

# PLASTER USE IN THE CERAMIC COMMUNITY

ENVIRONMENTAL IMPACT AND SUSTAINABILITY

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IN PROGRESS RESEARCH



# WHAT IS PLASTER?

Plaster as it pertains to the ceramics community is supplied most often by United States Gypsum (USG). The most widely used plaster in ceramics studios is:

## USG® #1 Pottery Plaster

This is the most used plaster in ceramics studios for its water absorption abilities both in using slab-work and slip-casting [1].

## What is #1 Pottery Plaster?

Plaster originates from the mineral rock **gypsum**.

**Gypsum** as a mineral rock is a **dihydrate**: CHEMICAL FORMULA-Calcium sulphate dihydrate (CaSO<sub>4</sub>·2H<sub>2</sub>O) [2].

When Gypsum is ground and heated after mining, it loses water and converts to a **hemihydrate** rock powder.

This hemihydrate is what we call **Plaster of Paris**.

**Plaster of Paris** is the brand name for **#1 Pottery Plaster**: CHEMICAL FORMULA-Calcium Sulfate Hemihydrate (CaSO<sub>4</sub>·1/2H<sub>2</sub>O) [3].

When water is added to the powder, the rock hardens again, forming a solid gypsum dihydrate mold.

## How is #1 Pottery Plaster different from Drywall or Sheetrock Plaster chemically? And why is this relevant to ceramics?

Gypsum Drywall Board, according to USG, is composed of **Calcium sulfate dihydrate** (CaSO<sub>4</sub>·2H<sub>2</sub>O) [5].

Drywall is a layer of plaster between two layers of paper. The powdered mineral hemihydrate is mixed with additives for usability, then formed by adding water and placing the wet mixture between two sheets of paper. It sets and is dried, forming a dihydrate, ready to use for construction [4].

This is relevant to ceramics because both pottery plaster and ceramics plaster contain the same chemical compounds and break down in similar manners, thus aiding our efforts in recycling and/or composting them in similar ways. Both sheetrock and plaster can be composted, with some restrictions.

[1] <https://ceramicartsnetwork.org/wp-content/uploads/2010/06/knownyourplaster.pdf>

[2] [https://www.usg.com/content/dam/USG\\_Marketing\\_Communications/united\\_states/product\\_promotional\\_materials/finished\\_assets/plastering-technical-guide-pm-glossary-en-PM1.pdf](https://www.usg.com/content/dam/USG_Marketing_Communications/united_states/product_promotional_materials/finished_assets/plastering-technical-guide-pm-glossary-en-PM1.pdf)

[3] [https://www.usg.com/content/dam/USG\\_Marketing\\_Communications/united\\_states/sds/usg-no-1-pottery-plaster-sds-en-52000000003.pdf](https://www.usg.com/content/dam/USG_Marketing_Communications/united_states/sds/usg-no-1-pottery-plaster-sds-en-52000000003.pdf)

[4] <https://en.wikipedia.org/wiki/Plaster> Original Source: [Global Gypsum Magazine, January 2009, p. 18]

[5] [https://www.usg.com/content/dam/USG\\_Marketing\\_Communications/united\\_states/sds/usg-sheetrock-abuse-resistant-firecode-core-gypsum-panels-sds-en-54000002006.pdf](https://www.usg.com/content/dam/USG_Marketing_Communications/united_states/sds/usg-sheetrock-abuse-resistant-firecode-core-gypsum-panels-sds-en-54000002006.pdf)

# PLASTER IN LANDFILLS: WHY NOT THROW PLASTER AWAY?

We know that plaster consists of *calcium sulfate dihydrate* ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) in its hardened solid mold form. On their own, calcium and sulfate are not necessarily harmful to the environment and could theoretically be disposed of without issue [1].

However, most ceramicists and mold-makers send plaster molds straight to the landfill, a location where these minerals can cause issues within that specific bacterial environment.

## Hydrogen Sulphide Gas

"In the environment of a landfill exist bacteria called '*Sulfate-reducing bacteria*' which convert sulfates to toxic hydrogen sulphide gas. These bacteria are killed by air exposure, but landfills are notoriously moist, airless, carbon-containing environments.

As plaster decomposes in landfills, it releases "up to a quarter its weight in hydrogen sulfide [2-5]."

## Breakdown of clay landfill liners

"Gypsum [plaster] is capable of breaking down clay [landfill] liners that waste management companies use to prevent toxins from seeping into water systems [2]."

## Acid Rain

The incineration of plaster waste in landfills also results in the potential release of sulphur dioxide gas, a contributor to acid rain formation [5].



[1] [https://www.usg.com/content/dam/USG\\_Marketing\\_Communications/united\\_states/sds/usg-no-1-pottery-plaster-sds-en-52000000003.pdf](https://www.usg.com/content/dam/USG_Marketing_Communications/united_states/sds/usg-no-1-pottery-plaster-sds-en-52000000003.pdf)

[2] <https://ieeco.com/gypsum-recycling/>

[3] <http://rcbc.bc.ca/education/faqs/hazard9>

[4] <https://water-research.net/index.php/sulfur>

[5] [https://www.researchgate.net/publication/309089266\\_Drywall\\_Gyproc\\_Plasterboard\\_Recycling\\_and\\_Reuse\\_as\\_a\\_Compost-Bulking\\_Agent\\_in\\_Canada\\_and\\_North\\_America\\_A\\_Review](https://www.researchgate.net/publication/309089266_Drywall_Gyproc_Plasterboard_Recycling_and_Reuse_as_a_Compost-Bulking_Agent_in_Canada_and_North_America_A_Review)

[Image 2] <https://theconversation.com/we-create-20m-tons-of-construction-industry-waste-each-year-heres-how-to-stop-it-going-to-landfill-114602>

[Image 1] <https://buckeyeceramicsupply.com/index.php/en/component/eventbooking/workshops-demos/making-plaster-casting-molds>

# INSTEAD OF PUTTING PLASTER IN LANDFILLS, WHAT ARE OUR OTHER OPTIONS?

PLASTER MOLD WASTE HAS POTENTIAL TO BE USED FOR:

SOIL AMENDMENT

FERTILIZER

COMPOST (AT HOME OR MUNICIPAL)

PLASTER MOLD WASTE CAN ALSO BE RECYCLED AND RECONSTITUTED



# SOLUTIONS:

## PLASTER FOR SOIL AMENDMENT/FERTILIZER

Gypsum (Plaster) is an excellent fertilizer and soil amendment for agriculture. Plaster can be used as a compost to bring back dead soils and create richer, more nutrient-full compost [5].

### Adding gypsum to large scale agricultural and horticultural soils:

- Increases water infiltration

- Adds calcium and sulfur back into the soil. These nutrients are essential when promoting sustainability in irrigated soils.

- Breaks down heavy clay soils to promote better drainage and plant growth [1].

- Breaks up non-porous, hard soils [5].

- Gypsum solubilizes rather slowly, and can thus provide a continual release of sulfur to soil for years after application.

- Use of gypsum as a sulfur fertilizer can enhance crop production for crops such as corn, soybean, canola, and alfalfa [2].

### Adding gypsum to small scale home compost systems and municipal scale compost:

- Gypsum reduces nitrogen losses which improves compost aeration, increases heat, enhances microbial growth and reduces unpleasant odors. Decomposition of sulfur in compost is not a concern in terms of hydrogen sulfide gas because compost is aerated.

- Gypsum provides calcium, sulfur, nitrogen and minerals to an existing compost [3].

- There are no major risks associated with use of pure plaster when added to household and municipal compost [5].

### Other potential degradation-based uses for plaster:

- Gypsum's absorbency allows it to be an additive for animal bedding. Adding gypsum additives to dairy bedding keeps bedding dryer, while decreasing exposure to harmful pathogens. "The result is healthier cows and safer milk production. Gypsum additives are also useful in chicken houses to promote healthier chickens. In fact, gypsum additives are natural, non-toxic and safe for humans and animals. Gypsum additives also aid in composting manure and improve manure value [4]."

[1] <https://feeco.com/gypsum-recycling/>

[2] <https://www.usagypsum.com/wp-content/uploads/2016/04/Gypsum-as-an-Agricultural-Amendment.pdf>

[3] <https://www.usagypsum.com/gypsum-products/gypsum-compost-additive>

[4] <https://www.usagypsum.com/10-beneficial-ways-use-recycled-gypsum>

[5] <https://phys.org/news/2015-04-drywall-good-composting-material.html>



# SOLUTIONS:

## COMPOSTING PLASTER MUNICIPALLY

How to compost plaster municipally?

Contact your local composter! Just ask!

When contacting public/private composters, some might not compost plaster at all, or might not be able to take specific kinds of plaster. Some might need to do more research, so it is helpful to be diligent and keep asking.

While researching, I have emailed at least 20 public, private, and government funded composting services to simply ask if they would be willing to compost plaster. Be aware that drywall plaster and plaster molds are not exactly the same. Some responded that they are unable to compost drywall and construction plaster waste, as old construction drywall can contain lead, asbestos, or other contaminants, not to mention the paper that the drywall plaster is wedged between. Be sure to mention you are using ceramic plaster, nothing that has been used in construction.

Mention the brand, volume of donation, and chemical composition, all information which will expedite the process and is fairly easy to access on the US Gypsum website, the main supplier of Pottery Plaster #1. If you are using the US Gypsum Pottery Plaster #1, the chemical information is available on page 2 of this powerpoint, or at this website:

[https://www.usg.com/content/dam/USG\\_Marketing\\_Communications/united\\_states/sds/usg-no-1-pottery-plaster-sds-en-52000000003.pdf](https://www.usg.com/content/dam/USG_Marketing_Communications/united_states/sds/usg-no-1-pottery-plaster-sds-en-52000000003.pdf)



# SOLUTIONS:

## COMPOSTING PLASTER AT HOME

### How to compost plaster at home:

- Break down plaster into small chunks. It will decompose whether or not it is in coarse or fine chunks, just at different speeds [1, 3, 4].
- Spread plaster over soil and let weather break down chunks (will take a while).

OR

- Break plaster down smaller or into coarse powder and mix with other dry matter/compost.
- Under regular circumstances, compost requires aeration, but with plaster, aeration is absolutely essential based on the way sulphates decompose.

OR

- According to US Gypsum Instructions:
- Break down plaster to fine powder or use existing powdered gypsum from manufacturer to mix with compost.
- "Blend 1 lb. with each wheelbarrow sized load, or 40 lbs. per ton of dry matter, when beginning the compost process [2]."
- "Combining organic nitrogen rich material streams with gypsum can reduce the release of ammonia and conserve nitrogen in the compost. This effect can be enhanced if the carbon / nitrogen ratio of the materials is 30:45. The gypsum in the final compost also benefits certain soil types such as those lacking calcium and sulfur or those high in sodium [2]."

More detailed instruction: <https://www.usagypsum.com/gypsum-products/gypsum-compost-additive>

[1] <http://www.potters.org/subject109401.htm>

[2] <https://www.usagypsum.com/gypsum-products/gypsum-compost-additive>

[3] <https://phys.org/news/2015-04-drywall-good-composting-material.html>

[4] <https://www.diychatroom.com/threads/recycle-plaster.145070/>



# SOLUTIONS:

## RECYCLING/REHEATING PLASTER

### Recycling:

US Gypsum has existing recycling centers which break down drywall and plaster from construction waste. It is entirely possible to contact USG drywall recycling to discern if they will accept donations of plaster molds as well. It might be that plaster would have to be crushed down to a powder in order to donate. This is an in-progress effort to streamline our waste with systems that are already in place, and convince these industries to accept our waste donations.

"Gypsum is fully and eternally recyclable and, as a consequence, gypsum waste is one of the few construction materials for which **closed-loop recycling** is possible through US Gypsum recycling locations. Closed-loop recycling of gypsum products involves the collection and processing of the gypsum waste, and the delivery of the obtained recycled gypsum to the manufacturer of gypsum products." The foremost plaster plants have substituted 30% of virgin gypsum with recycled gypsum, thus cutting mining, manufacturing, & transport emissions [4, 5].

Who Recycles Drywall and/or Gypsum?

US Gypsum: <https://www.usagypsum.com/drywall-recycling>

Urban Gypsum Recycling: <https://www.urbangypsum.com>

New West Gypsum: <https://www.nwgyypsum.com>

American Gypsum Recycling: <https://americangypsumrecycling.com>

### Reheating:

It is completely possible to infinitely recycle plaster, but not particularly practical. You would need to crush and mill the solid plaster down to a powder. If the mixture is not consistent and homogenous, the integrity of the plaster might be compromised [3]. "Plaster of Paris is a brand name for gypsum hemihydrate, which is a form of [partially] dehydrated gypsum rock powder. When water is added to the powder, the rock hardens again, forming a solid mold. You can recycle/reheat Plaster of Paris by [fully] dehydrating the plaster to make it revert to the powder state. When this occurs, the plaster can be remixed with water to mold the plaster into any desired shape or mold [1]."

"There is a great potential of recycling [reheating] Plaster of Paris from discarded gypsum moulds and using it for casting process in ceramic production mainly because it decreases the production cost of buying virgin plaster of Paris and also results in the development of environmentally friendly process[es] by decreasing the waste gypsum moulds that go to open air dumping [2]."

[1] [https://www.ehow.com/how\\_7234665\\_recycle-plaster-paris.html](https://www.ehow.com/how_7234665_recycle-plaster-paris.html)

[2] <http://213.55.95.56/bitstream/handle/123456789/8886/Tesfaye%20Ayele.pdf?sequence=1&isAllowed=y>

[3] <https://community.ceramicartsdaily.org/topic/3925-recycling-old-plaster-molds/>

[4] [https://web.archive.org/web/20131202221309/http://www.eurogypsum.org/\\_uploads/dbsattachedfiles/whatisgypsum.pdf](https://web.archive.org/web/20131202221309/http://www.eurogypsum.org/_uploads/dbsattachedfiles/whatisgypsum.pdf)

[5] <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKewjAr9zMO0bDvAhUGip4KHd-MAjMQFjAAegQIAhAD&url=https%3A%2F%2Fwww.mdpi.com%2F2313-4321%2F1%2F3%2F311%2Fpdf&usg=A0vVaw0K54cw4VcPQvUaf06dKBi2>





## SOLUTIONS:

### MORE INTENTIONAL PLASTER USE

While interviewing artists whom I know use plaster in their daily practice, I received a range of responses, with the overwhelming majority stating that they throw molds away in landfills after they have reached their limit of use. However, many highly established mold-makers have found ways to use the material more sparingly and intentionally:

One of these artists is Del Harrow. Del is widely known for his work in mold-making, and I myself figured he might go through a lot of plaster material since this is the basis of his parametric modeling work. This is not the case. His process could teach those wanting to work with plaster to use molds in much more intentional ways. In his words:

"When I am done with molds I do usually throw them in the trash - although I don't throw very many molds away. Maybe every 5 or so years I'll throw away a couple. I try to make molds in a way that they will be useful for a long time - a kind of mold library. This is connected to the ways I try to teach mold-making: eg. think about the aesthetics of your mold, not just a means to an end. Think of it like you are making a tool - something well crafted, that you care about and can use for many years. Care and craft are connected with ecology - it's all connected!"



## CONCLUSIONS:

THERE ARE MANY SOLUTIONS TO PLASTER WASTE. WHICH ARE REALISTIC?

HOW MUCH OF AN IMPACT CAN PLASTER WASTE REALLY MAKE?

Plaster waste may seem to be an incredibly small footprint in the scheme of the other environmental impacts a ceramicist makes on a daily basis (water/energy/mining), but if this information can be shared to any community studio, business, or university studio that goes through a lot of material in the process of educating and high-volume making, the impact could be incalculable.

In my research I have found that there are existing infrastructures in place for plaster waste in other industries already, and ceramicists only need to find that niche and do the research. Reheating and reconstituting plaster is possible, but semi-unrealistic for the average person. Recycling plaster at construction waste sites is possible, but requires us to do the work of convincing these companies to listen to us and accept donations (again on an individual basis). Compost seems to be the best option for the average person:

From my baseline researching, the most realistic option for plaster waste is to mix it in with an at-home compost system. After emailing back and forth with several municipal composters in the Pacific Northwest and Montana, most were open to integrating plaster into their existing systems, but were required to research more how plaster would affect their individual ratios of compost elements and the essential Carbon: Nitrogen ratios crucial to creating a successful compost pile.

Municipal composters all have different requirements for compost piles based on location and resources, and many cities do not even have yet have highly established private businesses or government programs for composting. Therefore, there are limitations, and if artists are interested, they must do their own research on an individual basis. If artists don't have the resources to contact (and convince) these established programs, at home compost seems the most easy method, with the least friction. If you do not have an at home compost, most everyone knows someone that does. Simply asking to donate a couple of molds to your neighbors compost will go a long way.

## ABOUT TESSA

Tessa Hoenig is a ceramic sculptor and illustrator interested in creating objects that feel abundant, textural, and overwhelming, despite starting on an intimately small scale. Her work is based on a fascination with creatures, shapes, and scenes sampled from her overly-active imagination. These works are large aggregations of many small parts, made up of hand-built, slip-cast, and press-molded items, each with an inherent personality that make their eventual confluence feel like a rambunctious conversation between many unique individuals.

Tessa is dedicated to creating opportunities for self-growth and abundance in her work while also considering what it means to be an artist in a world where excess is harmful to the planet.

## CONTACT

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