TADELAKT

STEP-BY-STEP GUIDE

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INTRODUCTION – HOW TO USE THE GUIDE

The present Tadelakt Step-by-step Guide is an online document; you will need Internet connection to view its full content. All the photos and videos linked to the text have been uploaded to the Internet so you can view them at any time, separately from the text. There is also an off-line/printable version (without photos and videos) that you can use as a Step-by-step Guide to take on site. Be sure you read the entire guide before starting the application process. In the printable version there are only the practical steps, but it is important to know also the theoretical part.

All the green and underlined words in the text are hyperlinks. You can enlarge each photo by clicking on it. The links for the full galleries are the following: tadelakt steps, tools and materials and inspiration.

Before starting making your decision about the final appearance of your tadelakt, read carefully the chapter 7.1. Pigments and chapter 11. Decorative techniques to get some ideas. Different appearances need somewhat different preparations, materials and tools.

Choose your tools and materials according to the substrates you have and according to the final finish you would like to achieve. Tadelakt can be used on very wide range of substrates. It is suitable for covering different substrates in humid rooms or substrates that have straight contact with water. It resists heat and therefore can be used on ovens and on other heated substrates. Although in Morocco tadelakt is widely used on floors, we don't recommend this type of use. In wet rooms tadelakt surface can be quite slippery and in dry rooms it is easy to damage it unless it is a room where you use soft slippers or where you walk barefoot. Tadelakt can be used outside, but the weather conditions affect it a lot, it might easily lose its colour and water-resistance.

1. A BRIEF HISTORY OF TADELAKT

Tadelakt is a traditional Moroccan lime plaster. It has its origins in the High Atlas, close to the city of Marrakech, where the lime is excavated still today. In this valley there is a geological phenomenon that allows the combination of different components and creates a lime with particular properties.

The history of this material goes back to the 12th century, when the city ramparts of Marrakech (photo 1) were built. It is said that during the construction the workers tried to attain a straight wall by rubbing repeatedly with a stone, but instead they created a smooth and shiny surface, discovering the technique by accident.

Photo 1

This material and technique received the name of tadelakt (meaning *rubbing* in Arabic) and after the discovery of its water-resistant qualities it started to be used in cisterns and water tanks. Later it became the chosen material for the inside of the hammams (photo 2), the public baths, that are still used today by the inhabitants of Morocco on a daily basis. This created a warmer and water-resistant environment for the baths. Curiously the black soap traditionally used for finishing the tadelakt is the same used in the baths by the people to shower.

Photos 2-4

After this period tadelakt started to be used in most of the riads of the city, covering the walls with a smooth, warm and elegant finish. Quickly it expanded from the kitchens and bathrooms to the living rooms and open salons. And today tadelakt can be seen almost everywhere inside (photo 3) and on the facades of the buildings (photo 4). It can be used for decorative pieces, like lamps, pots, kitchen stands and living room shelves. There is no limit to its use because of the plasticity that the material allows.

In short, tadelakt is inseparable from the art, architecture and social history of Marrakech.

2. TOOLS AND MATERIALS

To work with tadelakt you need a site with water and electricity supply and several tools and materials. The choice of materials depends on the substrates and on the final result you want to achieve. Before you make your list, read the entire guide to know exactly what you are going to need.

Materials for preparing the substrates

- lime or cement plaster
- backing material for plaster: reed mat, wood lattice, wood lath, metal mesh
- mesh: glass fibre mesh, natural fibre mesh (e.g. jute mesh)
- tile adhesive
- aggregates (crushed limestone, marble, sand or other similar granules)
- waterproofing mastic
- mineral primer

Materials for applying tadelakt

tadelakt dry mixture

pigments

liquid olive oil soap (transparent or black)

carnauba wax (solid or liquid; transparent or colourful)

The list of tools

Here is a list of tools that you need for applying tadelakt. Some of them you'll need for preparing your substrates as well.

mixing bath/bucket

covered bucket

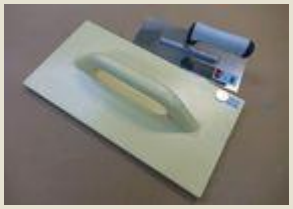
pigment mixer

plaster mixer

scales

sieve

staple gun and staples (only for reed mats)



steel trowel and float (wooden or polyurethane)

special trowels (Venetian or Japanese)

plastic trowel

filling knife

filling knife

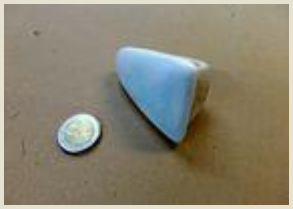
sharp cutter

brush for soaping

brush

masking tape

spray bottle



polishing stone (ceramic or natural stone, minimum hardness 6 on the Mohs scale)

lamp

sponge

light plastic

soft cloth (cotton or wool)

heat gun

stencil

The easiest way to clean your tools is to wash them with water straight after use.

3. SAFETY

Care should be taken when handling tadelakt (hydraulic lime) as personal injury may occur. Hydraulic lime is classified as irritating; it burns the eyes and dries out the skin. If it comes in contact with the eyes or skin, flush thoroughly with clean water for 15 minutes. With prolonged irritation after rinsing consult a doctor.

In the long term the use of hydraulic lime is not acutely toxic via oral, dermal or inhaled routes. There are no long term health issues, local corrosive effects (pH-effects) are the major health hazard.

Personal protection

It is recommended to wear suitable gloves, overalls and eye/face protection (photo 5). Rubber, leather or fabric/composite gloves provide suitable hand protection. Pay especial attention when handling tadelakt lime when you have any cuts or abrasions because the lime can enter your skin and burn it directly. If you have any cuts or abrasions in your hands use gloves during the entire process.

Do not breathe dust. In case of insufficient ventilation, wear suitable respiratory equipment. Store out of reach of children.

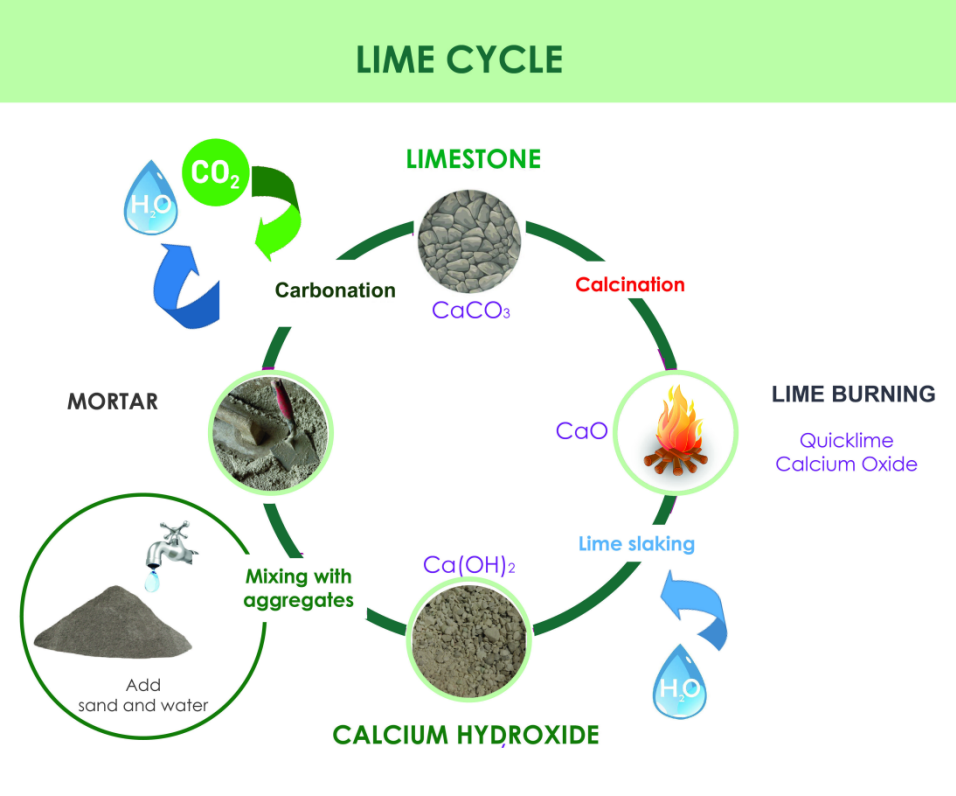
Photo 5

4. TADELAKT AS A MATERIAL

The essential part of a tadelakt mixture is hydraulic lime. Tadelakt, whether from the Moroccan handcrafted lime oven or factory produced, always includes hydraulic lime, different silica sands and clays, but also several other components like crushed limestone, dolomite flour, marble flour, cellulose, etc., quantities, proportions and exact materials vary from brand and location.

Construction lime and lime binders

The phases of construction lime production are (lime cycle): extracting the limestone, calcination, slaking, making the plaster, plastering and setting. Construction lime is a mineral binder that divides to air lime and hydraulic lime.



Air lime (high calcium lime) is a binder that consists mainly of calcium oxide or calcium hydroxide that, when mixed with water, dries in the air, binding slowly the carbon dioxide from the air and sets, preserving its strength. The hardening of air lime is impeded under water.

Hydraulic lime can set and harden both in air and under water. Hydraulic lime sets and hardens due to the hydration processes when mixed with water, and the artificial stone that has been formed as the result of this process is durable also in water. In addition, setting due to CO_2 takes place. Hydraulic limes can be divided into artificial hydraulic and natural hydraulic limes. Artificial hydraulic lime is produced of suitable raw material mixtures (mainly cement and different polymers), natural hydraulic lime is produced by burning (temperature under 1250 °C) and slaking into powder the limestone that includes a lot of clay and silica.

Natural hydraulic lime is achieved when the limestone has "impurities" of clay of more than 25%. These limes are classified according to their compressive strength: NHL 2, NHL 3.5 and NHL 5.

The production of natural hydraulic lime has longer traditions in Middle and Southern Europe where limestone with suitable qualities is found.

Lime in tadelakt

In tadelakt hydraulic lime is used due to its ability to set under water and the hardened hydraulic plaster is also durable in water (whilst air lime is not). Having hydraulic lime as binder in a tadelakt mixture is a precondition of achieving a water-resistant surface. In addition a special technique is used for applying tadelakt.

5. SUBSTRATES

A correctly prepared undercoat is essential for achieving a high-quality tadelakt surface. Tadelakt is a very strong material and it will not forgive structural movements. If you don't prepare your undercoat carefully you will have cracks very soon.

In Morocco, tadelakt is traditionally applied to a loam (rammed earth and earth bricks) undercoat. The absorption of dampness by the loam guarantees an even drying of tadelakt. The stored dampness in the earthen walls is released later and supports the carbonation of the lime plaster.

The substrate should be solid, firm and able to carry weight. Not all construction materials are suitable to be used as a direct undercoat for tadelakt, because it is a hydraulic and carbonating lime mixture. But most substrates can be pre-treated by applying a suitable undercoat.

The undercoat should be firm, clean, straight, homogenous, evenly absorbent, rough (with particles striking out and with small cavities), and free of cracks. Dust, wallpaper and old coatings of plaster or paint without stable adherence should be removed.

Tadelakt can be applied directly on rough mineral undercoats like:

- air lime
- hydraulic lime
- cement
- lime cement
- tile adhesive

All other substrates need previous specialized work to achieve mechanical anchoring and an evenly absorbent surface to apply the tadelakt plaster. The choice of material, for preparing your substrate, must always be appropriate for the specific situation; therefore a careful selection of binders and aggregates must be made. It is possible to work the tadelakt on a high variety of substrates, whilst never forgetting that the quality of the undercoats goes a long way in determining the good finish of tadelakt.

Some of the other possible substrates:

- plasterboard
- fibreboards
- artificial resin plasters
- cellular concrete stones
- ceramics
- tiles
- wood
- wood derived products
- earth

In some countries waterproofing humid and wet rooms is obligatory. Although tadelakt is a water-resistant material (as long as it is done correctly and is not damaged), the use of additional waterproofing materials is recommended (especially in new houses, where gypsum walls or concrete floors in bathrooms should be covered with waterproofing mastic). We strongly suggest always using waterproofing mastic in places that have direct contact with water (baths, basins, etc.).

If you have already a suitable undercoat for tadelakt you can continue reading chapter 6. Recommendations before you start working.

5.1. Making a suitable undercoat for tadelakt

Base coats have two main functions: protecting the substrate from mechanical stress; and to create a good surface for the final finish. Plastering is not something that can be easily taught without a practical demonstration, but if you have already done some plastering or can get someone to show you how, there are several guidelines that will help you to use plasters successfully.

5.1.1. Preparing the substrate

The extent and type of the preparation needed depends on the material and condition of the substrate to be covered.

There are several steps that must be done:

Cleaning the surface that will be plastered is essential for good adhesion. Salt deposits, loose particles and dirt must be removed. This is primarily done by brushing the surface with a stiff brush. Some cases might require thorough washing. The applied mixture needs to be 100% in contact with the surface; all these loose particles will offer an obstacle for this purpose.

Checking air conditions; as a rule when plastering the air and surface temperature should not be below 5 °C. Keep doors and windows closed during and after application and prevent any heat sources (heaters, lights and direct sunlight) from drying the material out too quickly.

Moistening the surface; substrates should not absorb water too quickly. Strongly-absorbent surfaces should be thoroughly moistened before application. Moistening the substrate with clean water using a spray bottle or brush are appropriate methods, where the more porous the background the more water will be required. Allow the water to soak in, then spray again, and repeat until the surface is thoroughly damp. All substrates, absorbent or not, should always be moistened prior to application. This is to provide good contact between the surface and the new coat. Remember that water will drain down through the substrate due to gravity, so the upper parts of the substrate will start to dry out faster than the lower parts and you may need to spray these areas more frequently.

If you do not plan to cover the entire substrate with tadelakt, but only a part of it, you must frame your tadelakt area with a masking tape. Apply masking tape before moistening the surface and apply the plaster only inside the frame. Remove the masking tape when the plaster has dried.

Choose the next subchapter to read according to the substrate you have.

5.1.2. Lime or cement plastering for brickwork and building boards

The number of coats in the plastering varies while normally is three. The thickness of the plastering is determined by, among other things, the evenness of the background and the surface desired. If the background is relatively uneven, such as ordinary brickwork, and the surface is to be smooth, it is necessary to have a total thickness of 10-15 mm.

It is important to reach an even surface; fill all the holes with the same plaster to be used for plastering. Larger gaps can be repaired with the same material as the substrate. Any hollow or decayed plaster should be hacked off and any loose pointing should be raked off and replaced prior to plastering. The more even the surface is the better the resulting finish will be.

The higher the cement content, the higher the mechanical stress on the substrate during and after the setting of the plaster. A basic principle in choosing a plaster is therefore electing a binder with the lowest cement content possible. This is especially important for weak substrates.

If you want to mix your own plaster, read subchapter 5.2. Mixing your own plaster.

First coat

Lime, cement or mixed plasters shrink as the water in them evaporates. This can be minimized by ensuring that the substrate is well moistened before you start and by applying the plaster in the appropriate thickness according to the grain size. Plasters must be applied using as much pressure as possible to force the plaster onto the surface, forming a close contact between plaster and the substrate.

The first coat can achieve a good result by throwing the plaster on from a trowel. This technique ensures the best bond between the plaster and the substrate, expels any air in the mix and ensures that the plaster is well compacted.

Using a mesh

If you work on building boards, reinforcing the surface is needed. When building boards are fitted together a joint is created, filling in or covering joints is needed. It is also necessary to cover screws and holes to prevent cracks as well as reinforcing joints with a mesh (natural fibre or glass fibre mesh). The same situation occurs when the substrate has different surface materials, especially when structural framework is not covered. A mesh in the first coat of plaster is necessary whenever there is a joint, however, using it in a general way will avoid risks and provide a stronger surface. Therefore **we suggest using mesh in the first plastering coat even if you have a strong and stable substrate**. It helps you to avoid cracks. Apply the mesh into the first coat by pushing it in with a trowel.

This coat needs to be ruled off, thereby further straightening the work, in order to produce the desired level of finish. Once sufficiently set the plaster should be rubbed up with a normal float and finished with a devil float to slightly score the plaster to form a key (mechanical support) for the topcoat of plaster (photo 6).

It is of the utmost importance that the first coat is adequately set before continuing. To follow on too soon with subsequent coats will result in much greater shrinkage problems, as the individual coats will be shrinking back at different rates.

Second coat

Once you have applied the first coat and have a fairly flat surface that has dried enough, subsequent coats can be applied successfully using a trowel. As you apply the plaster do not try to smooth the surface by stroking with a steel trowel or float. Excessive working of the surface of the wet plaster with a steel tool will draw the lime to the surface creating a lime-rich layer over a weak lime-depleted coat, which can lead to premature failure of the plaster.

Simply apply with one stroke, if there are high spots or ridges hold the edge of the trowel or float against the substrate and draw it across the surface. This will cut off the rough bits and leave a good open texture.

Photos 6-7

This coat is the straightening coat so after application, when the plaster starts drying, start scouring the surface with a float, using a circular movement and pushing hard in order to consolidate the plaster. This will help to reach an even surface. This will also enforce the bond between the coats and remove the high spots creating a flatter surface ready for the next coat. Cracks may develop, you must make sure that the cracks are due to shrinkage and not because the coat is peeling away from the backing; push the coat gently to check that it is firm against the backing. It is vital to take time and trouble over creating a good key, as the adhesion of the subsequent coat of tadelakt depends on it (photo 7).

You should leave enough time for each coat to dry before applying the next coat. The appropriate roughness of the second coat will depend on the grain size of your tadelakt plaster. Your second coat (previous coat to tadelakt) should have a similar grain size, not smaller, as the tadelakt mixture.

Final coat – tadelakt

The final coat is the visible layer of the finished plastering. Continue reading chapter 6. Recommendations before you start working.

5.1.3. Wooden substrates

If your substrate is made of wood, it needs to be prepared as following:

1. Apply a plaster backing (reed mat (photo 8), wood lattice, wood lath or metal mesh) on the wooden substrate by

using staples. This will provide a good connection with the plaster, because if you plaster straight onto the wood it will not have a good binding.


Photo 8

2. When plastering wooden surfaces use stronger plasters (e.g. hydraulic lime plaster). The plastering steps are the same as in the chapter 5.1.2. Lime or cement plastering for brickwork and building boards, so here they are described very shortly.
3. For the first coat use a plaster with big grains (about 0-4 mm) and apply a plastering mesh into this coat (as wooden substrates are not very stable). Let the first coat dry.
4. If the substrate is very uneven, add a second coat of plaster with a big grain size (about 0-4 mm) to make the substrate more even and straighter. Let it dry again.
5. The final coat should be done with a plaster that has grain size up to 2 mm and the surface should be left rough and textured so the tadelakt plaster will have a good key.
6. Let the plaster dry and harden until it is totally dry.
7. Apply tadelakt. Continue reading chapter 6. Recommendations before you start working.

If you want or must use a waterproofing mastic, then you add it on the completely dried finishing coat (after step 6). When the waterproofing mastic has dried, you follow the steps of tile adhesive from the following subchapter.

5.1.4. Using tile adhesive on wide range of substrates

If you have substrates that are covered with waterproofing mastic, their preparation should be following:

1. Apply thin coat of tile adhesive on the substrate with a trowel and push a plastic mesh into the wet mixture everywhere.
2. After applying the mesh and before the first coat of tile adhesive is dry, apply with a trowel another coat of tile adhesive. This coat will provide the key for the tadelakt coat so the addition of aggregates is needed to provide a rough, textured surface. Crushed limestone, marble, sand or other similar materials must be added to tile adhesive to achieve a more coarse plaster (the proportion of tile adhesive to aggregates should be 3:2 according to their dry volume).
3. When the mixture has hardened a little, trowel the surface with a wooden or plastic float to make the surface of the mixture as rough as possible (photo 9).


Photo 9

4. You can start applying tadelakt when the surface is completely dry and hard (usually after 24 hours). Continue reading chapter 6. Recommendations before you start working.

With this tile adhesive technique you can cover also substrates that are not common for tadelakt, or strong surfaces unsuitable for straight application of tadelakt (cast iron baths, glass, ceramic tiles, etc.).

Although lime plaster is a suitable surface for tadelakt, you can still use tile adhesive steps on top of it, as it makes the surface more evenly absorbent and gives a very good adhesion for tadelakt.

If you do not plan to cover the entire substrate with tadelakt, but only a part of it, you must frame your tadelakt area with a masking tape. Apply the tile adhesive only inside the frame. Remove the masking tape when the tile adhesive has dried.

5.1.5. Gypsum plasters

Apply a primer to provide roughness and for absorbance regulation on gypsum plaster. Using mineral bonding primers (like water glass silicate binder with quartz, tile adhesive) to apply lime plasters on non-textured surfaces (plasterboard, gypsum plasters) provides a key which enables continuity of a lime plaster finish throughout, however liquid primers might be used to provide absorbance regulation: e.g. water glass or casein primers.

Then follow the steps of plastering from subchapter 5.1.2. Lime or cement plastering for brickwork and building boards.

5.1.6. Earth and straw bale substrates

Lime plasters are suitable for use as a finish coat for loam bases, as long as the strength gradient according to the plastering rules is compatible with the loam base coat. The general rule of plastering is that the strength of the plaster should increase from the top coat to the base. When the top coat is harder, the base cannot normally adhere to it and should therefore be reinforced with a mesh. It is a good solution to apply an intermediate coat of an earth mixture with a 20% proportion of lime.

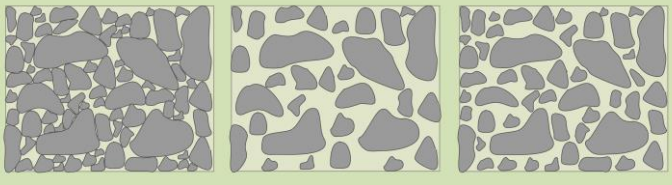
Earthen substrates are very absorbent, therefore the amount of water required to moisten the substrate should be increased.

Plastering a straw bale construction:

1. Straw bales (e.g. made of wheat or rye straw).
2. Clay slip made of local earth and water. This coat is applied deeply into the straw by hand (wearing thick rubber gloves to prevent scratching) or by using a spraying machine.
3. First coat of earth plaster (1-1.5 cm), coarse sand (0.5-4 mm), clay and chopped straw. Scratch the coat after application.
4. Second coat of clay plaster (0.8-1.5 cm) stabilized with 20% of hydrated lime and coarse sand. Scratch the coat after application.
5. Third coat of lime plaster (0.3-0.7 cm) made of hydrated lime and fine sand (0.4-1.3 mm). After application smoothen the coat with a wet sponge. Continue reading chapter 6. Recommendations before you start working.

5.2. Mixing your own plaster

The “grading curve” should always be present when mixing your own plasters. A well graded crushed stones selection consists of a wide range of different particle sizes, from very fine to coarse. These different particles should ideally be distributed so that the highest proportion of the aggregates consists of the medium-sized particles (marble, lime, quartz). The reason for this is because, if only a couple of sizes are present, and if they are not appropriately distributed, the grains will not pack tightly together to produce a cohesive plaster. The finer particles serve to fill the



A B C

A: Dry plaster; high proportion of big grain size will provide a rough workable plaster, particles will touch in between them.
B: Loose plaster; excess of binder and water, particles will sediment.
C: Plastic plaster; mixtures where binders fill up space between particles in a proper proportion will provide the perfect consistency.

spaces between the larger. On the other hand if coarse particles exceed the resulting plaster will provide difficult to work. It will require the addition of water which could result in a risk of shrinkage, and hence cracks.

The grading, and specific grain size, required for a plaster is largely dependent on the intended plaster function. Well graded, sharp sand is often the best choice for plasters. The characteristics of the sand influence the amount of lime to be used. In addition, the amount of sand used and its granulometry are very important for the characteristics of plasters while fresh as well as hardened. The sands can be: calcic, dolomitic or siliceous.

Granulometry

Sands should generally be used which have a maximum size that is appropriate to the thickness and finish of each coat. In any case, it is not recommended to exceed a maximum size of 4 mm. The applied plaster coat can be thinner in relation to the fineness of the sand; however, it should be noted that an excess of fine particles increases the need for water, and as a consequence, the shrinkage of the plaster during drying increases, adherence is reduced and there is a risk of microcracking.

The cleaning of the sand is essential, sands should be used which do not contain clay materials, organic matter, and compounds which reduce the durability of the plasters, for example: oxidisable iron sulphides (pyrites, marcasites); mica particles; and shales with laminar or scaly structures in sufficient quantities that can affect the finish of the plaster, and its mechanical strength and hardness.

The characteristics of mixtures for the undercoats will depend on the grain size of your tadelakt plaster. There is a large market of ready mixed lime plasters to perform the technique of tadelakt. Working with the genuine material from Marrakech you should first analyse the size of sieve that was used. It depends on the artisan who is in charge of the process and most of the times the tools are handmade. It is not an unusual situation to find different sand grain sizes out of a proper control, which can easily reach 3 mm. However there are now some producers highlighting quality control with controlled sieving, packaging and conservation practices all taking place. As a general rule a maximum of 2 mm particles can be present in a tadelakt mixture.

European brands producing ready mixed tadelakt plasters have their personal criteria, therefore you can find those that are mixing the lime binders with sand particles from 0.5 mm to 2 mm.

This is why depending on the mixture you choose to work you should adapt your previous layer to it. As there are many different good recipes for lime and cement plasters, we do not give here the exact dosages. We recommend trying different recipes and choosing the one that suits you the best.

6. RECOMMENDATIONS BEFORE YOU START WORKING

There are several advices to keep in mind before you start working with tadelakt.

- Always start with small samples (0.5-1 m^2) and practice a lot before working on real site.
- When working on a real site, start on smaller surfaces to understand your capability; and if something goes wrong – the smaller the surface, the less you have to remake.
- Always cover the whole surface in one day. If the surface is big, start working right in the morning to be sure that you have enough time to finish it. Otherwise you will have to work late at night, as you cannot leave tadelakt unfinished. If you do not have enough time and capability on your own, ask someone to help you.
- Make one surface at once – from the beginning to the end. When it is finished and you still have enough time and energy, you can take on the next surface.
- If you have many surfaces and you cannot manage to do them all on the same day, the suitable places to stop the work are the inner corners, in extreme cases also the outer corners.
- While tadelakt is drying you have to control the surface often. Never leave the work site during the drying process – if you miss the right time, you cannot continue with the next step and you have to start again from the beginning!

Following those points is essential for successful work with tadelakt.

7. PREPARING THE TADELAKT MIXTURE

For making the tadelakt plaster the dry powder must be mixed with clean cold water. Weigh out the necessary amount of dry tadelakt powder and measure out the water according to the product information (photo 10). First add the water to the mixing bath/bucket and then gradually add the powder (photo 11) meanwhile slowly stirring with a plaster mixer (photo 12).

Photos 10-12

Photo 13

The viscosity of the mixture is good when it is even paste (photo 13). Then the mixture should stay in a covered bucket for some time (follow the product information). This ensures that the mixture is more viscous and plastic and therefore it is easier to apply it.

Before using the mixture it must be stirred thoroughly once more. The prepared plaster must be used within 2-3 days (this time may vary with different mixtures, follow the product information). You can also keep a smaller amount of the plaster for a longer time (in case you need to repair some places) in a covered bucket, but after it has completely hardened, it should not be used anymore. While you do not use the mixture, keep it in a covered bucket. The minimum temperature for making the plaster is +5 °C.

7.1. Pigments

Traditionally tadelakt has been applied with no pigment. The natural shade of tadelakt varies according to the different sands and limes used to prepare the mixture. The colour can be something from a whitish or pearl-ivory tone to a light brown (photo 14). If you do not plan to use pigments, you can continue reading chapter 8. Preparing the surface.

Photo 14

How to choose a pigment?

When choosing a pigment for your tadelakt mixture make sure you use:

- alkaline and acid resistant pigments. Because if they are not alkaline resistant the colouring will fade away as it interacts with the lime.
- natural mineral pigments. Chemical colourants or even other powder pigments that you can find in general construction material shops are often not able to keep their colour once they enter in contact with the lime, because they are not alkaline and acid resistant.
- pigments that are not from vegetable or animal origin. Vegetable or animal origin is more suitable for textile tinting. They will not survive the lime, and besides that, they will also provoke a bad smell.
- pigments resistant to sun (if used outside) or to artificial lights (if used inside), to water and to heat. For this choose alkaline and acid resistant pigments.

Make colour samples

Once the pigment has been chosen it is necessary to try it out and make colour samples (e.g. on small tiles; photo 15), because the colour of the pigment will intensify as you polish it with the stone, but will also lose about 50% of intensity once the tadelakt is dry. The process of drying can take from 2 to 4 weeks. The colour will also change and become shinier with the application of the soap and after the waxing. So it is necessary to submit the samples to these treatments before you make a decision on what pigment to use.

Normally the colour samples will dry much faster (sometimes from one day to the other or in just a few hours) because they don't have a thick substrate behind blocking the drying process. So you don't have to wait 2 to 4 weeks to see if you have the right colour. The drying timings might also depend on the weather conditions.

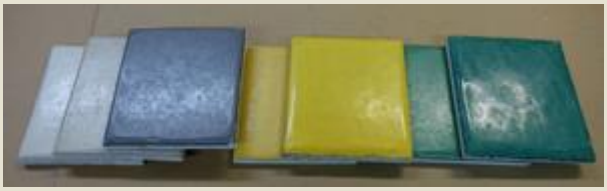


Photo 15

When starting a new project you should count on at least two days of preparation, for making the colour samples and preparing the surfaces.

Do not use more than 10%

Pigments, unlike dyes, do not mix with water; they will simply fill the very fine gaps in-between the lime micro-structure. This is something you can only see with a microscope but it helps to understand that pigments do not have a binder of their own and always need water to bind with the lime.

If you add too much pigment to the mixture it will become saturated. This will make the tadelakt mixture very difficult to work with and once the tadelakt is ready the pigment will simply come out of the surface when you pass your hand on it. So to be safe you should not use in your mixture more pigment than 7% of the weight of the dry tadelakt powder. Some pigments can be used up to 10% but make sure you read well the manufacturer's instructions.

Mixing the pigment

It is important to make this step in a very methodical way. Use the scales to measure the amount of dry tadelakt and dry pigment that you will use so you can find the right proportions (photo 16). You can use one pigment or combine pigments together to make colour combinations. To be able to repeat the colour you have once made, it is very important to write down in a safe place the proportions of tadelakt and pigments used, the type of tadelakt and the brand or the source of pigments (photo 17).

Photos 16-17

First mix the pigment with water (photo 18) and make sure all the grains are properly mixed (photo 19). If your working conditions allow you, it is better to mix the pigment up to a paste the day before so it can stay resting, but if you don't have the time it is also fine to do it on the same day. Just make sure you don't mix the pigment with too much water if the tadelakt mixture is already very liquid. You will need to find a balance between both mixtures to make sure you end up with the right consistence.

Photos 18-19

If you have left the tadelakt mixture resting for a few hours you should re-mix it before you add the pigment mixture. Be sure that you get all the pigment out of the bucket where you mixed it, as even small changes in the amount of pigment can change the colour noticeably and it might be very difficult to repeat the colour later. Mix the tadelakt and

pigment together and stir very well with a strong plaster mixer (photos 20-22). Thorough stirring is important to make sure that you don't have pigment lumps and a surface full of white spots.



Photos 20-22

Using pigments to divide surfaces that are too big to do in one day

Sometimes we are confronted with very big work surfaces. In this case you can ask for the help of a co-worker or use something to separate the surface into smaller parts. You can use a piece of metal, some beautiful tiles or stones, and this will allow you to make a separation between the square metres one can make in a day's work and the next (photo 23).

Photo 23

But another very simple way to make a separation is by using a different tadelakt colour (photos 24-26). In this case you simply do the tadelakt up to the point you want and make a nice cut/finish. You can cut the edge in a straight or curvy line with sharp cutter; or you can use masking tape to mark the divided areas. The important thing is to make sure the edge is strong and levelled so the next tadelakt can join nicely. The next day you apply the soap and a few weeks later the wax. The disadvantage about this choice is that you need to wait for the tadelakt to dry for at least two weeks to continue with the next colour. This waiting time is necessary because you need to make sure the tadelakt is strong, dry and treated with wax so it will not be damaged with your working tools, or stained with the other colour as you are working next to it. The result can be very beautiful.



Photos 24-26

7.1.1. Types of pigments

Natural earth and mineral pigments

Natural earth pigments are naturally occurring minerals that are extracted straight from nature. These natural pigments are found in rocks and soils around the world, where different combinations of minerals like manganese or iron oxides create vibrant colours that are unique to the regional landscapes. Some locations are famous for their colour mines like the Italian yellow Sienna or the French Provence ochre. Also in Marrakech tadelakt and most of the other plaster finishings were traditionally coloured with the red iron oxide pigments found in the surrounding areas, giving the city its nickname of the "red city".

Different colours can be obtained by heating the minerals present in clay, provoking different shades that go from light yellows and greens to dark reds and blacks. Although more rare, some pigment mines are also found near volcanos. These are called spinel pigments. The intense heat they are submitted to inside the volcano and the exchange of minerals creates a pallet of strong and bright yellows, oranges, greens, turquoises, and blues.

Synthetic pigments

These pigments are not natural iron oxide earth pigments. They are not found in the earth as natural soils, but are created using natural components such as iron and clay that are manipulated in an industrial way, resulting in bright shades, UV resistant, and with a powerful tinting strength. They are not as eco-friendly as the natural earth pigments and sometimes can be toxic due to the use of heavy metals.

To learn how to make decorations on tadelakt with pigments, read chapter 11. Decorative techniques.

8. PREPARING THE SURFACE

Photos 27-30

Before applying tadelakt the surface of the undercoat must be cleaned – use the edge of a steel trowel for scratching off loose particles and higher spots (photo 27). If you plan to cover with tadelakt only part of the undercoat, use masking tape to protect the surfaces near the edge of the tadelakt. Tadelakt allows you to make all kind of curvy edges, make the desired shape on the wall with masking tape (photos 28-29). Clean the surface with a soft brush (photo 30), then moisten it with clean water as evenly as possible. Use a spray bottle or a soft brush (photos 31-33). The need for moistening depends on the type of the substrate, on the temperature of the room, on the residual moisture of the surface, on the humidity of the room and on the viscosity of the plaster.

The surfaces in unheated rooms with a high level of humidity usually have high residual moisture and they must be moistened lightly or not at all (try it first on a small area to see if there is a need for moistening). The surfaces in warm, dry rooms are usually very dry and might need moistening several times (if the surface absorbs water very quickly after the first moistening, then it should be repeated).

Photos 31-33

Moistening fastens loose dust, improves the connection between the mixture and surface and does not let the substrate absorb humidity from the mixture too quickly. Strongly absorbing substrates (brickwork, old porous plasters, lightweight stone walls, etc.) must be moistened several times, to avoid the mixture drying too quickly. **Be aware that too much moistening** (the water stays on the surface and does not absorb anymore, but flows down on the surface) **extends the drying time of the mixture remarkably**.

9. APPLYING TADELAKT IN TWO COATS

Tadelakt plaster is applied on the prepared surface as two thin coats with a plastic or steel trowel or with a filling knife (choose the tool according to your preferences). We do not recommend plastering in one thick coat, therefore we do not describe it here. Optimal coat thickness is 2-3 mm, so when plastering in two coats they should be altogether 4-5 mm (depending on the plastering mixture the thickness of the coats can be bigger, follow the product instructions). **Before you start applying tadelakt, the mixture must be stirred thoroughly**.

9.1. First coat

Photos 34-36

The first coat is about 2-3 mm thick and is applied to the surface with a plastic or steel trowel or with a filling knife (photo 34). The applied plaster must be floated immediately with a wooden or polyurethane float, so that the plaster enters the pores of the surface and enables a strong connection (photo 35). Floating makes the plaster more even and makes its surface rough and porous which is a perfect base for applying the second coat (photo 36).

Photos 37-38

If you smoothen the first coat only with a trowel, it would remain too smooth and dense. It might reduce the connection between the two coats and the plaster might come off later when polishing, therefore floating is important. After floating the first coat it must harden for a while (usually about 5 to 30 minutes, it depends how fast the plaster dries – the plaster will become solid and matte, the watery shine on the plaster (photo 37) will disappear (photo 38)). **Do not leave your work site while tadelakt is hardening!** Tadelakt might dry very quickly and if you miss the right time it is hard or even impossible to continue working with it. When touching the plaster with your hand it must not stick nor make it wet. If the first coat has hardened for too long and has become too dry, the solution is moistening. Use clean water. You get a more even result when using a spray bottle. Watch the video about first coat.

9.2. Second coat

Photos 39-40

When the first coat has hardened enough, then the second coat is applied with a plastic or steel trowel or with a filling knife (photo 39). The second coat must be as thin and even as possible (about 2 mm; photo 40). If you use a rough tadelakt mixture (e.g. Moroccan tadelakt), first float and smoothen the second coat immediately with a wooden or polyurethane float for making the surface more even and to get the smaller particles of the plaster to the surface (if necessary, you can spray water on the surface to make floating easier). Then smoothen the surface immediately with trowel or filling knife to close the bigger pores and to make the plaster surface dense and smooth. If you are able to apply the second coat very evenly and smoothly or if the tadelakt is drying very fast, you can skip floating

and start right away smoothening with a trowel (photo 41). Continue smoothening until the surface is even and without big rough and porous areas (photo 42). Watch the video about second coat and closing the pores.




Photos 41-44

If you have some outside corners, use your trowel to make an edge of 45 degrees (photo 43). It doesn't have to be very nice and correct as you finish it later when it has dried for some time. Also make sure your inside corners are more or less nice (photo 44).

You should avoid smoothening and tightening one place for too long. This can cause the plaster to come off from the wall or make an air bubble under the plaster. If the plaster has come off due to excessive tightening, fill this hole with new plaster and leave this place to harden. If there is an air bubble under the surface, it should be opened and filled with new plaster and left to harden (do not try to smoothen this place immediately, it only increases the area that needs repairing). When the plaster has hardened enough, then you can start again smoothening and tightening it slightly and carefully (we recommend using a plastic trowel).

After the surface is evenly smooth, leave it hardening. **Do not leave your work site while tadelakt is hardening!** Tadelakt might dry very quickly and if you miss the right time it is hard or even impossible to continue working with it. There is no exact hardening time for tadelakt as it always depends on your working conditions, but with some practice you get the feeling when it is the right time to continue with the next step.

9.3. Closing the pores and first polishing

Smoothening, tightening and polishing tadelakt is very important for achieving a water-resistant surface with high density. You can start tightening the surface when the plaster has hardened enough and when tightening with the trowel or stone does not cause the surface to come off with the tool. Be aware that the plaster may dry very unevenly; drying is generally faster on the edges and on the upper parts of the surface.

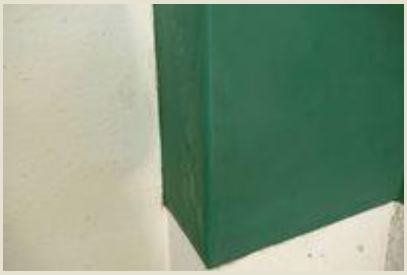
First the surface should be tightened with a stainless steel trowel, recommendably with a Venetian or Japanese trowel and then with a smaller plastic trowel (photo 45; there is a risk that other trowels might leave dark traces of steel on the already tightened and hardened surface). The purpose is to achieve a smooth and as evenly tight surface as possible (to close all the pores). Avoid traces of the trowel on the surface. Watch the video about second coat and closing the pores.



Photos 45-47

When you have applied tadelakt in two coats and you have done the first tightening with a steel or plastic trowel, then remove the masking tape. Hold a trowel on the edge of the tadelakt to avoid that the masking tape removes some tadelakt from the edge (photo 46). Smooth carefully the edge of the tadelakt with the edge of a plastic trowel or with the polishing stone to an angle of 45 degrees (photo 47). This way you get a nice and correct edge for your tadelakt

(photo 48). If there are holes in the edge, fill them with tadelakt and smoothen them immediately. Also finish the outside corners with a plastic trowel or with the polishing stone the same way as the edges, by giving them a nice round finish (photo 49). Use the edge of a plastic trowel to finish the inside corners (photo 50). Watch the video about corners and edges.


Photos 48-50

Polishing with stone

When the tightened surface is finally nice, smooth and evenly tight then this can be the final finish and you can start soaping (photo 51). But you get a more special result when after tightening with a plastic trowel you polish the surface with a polishing stone. Suitable stones are strong stones without pores (at least with hardness 6 in the Mohs scale), for example Kreidezeit polishing stone, but you can also use stones that you find in nature, as long as they have a straight edge/side.


Photos 51-52

Before starting to polish be sure that the plaster has hardened enough and it will not come off with the stone. You should do small round movements with the stone by pushing slightly on the stone and making pressure on the surface. This process tightens the surface even more, closes the pores and makes the surface a little bit shiny. Start polishing from the drier areas (usually from up and from the edges) and move on evenly on the surface (avoid "a bit from here a bit from there" style). **Do not leave noticeable straight edges of polishing areas**, move on irregularly and chaotically (photo 52; then the polishing edges are not very easily noticeable). Be very careful when polishing the edges, as it is easy to break them. Watch the video about first polishing.

Repairing holes, scratches, cracks and bigger damages

When there is a bigger pore or a small hole on the surface or if you have accidentally damaged the surface (scratches, notches with tool, etc.) then you can fill those places (use your fingertip or a spatula) with fresh fine plaster (photo 53) and polish it with a stone immediately. Places that are repaired later, usually remain slightly visible (especially when pigment is added to the plaster).




Photos 53-56

You should always avoid tightening one place for too long. This might cause the plaster to come off from the wall or make an air bubble under the plaster (photo 54; this can happen very easily if you have started

polishing too early and the plaster has not hardened enough). If the plaster has come off due to excessive tightening, fill this hole with new plaster and leave this place hardening. If there is an air bubble under the surface, it should be opened (photos 55-56) and filled with new plaster (photo 57) and left hardening (do not try to polish and smoothen this place immediately, it will only make the area bigger that needs repairing!). When the plaster has hardened enough, then you can start again smoothening and tightening it slightly and carefully (use first plastic trowel and later polishing stone, add fine plaster if the surface is still porous and repeat smoothening). Try to mix the edges of the repaired area with the already applied tadelakt very evenly, so it will be less noticeable later (photo 58). When a bigger area needs repairing, consider remaking the whole wall as the repairs are usually easily noticeable (photo 59).

Photos 57-60

If you notice the next day, before polishing the surface, that there is a crack on the surface, then it is probably a crack due to hardening (you have put too much plaster on this area). Micro-cracks disappear with polishing and soaping and there is no need to do anything special with them. Bigger cracks (photo 60) should be filled with fine plaster paste before soaping the surface (apply the plaster with your fingertip only to the cracks, wipe off the rest!).

9.4. Soaping

If you want to do fresco decorations, it must be done before soaping; read chapter 11. Decorative techniques.

For soaping tadelakt the best soap is transparent liquid olive oil polishing soap. Also black liquid olive oil soap is suitable; it leaves a dark shade on the surface, is much greasier and dries slower than the transparent olive oil soap. If you have none of those soaps, transparent liquid household soaps made of natural vegetable oils are also suitable. The soap should be mixed with water to get soapy water that is suitable for application. From now on "soap" means soapy water in this guide.

The result of the reaction of olive oil soap and tadelakt is a lime soap that does not dissolve in water and makes the surface water-resistant and dirt repellent. Soaping and polishing the surface should be done about 24 hours after the application of the plaster, so the surface has dried and hardened more (you get a more even result when the entire surface is dry; photos 61-62). Before applying the soap, check the surface to be sure there are no bigger cracks or holes/pores that need filling. If there are, fill them with fine plaster paste (wipe off immediately the excessive paste) and let it dry. Then clean the surface with a soft cloth; this has to be done to remove all the abrasive particles that could harm the surface during the polishing process. Finally apply the soap.

Photos 61-62

Choose the next paragraph to read according to the soap you have.

Applying the transparent soap


Photos 63-64

You can apply the soap with a brush, sponge or spray (photo 63). If the surface absorbs soap quickly, you can repeat the soaping process. Be aware that too much soap might leave a soap coat on the surface that comes off as small flakes when polishing and it might slightly harm the surface. Apply the soap only on the area that you plan to polish immediately (soap and polish one wall/surface at a time). The soap and tadelakt react and the longer the reaction takes place, the stronger the plaster gets and the harder it is to polish it. Apply the soap on the surface with irregular and chaotic movements to avoid the straight traces of the application of the soap (photo 64). When the soap is applied evenly and most of the soap has been absorbed (the soap is not visible on the surface anymore), you can start polishing.

Applying the black soap

The black soap makes the colour of tadelakt slightly darker and deeper. The soap can be applied with a soft brush, sponge or spray. If the surface absorbs the soap quickly you need to repeat the application. The dark soap is much greasier, therefore it should be polished while the surface is still wet and has not yet absorbed all the soap. If you polish when soap has dried, the „grease" in the dark soap might harm the surface as it can move with the polishing stone.

9.5. Polishing the soaped surface

The surface must be polished with the polishing stone or plastic trowel. You get a better result and shine when you polish tadelakt with stone, but using a small plastic trowel instead is also an option. Start from up and from edges (photo 65) and move on evenly (avoid „a bit from here a bit from there" style). Do not leave noticeable straight edges of polishing areas, move on irregularly and chaotically (then the polishing edges are not very easily noticeable). If it is hard to see which part is already polished, use a side light (photo 66) – the polished surface is shiny while the unpolished surface is not (photo 67). Watch the video about second polishing.

You should do small round movements with the stone by pushing slightly on the stone and making pressure on the surface (avoid too strong pushing as it might harm the surface). This process tightens the surface, making it silky and shiny. After polishing the surface with stone, let the surface dry and then polish it with a soft cloth or with a sponge covered with small plastic; this will remove the rest of the soap (especially if you let the black soap dry on the surface, some yellow soap marks may appear) and also will give more shine to the surface (photo 68).




Photos 65-68

If tadelakt is made on a surface that gets wet often, the surface has to be soaped and polished with a sponge covered with small light plastic (e.g a small transparent plastic bag) or with a soft cloth again after 2-3 days of carbonation. When the tadelakt is once soaped and partly carbonated (after 24 hours), it must not be polished with stone anymore. This might damage the shiny tadelakt surface. Tadelakt achieves its final strength after several months.

10. WAXING

Solid or liquid carnauba wax can be used as an additional protection of tadelakt. The wax should not be applied until 2 or 3 weeks have passed after soaping and polishing, to avoid slowing down the carbonisation process. The wax absorbs somewhat into the tadelakt surface and stays partly on the surface by making an additional protecting coat.

Photos 69-70

The solid wax must be applied on tadelakt's surface as a thin coat with a soft cloth or with a soft sponge to avoid damaging the surface (photo 69). Apply the wax as evenly as possible with round movements. The traces of the application of the wax can be slightly seen later, that is why waxing should be done as evenly as possible. It is enough to have one coat of solid wax. Horizontal surfaces and other surfaces that get straight water can be waxed twice (add the second coat after the first coat of wax has dried). After applying the wax let it dry for 10-15 minutes and polish it with a soft cloth until the surface gets evenly shiny (photo 70). Then the surface is ready to use. Watch the video about waxing.

Apply the liquid wax evenly with a soft brush, soft cloth or soft sponge, avoid damaging the surface. You can also use a spray bottle for applying liquid wax. Repeat applying the wax until saturation (when wax does not absorb into tadelakt anymore), let it dry completely and then polish it with a soft cloth.

Many times when you make tadelakt reparation it will be very difficult to make a perfect cut and to make the repaired connection with the remained tadelakt invisible. So, in this case a bit of wax mixed with the same pigment will make wonders in concealing the reparation. Mix the pigment with pure natural turpentine up to a paste and then apply it with a soft cloth. Make sure that the surface is untreated otherwise the pigment will not enter the surface. This procedure only works for new or old un-waxed tadelakt walls.

11. DECORATIVE TECHNIQUES

Make sure to try the decorations on a sample or in a place out of the way before you do it on the real surface because you may need to practice a bit to be able to create a balanced look. We recommend strongly making small samples before starting with the real work!

Fresco

Before the soap application and polishing the tadelakt surface it is possible to make fresco paintings (photo 71). Use watery paint made of pigments dissolved in lime water (mix lime putty with water, let it rest until the putty has settled and the water has come to the top, then use this water). The pigment must be well dissolved in the lime water and its percentage cannot be too big. Otherwise it will not be absorbed to the surface and the painting will become smeared. When the painting has dried you can start soaping and polishing. Be careful not to blur or disperse the paintings when applying the soap.

Photo 71

Photos 72-73

Cloudy effect

To get a cloudy effect on the entire surface (photos 72-73 – before and after) you can add pigment to the soap. Apply the soap very chaotically and unevenly, and then polish it with the polishing stone. If the pigment particles that have stayed on the surface make coloured stripes on the surface while polishing with a stone, use a soft cloth or a sponge covered with a light plastic instead.

Stencils

It is possible to use colourful wax and stencils for decorating the surface of tadelakt. For this the surface must be already soaped and polished with stone. Place the stencil on the surface and apply the wax in a light coat by dabbing with a sponge (photo 74). Be careful with the edges of the stencil as the wax can go under the edges and the outline will not be sharp. When you have applied the pattern and removed the stencil, you can warm the wax with a heat gun so it can be absorbed better (photo 75). If too much wax remains on the surface, you can remove the excess carefully with the edge of a trowel (photo 76). Then, if you want, you can cover the rest of the surface with colourless wax. Be careful when applying the wax on the pattern as the fresh wax might melt it and blur the outlines. When the wax has dried, polish it with a soft cloth (photo 77).

Photos 74-77

Sgraffito

Sgraffito consists of scratching a design into plaster before it sets, using a fine point metal tool in order to reveal the texture of the underlying plaster. The design stands out, especially due to the effects of light-dark obtained by the different textures and shadows. The result is an expressive plastic game of *chiaroscuro*. A drawing can be transferred to the surface by cutting with a sharp cutter through the lines of the drawing, leaving a continuous trace on the plaster below. Then, in the selected areas the top coat of tadelakt is removed. You can use ribbon tools with different endings for collecting a few millimetres on the surface of tadelakt. Even if it is only applied to a single, undifferentiated plaster colour, the exposed deeper coat will have a darker colour (photos 78-80).



Photos 78-80

In sgraffito you can also use two different colour combinations, one for each coat of tadelakt, and so by carving the top coat you open the light to the first coat, giving a two colour dynamic to the space.

Wax mixed with pigment

If you need to change or add colour to your tadelakt you can also mix a pigment with wax and try to make some new colour shades. For example you can have a red tadelakt as a background and then add some gold pigment on top to give a more oriental look (photo 81). Mix the pigment with pure natural turpentine up to a paste. This will allow the pigment to mix properly without lumps; and will work as a medium for the wax to bind with tadelakt. With the help of a soft cloth collect some hard carnauba wax; tip that same cloth on your pigment mix and apply it on the finished tadelakt surface. Repeat as many times as necessary to achieve the desired result. This procedure only works for new or old un-waxed tadelakt walls. Make sure that the surface is untreated otherwise the pigment will not enter the tadelakt pores.

Photo 81

12. MAINTENANCE

Tadelakt is dirt repellent on condition that the surface is cleaned right after becoming dirty. The surface must be cleaned with clean water, using a soft cloth or sponge. It is recommended to add olive oil soap or some other natural vegetable oil soap to the water. You must not use acid cleaning products meant for ceramic tiles nor rough sponges. You must not scratch the surface!

Soaped surfaces

In the first half year the tadelakt surface should be covered with olive oil soap every 2-3 months. Before soaping clean the surface and wash it with water, using a soft cloth or sponge. Apply the soap with a brush. After the soap has dried, polish it with a soft sponge covered with light plastic. It is especially important to soap the surfaces that have direct contact with water (baths, sinks, shower corners, back walls of sinks, work surfaces, etc.). Soaping the tadelakt several times gives lasting water resistance to it.

Waxed surfaces

We suggest covering tadelakt with a light layer of wax once per year. Before waxing, clean the surface and wash it with water using a soft cloth or sponge. Apply a light layer of wax with a soft cloth or a sponge on the cleaned, dry tadelakt surface. Let it dry for 10-15 minutes, then polish the surface with a soft cloth. If possible, use the wax of the same producer that you used the first time. If you first used colourful wax, you can later use colourless wax.

Repairing damaged places

Tadelakt does not withstand acidic products, nor strongly smearing substances. Sharp objects and abrasive materials can damage tadelakt's surface. It is possible to repair smaller notches/holes by filling the notch/hole with a tadelakt mixture of the same colour and by polishing it with a stone. If you have damaged a larger area, you should cut out all the loose tadelakt from this place (use a utility knife or the edge of trowel) and fill it with fresh tadelakt mixture. The steps of the work are the same as for applying tadelakt. It is not possible to join the old, already soaped and carbonated surface and new tadelakt perfectly. The repaired place can sometimes remain clearly visible (especially with darker colours). Therefore if you have damaged a large area on a small surface, it might be better to take off the entire tadelakt from the substrate and apply a new one, the result will be more beautiful.

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