Zeolites for Cooling Synthetic Turf

Zeolite Cooling Properties

Zeolite cooling properties are similar to Transpiration which is water within a plant and the subsequent loss of water as vapor through stomata in its leaves. The natural mineral zeolite (e.g. porous aluminosilicate) has the property to naturally attract (adsorb) water vapor for long periods of time and to incorporate it in its internal crystal lattice while releasing heat at the same time:

Cooling System

A zeolite cooling system requires cycling between adsorption and desorption.
While heat is released in the zeolite, and cooling is seen at the evaporation level. If absorption proceeds in an evacuated environment the attraction of water by the zeolite is so forceful that the internal pressure drops dramatically. The remaining water in an attached vessel evaporates, cools down turf fibers immediately due to the effect of evapotranspiration resulting in cooler synthetic turf fibers. Evapotranspiration (ET) is the sum of evaporation and transpiration from the Earth's land surface to atmosphere which is an important part of the water cycle. Evaporation accounts for the movement of water to the air from the zeolite granule.

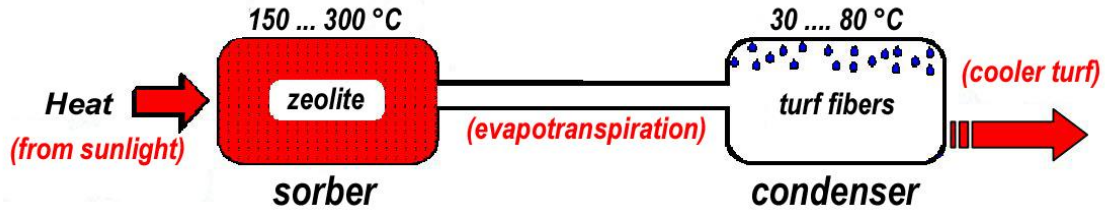

Figure 5: Desorption phase of a Zeolite system

Figure 5 shows the desorption phase. For a comparison to the absorption and transpiration of heat, the left container (sorber) in takes on the role of a single zeolite granule saturated with water under sunlight, and the right container is the (condenser) after evapotranspiration effect. When the zeolite is saturated with water either by soaking using any water source or condensation, desorption is initiated by heat from sunlight at high temperatures. The adsorbed water molecules are forced to evaporate (desorption), and condensation takes place in the condenser. The sequence of adsorption/desorption processes is completely reversible.

Advantages and Disadvantages

The adsorption of zeolites is very strong, thereby providing the family of materials with unique adsorption properties and permitting extremely high efficiencies for adsorption with artificial turf. Another advantage of zeolite systems is that they allow heating and cooling at the same time. One disadvantage of zeolite systems is that to provide continuous cooling, systems need to cycle between multiple sorption modules. Meaning; when the zeolite granules are dry, no evaporation occur resulting in comparable temperatures to standard silica sand infills. High humidity areas will benefit more than areas with low humidity.

Materials

Currently the zeolite mines produces more than 1.4 million tons of zeolite annually and it can be expected that the worldwide demand and consequently the production will further increase for a multiple of uses. Only 97% + pure zeolite is adequate for use as an infill for any synthetic turf application as lower purity can destroy turf fibers and/or cause drainage issues due to the negative elements it holds.