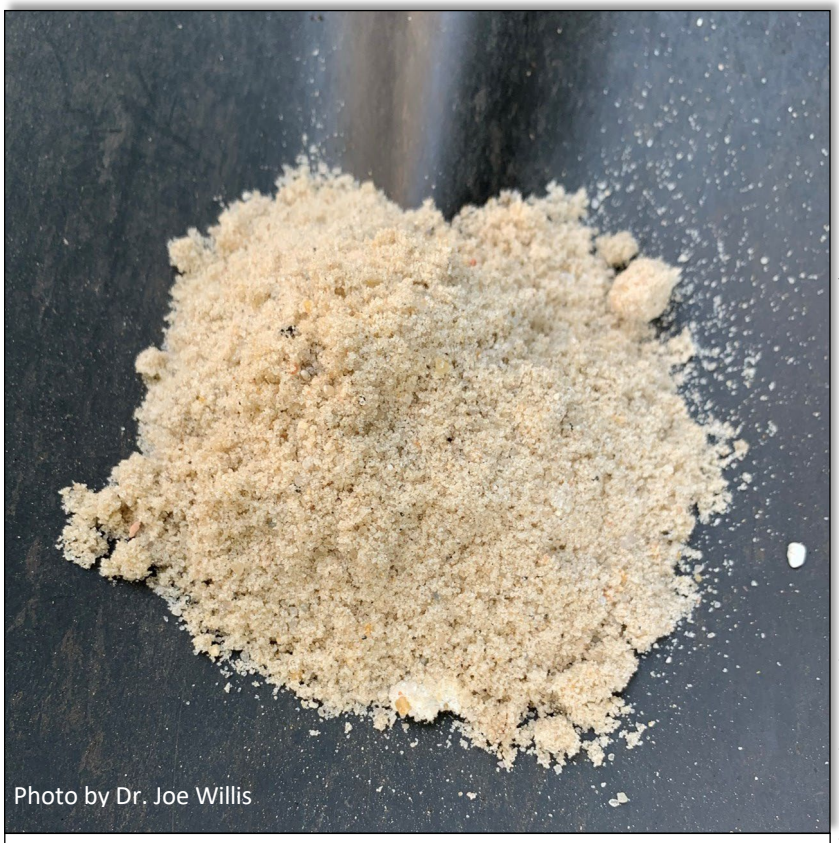
Growing Media for Containers
Part II: The Inorganics

The components of potting mixes are primarily chosen on the basis of their physical and chemical characteristics. In Part 1 (GNO Gardening August 2021) we looked at the organic components commonly used or available for use in potting mixes. In Part 2, we are going to look at the properties of the more commonly used inorganic or synthetic potting mix substrates.

Sand

You should recollect from your study of soils that sand is one of the three major mineral particles in native soils (silt and clay are the others) and the percent of sand in your soil contributes to its texture. The most common constituent of sand is quartz (SiO_2) which is the second most common mineral in the earth's crust making up about 12%. Of course, depending on the source of sand, it can also contain feldspars, salts, silt, organic matter, etc..



Sand particles

You can find Horticultural Sand for sale in some locations; however, Builder's Sand, which is a medium to coarse sand (0.25-2.0 mm) will suffice in horticultural usage. Avoid beach sand or sand mined from the ocean as it tends to be high in salinity.

- Sand can vary in color from light grey to tan to almost white depending on source and impurities.
- Sand is very heavy (bulk density of 2500-3000 lb/ yd^3)
- Total porosity is around 30% by volume
- Water holding capacity (27% by volume)
- Pure sand pH ca. 7.0
- Pure sand CEC < 2 meq/100g
- Fairly common in propagation applications

Sand is used in container mixes to increase drainage and to act as a ballast to prevent blow-over in outside, windy instances. Sand content in container mixes rarely exceeds 10%. Sand is considered highly stable and mostly chemically inert. The low CEC means it does not retain nutrients well.

Perlite

Perlite is volcanic glass consisting of 70-75% SiO_2, 3-5% water and minor amounts of oxides of Al, Na, K, Fe, Mg and Ca. Because of the trapped water, when perlite is heated to temperatures of 1100 to 1600°F, it expands 7-16 times its original volume – like popcorn. The reflectivity of the trapped air bubbles makes perlite pure white in color. Perlite is usually screened after production and marketed based on particle size.

Super coarse perlite has particles ranging in size between ¼ and 3/32" with a water holding capacity of 19%. Creates the best porosity for drainage and aeration but isn't as popular in gardening because of the particle size.

Coarse perlite ranges in size between 3/16 and 3/64", with a 34% water holding capacity. Considered an all-purpose grade it is a good balance of drainage and

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water holding capacity. Due to its size, it doesn't blend well with garden soil but makes a great media for succulents and orchids.

Medium grade perlite is a middle ground between the coarse and fine grades ranging in size between ⅛" and 1/32". It has a 46% water holding capacity and is best to use alone as growing media for potted plants and potted seedlings or as an ingredient in potting mixes with other components.

Fine grade perlite has the smallest particle size, with pieces between 1/16 and 1/128". With a water holding capacity of 52%, it works well for rooting cuttings and starting seeds.

- Perlite is stable, sterile and chemically inert.
- Perlite is bright white
- Perlite is very light (bulk density 168 lb/ yd^3)
- Total porosity is around 70% by volume
- Water holding capacity (36-40% by volume)
- pH ca. 7.0-7.5
- CEC 1.5 meq/100g

Perlite particles

Vermicullite particles

Perlite is used in propagation applications and as a potting mix component to increase drainage, increase aeration, reduce weight, and increase water holding capacity. The low CEC means it does not retain nutrients well. Perlite is a fairly expensive media component and is sometimes replaced with pine bark in media recipes.

Vermiculite

Vermiculite is also a mined mineral. It is ground and sieved, then heated to high temperatures (1800°F). The trapped water quickly vaporizes and causes interlayer spacing, a process termed "exfoliation". You can readily see this layering in the vermiculite particles. As stated above, perlite is mostly SiO2 with minor amounts of other oxides; whereas vermiculite is made up primarily of only four oxides with the main ones being Mg and Fe: SiO_2 (20-25%), Al_2O_3 (5-10%), MgO (35-40%) and Fe_2O_3 (32-35%). This can vary depending on where it is mined. Vermiculite is

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sold in several grades with Fine (0-2.0 mm dia.), Medium (2-4 mm dia.), and Large (4-8 mm dia.) being the most common. Fine grades are mainly used in seedling mixes and as a mulch in seedling production and the larger grades for rooting media or as components of potting mixes.

Vermiculite is sterile and chemically inert but can be compacted.

Vermiculite is golden brown

Vermiculite is very light (bulk density 100-168 lb/ yd^3)

Total porosity is up to 70% by volume

Water holding capacity (78-80% by volume)

pH ca. 5.0-7.5 (depending on source)

CEC 150 meq/100g

Vermiculite is used as a propagation medium and as a component in potting mixes to increase porosity and water holding capacity. The high CEC also makes vermiculite valuable in retaining nutrients in the potting mixes.

Conclusion

While sand, perlite and vermiculite are the three main inorganic components commonly found in potting mixes, there are a number of others that are sometimes seen. This includes expanded clay particles, zeolites, rock wool, and some synthetics such as polyurethane or polystyrene particles. The inorganic components are usually sterile, chemically stable, and long-lasting. They are used to influence porosity, aeration, water holding capacity, CEC, and weight of your potting mixes. The percentage of these in potting mixes can vary widely depending on source and usage.

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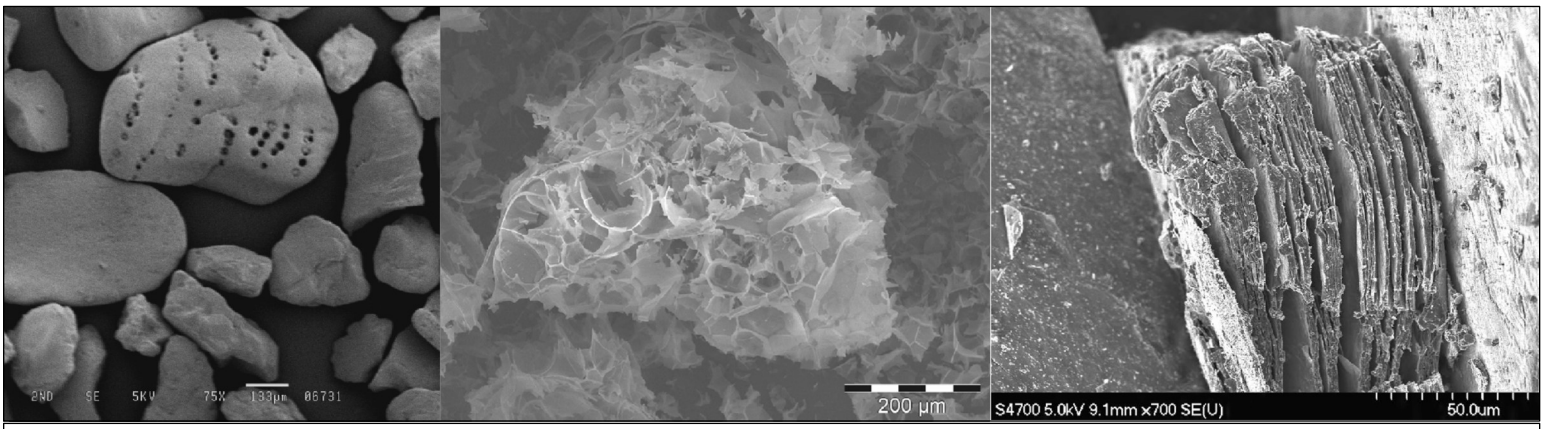
~Dr. Joe Willis



Highly magnified images of sand, perlite and vermiculite particles.