



## Technical Bulletin # 124

**RE: Bacteria Resistance of Portland Cement**  
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For the past 100 years, and continuing into the foreseeable future, ceramic tile and Portland cement grout have been the leading choice for installations that require durability, ease of maintenance, and bacterial resistance. An understanding of what grout is chemically will be helpful to the understanding of how bacterial resistance is accomplished.

Portland cement is generally composed of calcium and silica. These materials are combined in a slurry and fired in a kiln at temperatures above 2500°F. The resultant product, called "clinker", is then ground and amended with calcium sulfate and other constituents to control set time and strength.

When water is added to cement a chemical reaction takes place transforming the dry cement into a fused latticework of crystalline structure. During hydration (curing) the cement becomes harder and denser ultimately forming a smooth surface.

By its nature, cement is highly alkaline. When cement and water are present together a pH of 12 or higher is the result.

Most common bacteria require a food source and a pH environment ranging from 6-8. Bacteria such as aspergillus niger, aureobasidium pullulans and penicillium funiculosum will die quickly if left on a grout surface. Other harmful bacteria like salmonella and staphylococcus aureus are equally attacked in the highly alkaline environment of cement.

Caustic environments disrupt cell walls causing rapid destruction of the cell membrane. Unprotected and unable to reproduce, the bacterium rapidly dies. Cement in this equation not only denies the bacteria any food source but also provides a high alkaline environment that quickly kills it.

Since common bacteria cannot exist in highly alkaline environments adding anti-microbial or anti-bacterial agents is simply "overkill". When there is no food source, there is no way for bacteria to thrive. Should any surface, whether it's wood, tile, cement, or plastic become soiled, bacteria, mold, fungus can and will grow regardless of chemicals present in the substrate or the alkalinity of the cement.

Portland cement is a miraculous product that has been proven to be capable of reinforcing the highest buildings as well as filling joints between tile. In this case grout not only performs the function of hard and durable surface but, by nature of its unique chemistry, also provides an environment which is most hostile to the host of bacteria, fungus, mold and other invisible creatures which are both unsightly and unhealthy.

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