pigmented so that the article will require no finishing after solidification.

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