

Pumice in Compost:

Improves Both the Biological Process and in-Soil Performance

A blend of compost and pumice makes sense on several levels—pumice provides a buffer to the extreme volatilization taking place in the decomposing matter, mitigates nitrogen loss, and provides inert bulk that improves airflow. Then, once in the soil, provides long-term soil structure improvement.

PUMICE IMPROVES THE COMPOSTING PROCESS

The following studies show the viability of pumice as an amendment to the composting matter to improve the overall process and better meet the challenges presented by various feedstocks.

■ **Reduction of VOCs.** A study published in *Biosource Technology*¹ detailed research using natural material amendments blended at a 1:10 volumetric ratio with poultry litter to reduce VOCs during composting. The results quantified the effectiveness of pumice (at 100 days) to significantly reduce VOCs at an 88% reduction (with pumice out-performing the other materials tested).

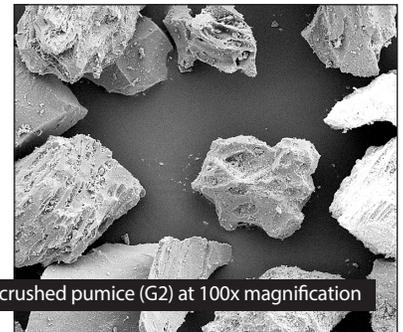
■ **Mitigating Nitrogen Loss.** A study² done by the Department of Environmental Engineering, Ondokuz Mayıs University in Samsun, Turkey looked at improving nitrogen availability in composted poultry litter (mitigating NH₃ volatilization) using natural amendments. Using a 1:10 volumetric ratio of natural material: poultry litter, it was found that natural materials significantly reduced NH₃ volatilization. In particular, only 26% of initial total N was lost from the compost containing pumice.

■ **Effective Bulking Agent.** Bulking agents can reduce the cost, labor, time duration, and increase the compost quality and nutritive values. The choice of bulking agent is greatly dependant on what is being composted. For wet materials, such as hog manure or municipal sewage sludge, a low-moisture, highly absorbent amendment like pumice meets the need.

A Chinese study³ quantified the contributions of pumice in sewage sludge composting when used as an inert bulking agent. Pumice, with its rich pore structure and strong water absorbent capacity, was found to significantly improve



close-up of a 1-inch pumice stone



crushed pumice (G2) at 100x magnification

KEY CHARACTERISTICS of HESS PUMICE:

- Specific gravity weight of 2.35 g/cc
- Low unit weight: 40 - 50 lbs cubic foot (depending on grade)
- MOHS-scale hardness: 6
- pH neutral: 7.2
- Due to its amorphous characteristics, pumice is not considered a health risk to the workers who handle it.
- Chemically, pumice is primarily Silicon Dioxide (Amorphous Aluminum Silicate), some Aluminum Oxide, and trace amounts of other oxides.

[1] **Removal of Volatile Organic Compounds by Natural Materials During Composting of Poultry Litter.** (*Bioresource Technology*, 2008) Department of Environmental Engineering, Ondokuz Mayıs University, Samsun, Turkey; by N.G. Turan, A. Akdemir, O.N. Ergun.

[2] **Nitrogen Availability in Composted Poultry Litter Using Natural Amendments.** Department of Environmental Engineering, Ondokuz Mayıs University, Samsun, Turkey; by N. Gamze Turan. gturan@omu.edu.tr Waste Manag Res. 2009 Feb

[3] **Usage of Pumice as Bulking Agent in Sewage Sludge Composting.** (*Bioresource Technology*, 2015) Harbin Institute of Technology, Harbin 150090 & School of Environment, Henan Normal University, Xinxiang 453007, China; by Chuandong Wu, Weiguang Li, Ke Wang, Yunbei Li.



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the biological reactions in the composting process in terms of material porosity, water-holding capacity, nitrogen absorption (promoting ammonia assimilation to organic nitrogen rather than loss to volatilization), and accelerating the composting period.

■ Reduction of Ammonia Release

from poultry litter via a silica-based feed supplement. A study⁴ entitled *Effects of a Silica-Based Feed Supplement on performance, health, and litter quality of growing turkeys* was published in *Poultry Science* in 2015. The point of the study was to see whether the reported benefits of a silicon-dioxide mineral (like pumice), when used as a feed supplement, would improve flock health by reducing ambient ammonia concentration in the litter and thus improve footpad health and ammonia volatilization. Per the published results: "The feeding of silicon dioxide reduced litter pH which decreased the conversion of NH₄⁺ to NH₃ thereby reducing nitrogen losses from litter."

As an inert amendment agent to compost, pumice suffers from none of the drawbacks of using organic bulking agents like straw, husks, wood chips or sawdust—pumice does not degrade and compact during the composting process, performs consistently, blends readily, and is easily sourced and stored. The physical nature of pumice also provides an ideal carrier for adding additional elements to the bio-formulation, such as sucrose³ (to add a carbon source and provide a growth platform to quickly ignite microbial action).

PUMICE PROVIDES A NON-CONSUMPTIVE SOIL CONDITIONING COUNTERPOINT TO THE CONSUMPTIVE NATURE OF COMPOST

Compost is valuable not only for the nutrients that it adds to poor or depleted soil, but also for the physical improvement it makes to the soil structure itself. A properly-structured root zone is vital to sustained growth, and composted organic matter provides such benefits



to the soil it is added to...until the organic matter is exhausted.

The foamed-glass structure of pumice provides the key physical soil-improvement benefits needed by structure-poor soils—it lightens soil texture, resists compaction, improves drainage and aeration, moderates soil temperature, enhances pore space, retains moisture—but does so indefinitely, as it will not break down or leach out over time. And while pumice is not physically consumed by plant needs, it does provide trace nutrients.

■ **Value to Consumer/End User:** Pumice remains to physically improve the soil profile after the organic matter is consumed.

■ Value to Composter:

1—A value-added product to market to regions with poor or problematic native soils—as the pumice-enhanced compost is applied, a residual, cumulative improvement is taking place long-term as the pumice improves the soil structure. This physical and long-lived improvement continues to build cycle after cycle. When the physical soil structure is deemed ideal, the pumice-enhanced formulation can be discontinued.

2—In most large-scale soil-improvement and revegetation project applications a recharging application of compost at a later date is not possible or feasible. These projects—construction repair or mining reclamation, runoff control via ecology embankments and bio-retention basins, turf-bed preparations—are of necessity fix-and-forget projects, and if the soil profile is not improved in the long-term,⁵ most fail in sustaining the plant life that is seeded in them. Engineering proper long-term soil structure and water-holding and/or drainage capacity increases the odds of success significantly.

Pumice-enhanced compost provides revegetation contractors with a viable, cost-effective pre-seeding solution to amend poor or damaged native soils and achieve long-term, self-sustaining vegetative cover.

[4] *Effects of a Silica-Based Feed Supplement on Performance, Health, and Litter Quality of Growing Turkeys*; *Poultry Science* (August 2015) 94 (8): 1902-1908 first published online June 18, 2015; by S. T. Tran, M. E. Bowman and T. K. Smith

[5] *Shortcomings of Native Seeding Project Implementation*; Western Chapter of IECA Newsletter, Spring 2006

3—Poor-performing agricultural fields provide opportunity for large commercial composters to offer a value-based soil amendment blend of an organic nutrient charge and a soil structure changing mineral to improve workability and tilth, moisture retention, and the foundation for on-going healthy soil biology.

■ **Pumice-Amended Soil Performs.** A study⁶ published in the *Journal of Central European Agriculture* (2005) measured strawberry seedling growth in pumice-amended soil (at 15, 30, and 45% amendment levels) and determined “important level” increase in growth, attributed to the studied enhanced moisture retention and pore size distribution factors contributed by the pumice amendment, especially at 45% amendment ratio.

Another study⁷ concluded “that pumice may be effectively used in specific amounts for improving aeration and bulk density conditions of poorly structured soils.”

The *Australian Journal of Crop Science* published a study⁸ that looked at adding pumice to achieve gains in soil moisture absorption and retention for maize (corn) crops. The results showed that “pumice significantly

($p > 0.05$) increased the amount of soil moisture retention compared to control. Growth characteristics of maize (vegetative growth and yield) were significantly improved with increasing amount of pumice concentration” with the max results obtained with the 30% pumice application.

OTHER CONSIDERATIONS

■ **Blending.** The uniformity of the pumice soil-amendment grades make quality control easy during the blending operation, as pumice is dry and flowable.

■ **A Lightweight Soil Amendment.** The frothy-stone makeup of pumice makes it an ideal lightweight amendment for roof-gardens and other weight-sensitive grow-bed applications like large pots and raised planter beds. In greenhouse culture, a lower bulk density is desirable due to easier handling and less root loss during pick up and transportation.

■ **Pumice vs. Manufactured Soil Amendments.** The practice of blending bits of light, frothy rock with growing soils is already a well-established practice in the

[6] **Effect Of Pumice Amendment On Physical Soil Properties and Strawberry Plant Growth.**

Ustun SAHIN, Selda ORS, Sezai ERCISLI, Omer ANAPALI, Ahmet ESITKEN; Atatürk University, Department of Agricultural Structures and Irrigation, Erzurum-Turkey

[7] **Addition of Pumice Affects Physical Properties of Soil Used for Container Grown Plants.**

Ustun SAHIN, Omer ANAPALI; *Agriculturae Conspectus Scientificus* (ACS) 01/2006; 71(2)

[8] **Soil Water Retention and Maize (*Zea mays* L.) Growth as Effected by Different Amounts of Pumice.**

Ashraf Malekian, Einollah Valizadeh, Mona Dastoori, Sohaila Samadi, Vahid Bayat; Department of Agriculture, Payame Noor University, PO Box 19395-3697, Tehran, Iran



marketplace. There are several man-made products that mimic the structural character and in-soil performance of pumice—materials such as expanded perlite, expanded vermiculite, expanded clays (like Hydrock™) and expanded shale (such as Perma-Till™ and Utelite™). Note the use of the word “expanded” in each. The ores for these products have to undergo an energy-intensive super-heating process that expands or puffs the ore to its useful, pumice-like state. Pumice, on the other hand, was calcined in a volcano.

Pumice provides the same physical-structure amendment improvements to soil in its natural mined state without the environmental impact/fuel burn and processing costs of the expanded products. This fact not only makes pumice the green choice but also makes pumice the economical choice—bringing it in at a quarter-to-half the price of expanded perlite, for example. That yields significant value, especially in large-scale applications.

An example of a successful compost-blended product is Utah-based Utelite Corp’s Utelite Soil Builder™, which is described as a balanced blend of Utelite Soil Conditioner (expanded shale) and organic compost and is designed to improve both heavy clay and sandy soils.

There are also products on the market (some using pumice) that are marketed/sold specifically to amend heavy clay soils (such as EKO Clay Buster™).

■ **Pumice vs. Perlite.** Perlite is widely used in horticulture, especially in potting and garden soils. It is valued for its contribution to desirable soil structure and water and nutrient retention. But the process of flash-heating

perlite ore to expand it adds to the cost and the carbon footprint of perlite.

Pumice need only be crushed and screened to proper in-soil grade, making pumice an economical choice for large-scale composting operations.

A University of Illinois study⁹ evaluated pumice as a perlite substitute as a soil amendment. Specifically, chemical properties and surface characteristics were compared and proved analogous, with pumice exhibiting a greater pore size span. From the report summary: “Pumice and perlite were shown to have similar physicochemical properties which subsequently translated into similar behavior in blended soil mixtures. It proved equally, if not even more effective in some way than perlite. A subsequent companion plant growth study (not reported herein) further confirmed the suitability of pumice as a soil amendment. Plants grew equally well in pumice and perlite media.”

■ **Hess Pumice Products.**

Pumice is found all over the world, but the quality, physical characteristics and chemical composition vary from deposit to deposit. The Hess pumice deposit in southeast Idaho is recognized as the purest commercial deposit of pumice on the planet and Hess ships that pumice world-wide for use in various industrial and agricultural

processes. Hess Pumice Products has been mining and refining this choice pumice deposit since 1958 and enjoys a well-earned reputation for getting it where it needs to be on-time and on-spec.

Hess Pumice is available in supersacks or shipped in bulk via truck or train cars.



[9] Evaluation of Pumice as a Perlite Substitute for Container Soil Physical Amendment.

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