Botanical Embedding

by SHEILA MAGULLION

This article is not intended as a detailed guide to embedding, but discusses only the basics of botanical embedding and some of the procedures that have been moderately successful for me. As with all practical matters, experience is the only real teacher, and the hope here is to provide a starting point for readers interested in pursuing the subject.

To embed is "to lay in surrounding matter — as to embed in clay or sand," according to Webster. A simplified outline of the process of surrounding dried horticultural material with plastic is to lay the specimen on a supporting layer of plastic in a suitable container, cover it with another layer, and when the resulting block has hardened, remove it from the mold to be sanded and polished.

The plastic used is a polyester resin that comes from the manufacturer as a light blue, syrupy liquid with a strong gaseous odor. On the addition of a catalyst (usually M.E.K. peroxide), it turns green, then clear, and eventually cures hard and odorless with some shrinkage. Technical books on plastics in general include information on the make-up of embedding plastic (or casting resin, as it also may be called), and the exact manner in which it reacts to the catalyst. Knowledge of this process is a prerequisite to understanding and solving some of the problems that may arise in embedding.

It should be mentioned that both the plastic and catalyst are inflammable — the catalyst highly so — and although the makers usually state that the plastic is no more toxic than ordinary house paint, I find that it is, especially when large quantities are curing. As a safety precaution, an exhaust fan should be operating while the odor is noticeable.

It is advisable to have the work area located away from food and food preparation because of the insidious odor that is readily transferred. A place where the materials may be left undisturbed for several days at a time, and where the inevitable spill will not be a tragedy is necessary; the plastic has great adhesive qualities and once hardened is almost impossible to remove. In the liquid or tacky stages it can be taken off one's person with an abrasive cleaner, and off clothing, if tackled immediately, with a strong detergent. Most other surfaces, including measuring and mixing containers, can be cleaned with a solvent, or detergent and hot water. Heatproof glassware can be boiled in a strong detergent solution. Cleaning of equip-

ment is not easy, so whenever possible disposable items should be used. Clean-up material and the plastic itself should not be disposed of by way of household plumbing.

Flower Drying

Drying the botanical material is a very important part of the embedding process. Since there is so much excellent literature available on the subject, only a few points in relation to the preparation of the items for embedding will be mentioned here. It is essential that the material be quite dry and as perfect as possible before it goes into the plastic. Any flaws will worsen and appear magnified in the finished cast, and improperly dried items will discolor.

Select perfect flowers just opened or opening. Mature blooms often develop brown edges in the drying medium and are much more likely to become transparent in the plastic.

Flowers with woody stems attached should be removed from the desiccant when the petals are crisp; then the stem portion is given extra time to dry either in or on top of the drying medium. Flowers such as roses with heavy calyces require similar treatment.

Large leaves can trap air bubbles when positioned in the plastic, so care must be taken to preserve their natural contour and to avoid flattening them in the drying process.

Leathery evergreen leaves turn brown unless given time to dry thoroughly. They also are prone to "silver" when embedded, as are nuts, pine cones, and certain woody materials

Silvering occurs when the plastic fails to adhere to the embedded specimen, creating a void that gives the illusion of a silver coating. The exact cause of the trouble is uncertain; the shrinkage of the plastic or specimen, or the presence of a barrier substance are two theories. Some authorities advise preparing difficult materials by soaking them in various solvents. Unfortunately, this has not yet worked for me and silvering remains a problem. In any case, I think it is very important that material prone to this difficulty receive long and careful drying to insure that all shrinkage has taken place before the embedding process.

Dried pine cones, nuts and seeds can be stored indefinitely under ordinary room conditions without deterioration. Autumn leaves when dried also will keep their color and form for months with a minimum of fussing. Other material must be kept closely covered at all times and is best embedded as soon as possible after it is thoroughly dry. If storage is necessary, light and humidity should be excluded to preserve flower color, and to keep fragile items crisp.

Molds

Almost any leakproof container other than those made of copper, rubber, and certain plastics can be used as a mold for the plastic while it is setting. However, in order to produce the most satisfactory results, the following points might be considered before making a selection.

Square and rectangular casts with straight sides are easier to sand and polish than are those of other shapes, and in general are more satisfactory to display.

It is much easier to remove the hardened cast from a flexible mold than from a rigid one; however, as the inevitable shrinking takes place during the gelling process, the sides of a flexible mold will draw in. All rigid molds should be treated with mold release before the plastic is poured.

When hardened, the plastic will mirror exactly the container in which it was set; a glass surface will produce a cast with a glasslike finish that requires no sanding or polishing. Most miscellaneous objects such as tin cans have bumps and seams that are transferred to the cast and will have to be sanded out later. Materials that scratch easily and are difficult to clean should be avoided if the molds are to be reused.

When only a few small specimens are to be embedded, suitable molds can be found among the commercially available ceramic or plastic types; or there are specially designed metal molds that can be taken apart to facilitate removal of the cured cast. The sizes available limit their usefulness for most botanical embedding.

Satisfactory containers, mostly round, can be found among laboratory glassware; however these are expensive and have a limited life

Stems are allowed extra time to dry thoroughly on top of desiccant.

Euonymus *leaves and fruits that have silvered badly.*

expectancy. Items with beading around the rim make removal of the cast difficult without breakage. Tupperware and freezer containers in heavy polyethylene plastic come in acceptable shapes and sizes and some bakeware may be useful. Kitchenware should not be used for food after being used as a mold for the plastic.

If a number of larger casts are contemplated, it usually will be more satisfactory to make molds to the required specifications. Aluminum or other light gauge metal makes up into quick easy molds, inexpensive enough to be considered disposable. Aluminum sheets can be measured and ruled with a pencil and a long straight ruler, and cut into strips with kitchen scissors. Right angle corners are made by bending the strip against the ruler, or any straight sided object, and joining the ends with Scotch or masking tape to make a frame; this is sealed to the base with caulking cord, or similar material, to form a leakproof container. Four pieces of wood strip or plate glass can be made up in the same way. Wood must be covered with Mylar or cellophane to make it waterproof.

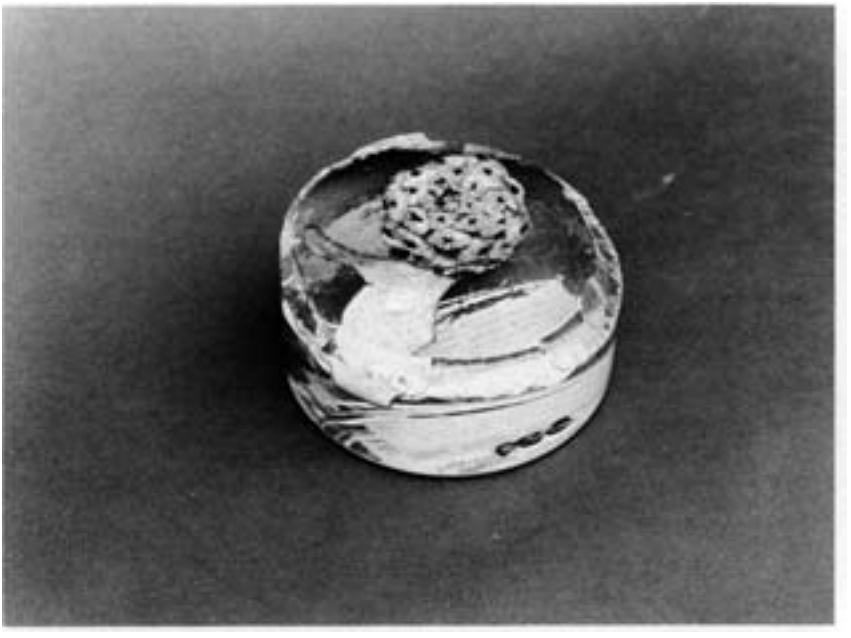
The base need not be of the same material as the sides. An aluminum base sometimes permits a large thin cast to warp, but on the other hand presents no removal problems as it needs no mold release and can be peeled off easily as soon as the plastic has hardened. If the cast is to be displayed bottom side up, a glass base will allow the work to be checked at all stages for bubbles and general effect. Plate glass should be used to minimize the possibility of cracking from stress as the plastic sets.

Calculating the Catalyst

This is a very critical phase of the embedding procedure. If too much catalyst is added, the plastic will set too quickly and in the process generate internal heat; the degree of heat reached being in direct proportion to the amount of catalyst used. This internal heat produces adverse results such as bleaching and silvering of the embedded specimen and fracture and splitting of the cast. Shrinkage also seems to increase. Conversely, too little catalyst will keep the plastic under control but it will not cure to the desired crystal clarity.

When determining the percentage of catalyst to plastic, the two most important factors to consider are the quantity of plastic needed to cover the specimen, and the temperature at which the work is to be done.

Most instructions advise working at a temperature between 70 and 75 degrees. I have found temperatures as low as the upper 50s to be quite satisfactory, especially when embedding large and difficult items, and would postpone beginning any major project if the temperature of the work area were above 70 degrees. The plastic takes longer to set in this lower range, but there will be much less danger of internal heating.



A major fracture.

A fast setting formula is used for all base layers, which are usually less than 1/4 inch deep, and for very small casts. However, as the size of the block increases, decreasing amounts of catalyst are needed for the covering layer. Material requiring a mold 5 inches square and larger can be covered more safely by two or more layers. The drawback here is the noticeable dividing line between layers, especially when slow setting mixtures are used. Flowers with large fragile petals should be covered completely with one pouring or layer, otherwise the portion of petal left exposed will probably become limp and collapse into the plastic.

Be sure to select a resin specifically designed for botanical embedding, and use the manufacturer's instructions as a general guide. Some experiments with small expendable material will develop experience and confidence.

Embedding Procedure

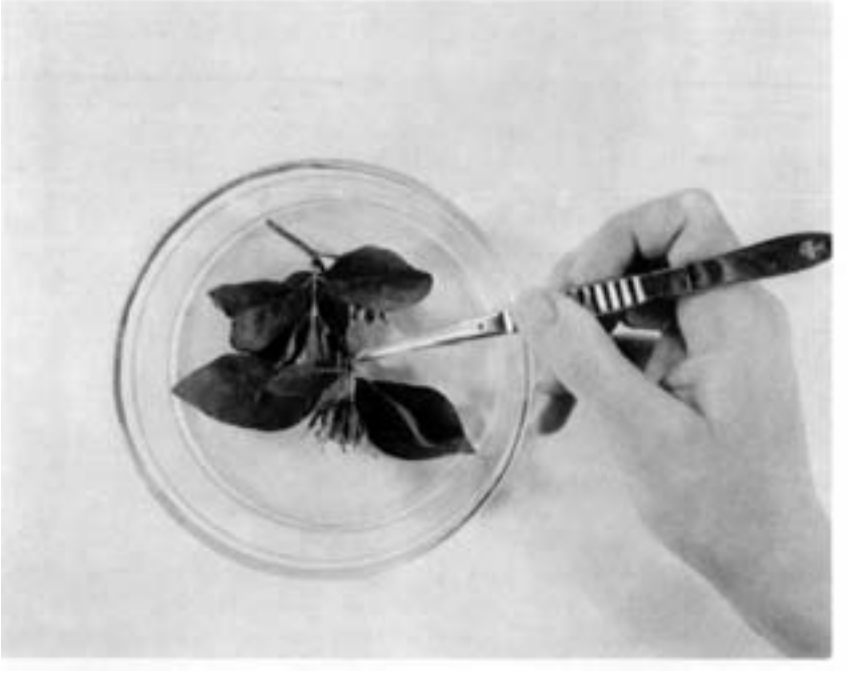
The specimen probably will need to be cleaned with an artist's brush to remove dust and any remaining traces of desiccant. Trim it to fit comfortably into the selected mold, establish a plan for the exact position of the arrangement, and determine the quantity of plastic that will be needed to cover it.

This can be calculated mathematically. In metric measurements, L $\times$ W divided by 30 will give the number of ounces necessary to

make a layer 1 cm. deep, or the quantity can be measured by filling the mold with water to the required depth and transferring it to a measuring container.

Make sure the mold is clean and dry and apply mold release if necessary. Measure into a small mixing container enough resin for the base layer, and with an eye dropper add the catalyst to make a fast setting mixture. Stir thoroughly for at least a minute or until all traces of the catalyst have disappeared. The catalyst will spread outwards to the circumference of the container and must be stirred back into the center to insure thorough blending. Pour the mixture into the mold, cover it with a tent of paper to keep out dust and foreign objects, and leave it to gel for approximately an hour or until it is firm but still very tacky.

Using tweezers or forceps, position the specimen so that it makes contact with the plastic in at least two or three places, particularly if it is a spray or consists of several small pieces. If possible, arrange leaves and campanulate flowers so that air can escape. Minor adjustments can be made for a few minutes; fragile items should be moved as little as possible after being positioned on the base layer of plastic.



Positioning a specimen on base layer of plastic.

Cover the mold until the specimen has adhered firmly to the supporting layer. This probably will take less than an hour, but the project can be left for longer periods or even overnight. Any part of the specimen that has not adhered will float to the surface when the covering layer is poured; if allowed to remain there, the fragment will be moved by the setting action of the plastic to the side of the mold, ruining a cast that might otherwise have been usable.

If this mishap befalls a valuable or irreplaceable item, the situation sometimes can be saved by waiting until the covering layer has begun to set. The wayward object then may be pressed back into its position on the base layer very gently with the stirring rod, and held in place until it has been caught by the setting plastic. This is time consuming and irritating and it is much better to avoid the problem when the item is positioned by trickling a few drops of catalyzed plastic over any part that may fail to adhere.

Measure resin and catalyst to make the covering layer. Mix thoroughly as before and pour it into the mold, taking care not to direct the stream onto any fragile areas. Let the resin run down the stirring rod to break the force and also to help eliminate air bubbles. Again cover the mold with the paper tent and leave it to set overnight. If another layer is needed to cover the specimen, repeat the procedure the next day using the same formula as for the first layer.

An identifying label written or printed on plastic film can be placed on the layer preferred. If it is to be set on the supporting or base layer, place it in position after the covering layer has been poured so no air will be trapped under it. Unlike plant material, it will not rise to the surface.

Some thin textured and light colored flowers become transparent while the plastic is setting. If this tendency is aesthetically displeasing, it can be prevented to a great extent by waiting until the catalyzed plastic begins to turn clear before covering the specimen. The timing has to be very exact in order to permit the air bubbles trapped in the specimen to be released and rise to the surface before the plastic sets.

Sanding and Polishing

The surface exposed to the air does not cure completely for some days and will remain slightly tacky to the touch. If sanding is attempted at this stage the paper will gum up and become useless immediately. To overcome this some instructions advise curing the cast by applying gentle heat, but as this can very easily result in damage to a flower of unstable color, I prefer to finish the cast with a very thin layer of plastic of the same fast setting formula used for the base. When it has set, the mold and contents can be moved to a warmer situation where it may be left for a few days to cure to workable hardness.

A cast prior to sanding.

If a flexible mold was used there will be no problem in removing the cast at this point, but with rigid molds more curing time may be needed for the cast to come free. If the embedded item is sturdy enough, gentle top heat may be applied using a 40-watt light bulb inside a cardboard carton; or the mold can be given alternate hot and cold water treatment. Placing the mold in the refrigerator for a few hours may be enough to release the cast. Glass molds sometimes shatter under this cold treatment, so they should be securely enclosed in a heavy paper bag as a precaution.

The sanding and polishing operation is easier if done by machine; however, if none is available satisfactory results can be accomplished by hand rubbing. Sanding is done wet with four grades of waterproof silicon carbide paper.

A small cast that can be grasped comfortably in the hand may be sanded by laying a sheet of 120 grit paper on a flat bench and rubbing the cast across it until the surface is completely smooth. A large cast of 4 inches or more is easier for a small hand to manage if it is placed on a wet towel or thin piece of wettex laid on the work area, then rubbed with the sanding paper which has been wrapped around a piece of wood or a sanding block. At intervals the cast and the paper should be washed to remove accumulated sludge and to check progress.

When there are no traces left of the original top surface the same procedure is repeated with the 220, 400, and 600 grits. Before moving on from the 220 paper make sure there are no deep scratches left from the 120 grade. Depending on the type and texture of the mold that was used, the bottom and sides may only need to be sanded with the 600 grit. Rottenstone can be used for the final sanding operation.

Hand buffing does not produce the same finish as a buffing wheel, but brisk rubbing with a soft cloth and either silver polish, auto polish, or one of the polishes sold specifically for plastic will produce a very satisfactory lustre. A final gloss can be added with a coat of spray-type furniture polish.

Sheila Magullion is a Friend of the Arnold Arboretum and an active volunteer who has been working on an experimental embedding project for several years. Many of her beautiful casts of Arboretum plants are on display in the entrance hall of the Administration Building in Jamaica Plain.

A group of finished casts.

Materials

For Flower Drying

Desiccant
- Sand
- Silica Gel (hobby shops, garden supply stores, etc.)
- Boraxo
- Cornmeal

Rigid, leakproof containers that can be covered easily.
Camel's hair brush for cleaning flowers.

For Embedding

Level work bench
Newspapers to protect work surface, floor and surroundings.
Plastic (hobby shops are possible sources of suitable types)
Catalyst — comes with plastic.
Eye Droppers — usually come with catalyst.
Measuring and Mixing Containers — glass or disposable laboratory containers. Pyrex glassware (½-pint to 1-quart pitchers), paper cups (unwaxed), coffee cans.
Stirring Rods — laboratory glassware, wire made from coat hangers or such.
Molds
Mold Release — (hobby shops or same source as plastic).
Brush — for release.
Solvent
Detergent — Tide, Boraxo.
An old saucepan for cleaning up.

For Polishing

Sanding paper — 120, 220, 400, 600 wet strength.
Any silver polish, auto polish, polishing cloth (or any old soft rags).
Furniture polish — Pledge.

Suggested Reading

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Cherry, R. 1967. General Plastics. McKnight Publishing Co., New York.
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Newman, J. H. and Newman, S. 1972. Plastics for the Craftsman. Crown Publishers, New York. (Some sources.)
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Simonds, H. R. and Church, J. M. 1963. Concise Guide to Plastics. Van Nostrand Reinhold Publishing, New York.
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