

Earthen Plaster

Why Use Earthen Plaster?

Beauty – The soft finish, earthy colors, and additives that are possible with earthen plasters are exquisite! The sculptural element also allows the artistically inclined to express their visions through the walls of their home.

Fun – A lovely way to bring out your inner child!

SAFE – Non-toxic. Earthen plaster, unlike other plasters, is not carcinogenic, nor does it burn your skin.

The clean up is easy! A little water and a scrub-brush is all you need!

Earth-friendly – Of course, although if you harvest your own, be conscientious.

Repairable/Recyclable – Make a mistake? No problem! You can pry/scrape it off, toss it under a bush to integrate with your soil, and start over!

Inexpensive – Often, the earth under our feet contains an amendable amount of clay! And, bagged clay is not that expensive.



Things to be Aware of

Maintenance Plaster does crack occasionally, due to freezing and thawing, as well as the settling of buildings. Earthen plaster is remarkably easy to fix – just mix a bit of plaster and alis!

Plaster May Dust If it is not prepared and applied correctly. Additives can assist this, as well as giving your finish coat a good dry polish.

Components of Earthen Plaster

Binder – CLAY

Aggregate – SAND

Fiber – STRAW, usually.

Clay

Clay Soil, on a molecular level, is made up of tiny plates that slide over and adhere to each other. When water contacts these molecules, it binds to them, and forms a bridge between them, causing them to expand. When they dry out, they contract (this is why clay cracks) This property causes clay to form a natural barrier to deep penetration of moisture, a sort of ‘self-sealing’ top layer, unlike cement plasters, that wick moisture all the way through. However, it still allows vapor permeability.

Clay is ‘sticky’ and sculptable, and comes in a rainbow of colors, naturally!

Identifying clay: Get down under the humus!

Worm Test/Ball test

Make a ‘dirt worm’ or a ball out of damp soil. A clay worm will be moldable, and will not break easily.

Jar Test:

Fill a glass jar 1/3 full of dirt, and fill the rest with water. Shake well – very well! Let settle – the clay will settle last. If your jar is cloudy for hours after the ‘shake test’ – you’ve got clay! Ideally, you want at least 20 percent clay in your plaster dirt.

Clay vs Silt

Silt is made of tiny particles of rock that are larger than clay but smaller than sand. Silt often feels slippery, like clay, so knowing your silt/clay difference is crucial. Clay is STICKY, silt is slippery. Your ‘dirt worm’ will break apart easily. Another test – take a small clump of wet soil, flatten it against your palm, and turn your hand over – a clay will stick, silt will not.

Sand

Sand is the ‘strength’ of the plaster. The sand prevents the plaster from cracking and flaking off, and provides structure to the plaster. If you are a hard-core DIYer, or just love things being free and want to collect beach sand, do give it a good rinse before using it in plaster, as the salt will crystallize on the surface of your plaster.

Fiber

Fiber is the reinforcement and ‘tensile strength’ element. Any kind of mold and protein-free fiber can be used – hair, straw, hemp, cattail fluff, manure. Straw is nice for it’s availability. Make sure it is ‘bright,’ and does not arrive damp.

Additives

Flour paste, Manure, Prickly pear juice, fine fiber, lime, mica.....many more!

These three things together form the basis for most traditional architecture across the world, and, thankfully, are re-emerging!

Mixing it Up

Tips: Mix the clay and sand, adding the sand first to prevent clumping. Add water a LITTLE at a time – for some odd reason, if your mix gets too wet, it is difficult to get the mix ‘just right’ again. Then blend in the fiber. For small jobs, a wheelbarrow is fine. For large jobs, use the ‘pit’ or ‘tarp’ method, or a cement mixer.

Application:

Mask everything you don’t want mud on, and lay tarps. Remember to work slowly and steadily to avoid waste.

Do Tests to make sure you have a good mix – if it cracks, it needs sand. If it falls apart, it needs clay.

If your plaster is needing to go over a non-porous material, like metal or tarpaper (or even some kinds of milled lumber) there are a few techniques that make this feat possible (although not for large stretches of metal and tarpaper). Some plasterers like to use stapled metal lath to plaster over. This works fine, but must be done with great care to avoid air pockets. Air pockets create weak plaster. Another technique is to make a thick cob, or a straw-clay, and apply this in layers, allowing it to dry. Then you can continue the plaster. In the case of metal, or large expanses of wood, I would apply our ‘adhesion’ coat, then a high fiber plaster layer, then the fine plaster.

Adhesion Coat

Cooked flour paste, mixed with sand, finely chopped straw or other fiber, and a handful of clay. Sticky gooey textured adhesion.

Cooked Flour Paste Recipe

1. Add 1 quart white flour to 2 quarts cold water, and set aside. This should be reminiscent of pancake batter.
2. Boil another quart water. When boiling, add the mixture of flour and cold water. Turn heat to low, and continue to cook until the mixture thickens. Continually stir the bottom to prevent burning.

This is 'wallpaper glue,' and is used to add plasticity to plaster, as a primary ingredient in our form of alis (clay paint) and in adhesion coats.

On a bale, earthbag, adobe, or other wall, use three coats, after filling in any gaps with a mixture of clay-coated straw (straw-clay) or cob.

❖ Slip Coat

A hand-applied creamy clay slip.

This coat, pushed strongly by hand onto the substrate, allows the infill coat to be troweled on nicely, easily adhering to the clay underneath. It also allows the plaster to have a firm attachment (no air pockets) to the wall beneath, a key factor to achieve good wall strength. This is created simply by mixing your clay with water until you get something in between cake batter and cream. You want some substance, but not too much.

❖ Infill Coat

½" screened clay soil, sand, fiber, additives optional

I like to trowel on this coat, for simply achieved smooth walls in the end. This coat is typically thick, and coarse grained sand and a good amount of well chopped straw is recommended to decrease the likelihood of cracking and add tensile strength. I like to add flour paste for workability and a cup of lime water or ½ cup of lime per wheelbarrow full to kill any mold spores.

❖ Finish Coat

¼" screened clay soil, sand, fiber optional, additives recommended

This is the base coat for any color you are going to want on your wall. If you have found a nicely colored natural clay, this might be just fine. If you are wanting a white, yellow, or otherwise light colored wall, purchased white kaolin is a good choice. I find kaolin to be less sticky than the natural clays I have access to, so I always add flour paste to this layer, enabling me to add enough sand to prevent cracking, and still have a workable plaster.

Color Your Walls!

Alis, or Clay Paint

Mixture

Cooked Flour Paste is the base ingredient for our version of alis.

For every quart of flour paste, dilute with 2 quarts of water. This makes the paste liquid enough to add the other ingredients. Next, add enough colored clay, or white kaolin clay with pigments, to achieve a consistency that will spread easily with a brush, like thick cream. Earth pigments can be purchased from your ceramics shop. People have also had success with food coloring!

Add mica for a subtle, glittery sheen. Fine chopped straw can also be added. If adding either or both, use a little less clay, as the mica and straw will thicken the mix.

Application and Polishing

Apply with a brush, and when the paint has set but is still moist, use a damp (not wet) tile sponge to polish the surface, remove excess dust and reveal the straw and mica. A plastic lid with the edges cut off can also be used as a flexible scraper to further polish the surface to a burnished glow. You may wish to apply a second coat and repeat the process.

Lime Plasters

Lime Plaster is a mix of hydrated lime and sand. Lime is a 'natural' material, although it doesn't appear in 'plaster' form in nature.

CaCO₃ (limestone) is burned, releasing water and CO₂. It is bagged and shipped as 'quicklime' and then we soak it in water, mix it with sand, and apply it to our wall, where it CHEMICALLY cures back into limestone, releasing water and absorbing CO₂.

Why we Love it Anyway

- ❖ It kills mold.
- ❖ Extremely strong, yet flexible
- ❖ More water resistant than plain earthen plaster – it cures back into limestone on your wall.
- ❖ Excellent plasticity – comparable to clay.
- ❖ Our humid climate actually is Good for it.
- ❖ Vapor permeable
- ❖ Self-healing

Why it's not that Easy

Proper carbonation demands moisture – for 7-14 days after application, lime plaster has to be misted every day (in our climate) In a hot and dry climate, they need more.

Lime, like cement, is also caustic, and will burn your skin and damage tools if left on. Caution is key, goggles and protective clothing are as well. Keep vinegar handy to stop the burn if skin contact is made.

Making Lime Putty:

Type S Hydrated Lime (masonry section of hardware store)

Water

Tough plastic garbage can

Put a little bit of water in the bottom of the can. Then add lime slowly (wearing a mask and goggles) and stir, adding more water as needed. In the end, you want at least 2 inches of water covering your lime putty or it will start to carbonate.

Sand: You want to find rough, mixed grade sand for a stronger lime plaster

We usually do three coats with finer and finer plaster if using solely lime.

First two coats: 1 part lime to 2-3 parts sand, fiber additives optional

Finish Coat: 1.5 parts lime to 2-3 parts sand

For Love of Mud

by Keely Meagan

Mud is magic. Mud is fun. Mud can also be quarrelsome.

Sometimes earth plastering is so simple it is astonishing. Friends in Arizona and California have found that the earth beneath their straw bale cabins had the perfect proportion of clay and sand. All they had to do was add water, one also added a bit of chopped straw, and voila! Beautiful plasters that didn't crack.

So why do I quarrel with my walls? Well, I don't really (mud is always right). But I have had several long, drawn-out head-scratching sessions while questioning my walls ("just why are you doing that?") Working with mud keeps me on my toes and forever curious.

The simple truth is, mud will never be a standardized material like cement. Each batch of dirt is different and has its own personality. Earth plasters have a slower drying time and must be built up more slowly than cement. There are very few people with big machines to spray it on (and even fewer who have enough experience to be beyond the experimental stage).

If you want smooth walls that don't reveal the shapes of the bales, you are probably looking at a lot more labor and time. And then, with each new batch of dirt, there are the potential surprises. In this country, we are only beginning to recover the lost art of earthen plasters.

A hundred years ago in New Mexico, each village had its own location for the best plaster dirt. Adobes could be made from virtually any earth, but the plaster dirt was special and was often carted, if necessary, to the building sites. Its properties were known and loved, and the techniques for working with that particular dirt were passed down from mother to daughter in the tradition of the *enjarradoras*.

Unfortunately, much of that plastering knowledge was lost with the arrival of the upstart newcomer, cement. The source sites for the dirt are remembered by few. Carole Crews, Cornerstones (the folks who restore the old adobe churches in NM), and others have done a lot of research into the old ways. Susan Barger has some fascinating interviews with older folks who remember participating in the plastering as kids. She also analyzed old plaster samples, looking for clues to what makes a durable mix. Ms. Barger found the chemical reactions in mud plasters to be so complex that they had more questions than answers at the end of the research. Clearly more is needed.

But even if we understand how to work with one particular dirt, the fact remains that the soil of Santa Fe is different from the soil in Oregon. In fact, the dirt under my feet may be completely different from the dirt 30 yards away.

So What Does This Mean?

First of all, relax. Earth plastering is easy. Once in the mud, many of us feel we are remembering information our cells have tucked away for us long ago. Getting in the mud helps us access that knowledge. I had a similar experience in one of Robert Laporte's timber framing workshops. After struggling with the chisels for days, feeling clumsy and awkward, I experienced something clicking in, and all of a sudden I was handling that chisel like I'd been doing it for years.

But we shouldn't have to rely completely on intuition and memory of past lives! Or whatever it is that happens in those magical moments. So here are some tips avoiding potential problems and keeping the fun in the mud.

First, ask yourself these questions:

1. **How much durability do I want and need?** Is it a meditation hut or a conference center? Do you have ten kids?
2. **How much time do I have?** (If you need it finished this week, call the local cement stucco crew. Earth plasters take longer. Plan it into your schedule. Prioritize the areas that need to be finished first. Prioritize the exterior if winter is coming on. Interiors can be done in cold weather, but see sidebar cautions about plastering in winter.)
3. **How much money can I put into this?** If you are on a tight budget, get your friends to help you and/or do workshops. The materials are dirt cheap and the labor will be free. If it is a big house, consider bringing in an experienced person to show you the ropes and help you figure out the mixes. If you want to hire a crew and want smooth, polished walls, expect to spend more than you would for cement stucco. If anyone out there knows how to make it less expensive, write an article and let us know!
4. **What do I want the finished walls to look like?** It takes more labor and materials to create smooth walls out of lumpy, undulating bale walls. If you like the natural curves, keep them!
5. **What materials do I feel comfortable using?** The mining of materials - even dirt - is harmful to the earth. Look first at what is around you, and what friends have available on their lands. Try to use materials that have the least impact to create the plasters you want and need. We will all make different compromises - make sure yours feel ok to you. And get creative if compromising doesn't work for you. Perhaps you'll discover something that will help us all out!

Forgo chicken wire.

It's labor-intensive, a pain to work with and prevents you from working the plasters deep into the bales. Cedar Rose developed the idea of using a drywall texture gun to spray a thin clay slip onto the bales before plastering in order to help the plasters really grab onto the straw. It Works. (You can also apply the slip with your hands, but it's really messy).

I now use the following system: patch holes first by stuffing them with straw dipped into a clay slip. Let the patches dry. Spray the walls once with a clay slip, and have others come behind working the scratch coat in with their hands before the slip dries. Don't build out the wall at all, just work that first coat deep into the bales. (The elements of this system all came from Cedar Rose.)

On smaller buildings where it doesn't make sense to rent a drywall texture gun, I combine the slip and scratch coats by making one sloppy, high clay-content plaster and mush that directly into the bales. It seems to bond to the wall almost as well and saves me from going over the wall twice by hand.

Pits work well for mixing large batches of plaster if you have a bunch of people.

I think it is faster than using a mixer, and easier to let the plasters sit overnight. (Old folks in New Mexico say plaster that sits overnight is better - easier to work with and makes a more durable plaster.) To make a pit, put 4 or 5 straw bales together in a square or circle, and cover with a tarp big enough to go over the edges. Mix it by stomping around with bare feet. You can then roll the mix by grabbing the edge of the tarp and pulling towards you. (This helps get unmixed materials off the bottom). If there are only one or two people plastering, or it is getting cold outside, a mixer is faster and easier.

Use fresh, clean chopped straw so that you do not introduce mold spores into your plasters.

Chop it quickly with a leaf mulcher (a sort of stationary weed whacker that shoots chopped straw out the bottom). Sears has a "Leafwhacker Plus" for about \$110, and it is well worth the price for big plastering jobs. Keying plasters into the previous layer helps create a strong wall. Things that will help: wet down the previous layer of plaster before adding a new layer, and leave the scratch and brown coats rough (if you use a trowel, come back with your hand or whisk broom or rake to give it some texture before it dries.)

Earth Plaster on Drywall

If you use wheat paste in your finish plaster mix, you can put it right on drywall. It's quick, easy, and beautiful. Just be sure to use a gypsum-based (non-synthetic, non-asbestos) joint compound. I had to scrape our test patches off drywall and it was tough. If you want it even tougher, paint the drywall first with a mix of 10 parts hydrated or homemade wheat paste, 1 part fine sand and 1 part clay. Let it dry and don't wet it down before you plaster it. I've sunk 16 penny nails into drywall finished this way without splitting, chipping or other damage. It surprised even me!