

ABSTRACT

The BioPledge AntiMicrobial Protection (AMP)[®] technology destroys microbial organisms by acting directly on the surface of the cell. While highly active in solution, the polymer agent is most active as a bound polymer matrix attached to a surface. This short technical review describes the mode of action of the antimicrobial agent with respect to both solution activity and surface bound activity.

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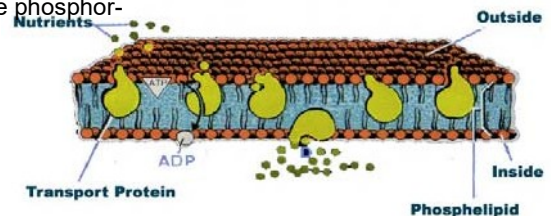


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Mode of Action of the BioPledge AntiMicrobial Protection (AMP)[®] Technology: Solution Activity vs. Bonded Activity

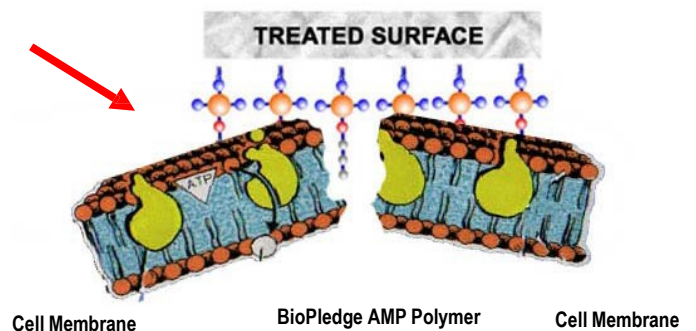
The BioPledge AMP active ingredient (A.I.) in aqueous solution is known to have high antimicrobial activity. In water, the A.I., 3-(trihydroxysilyl) propyldimethyloctadecyl ammonium chloride will hydrolyze into a silane triol. The ability of this molecule to kill virus, bacteria in solution is high (MIC *Avian Influenza* $\geq 5.5 \log_{10}$). As this molecule reacts with receptive surfaces, the ability for it to orient into subsequent monolayers leads to the formation of a covalently bound, very potent durable antimicrobial.

The mode of action of the BioPledge AMP surface bound polymer is directed specifically at the inner membrane of the cell. This cellular membrane is fluid. The phospholipids that make up the backbone of the membrane are in constant motion.



It is this fluidity that allows for the transport of food and energy throughout the cell and is responsible for the entire integrity of the organism itself. If this membrane fluidity is disrupted, the cell will die.

As the hydrolyzed A.I. reacts with the surface, it transforms from a silane triol monomer (found in solution) to a covalently linked polymer matrix. It is only in this polymer matrix that full durable antimicrobial activity is obtained. As the bacteria, virus or fungi contact the polymer matrix, the BioPledge AMP polymer integrates into the membrane. A one micron cell organism contacts a treated surface and is exposed to approximately 25,000 molecules of the A.I. concentrated at a single site. It is this concentrated attack that disrupts the fluidity of the membrane and ruptures the cell. In solution, this concentrated attack on the membrane by the A.I. cannot happen due to the lack of matrix formation and overall concentration of the active ingredient. This is shown graphically below:



As the micro polymer matrix integrates directly into the cell membrane, the cell is ruptured. This concentrated polymer is only available on the surface of a treated substrate as the solution contains unreacted monomers.

BioPledge, LLC produces the 1-step, non-toxic, non-off-gassing, quick killing, and **DURABLE** Antimicrobial (disinfectant), AntiMicrobial Protection (AMP).

When it comes to harmful microbes (virus, bacteria, mold, mildew, algae and yeast)...**BioPledge AMP provides a quick killing action, molecularly bonds to the treated surfaces and keeps on killing for extended periods of time.**

All conventional antimicrobials, disinfectants (**unbound**) used legally in the US, including quaternary ammonium salts, bleach, peroxides, alcohols, phenols, formaldehydes, paint formulations, etc., work on the basis of diffusion away from the treated surface. This promotes adaptation, loss of activity, leaching, diffusion, and creation of zones of inhibition. Quite simply, their effect is short-lived. An unbound chemical, such as ethyl alcohol, and any of the quaternary ammonium compounds (quats), peroxide, formaldehyde, metal ions and other topical disinfectants, must be applied to and then diffuse or leach from the treated surface and be consumed by the microorganism to be effective. These chemicals are intended to act quickly and dissipate equally quickly to minimize the danger to humans and treated objects. Many, including those used routinely in health care environments to clean hard non-porous surfaces are simply wiped away after a brief contact time or just evaporate.

Once the antimicrobial/disinfectant has dried or is depleted or has been washed away during regular maintenance, the **protection vanishes**. This is why high touch surfaces must be cleaned routinely - the chemicals used have no lasting effect. This is not an unintended deficiency; instead, it is what they are meant to do. Microbes are then transferred from their source to hands, clothing, and equipment and then to unprotected (but perhaps recently cleaned or disinfected) objects such as doorknobs, clothing, surfaces are not destroyed by contact with the objects. Instead, they remain there until they die or become non-viable, are removed at a subsequent cleaning or are transferred to another individual. **It is this transfer of viable microbes that, if prevented or controlled, can lower risk by lowering frequently of exposure.**

BioPledge AMP utilizes reactive organo-silane chemistry which makes it essentially permanent, and treated surfaces benefit from extended antimicrobial protection that can be measured in weeks, months and years.

A (**bound**) antimicrobial agent such as **BioPledge AMP** remains chemically attached to the surface on which it is applied. It functions by interrupting the organism's delicate cell membrane. This prevents microorganisms from carrying on vital life processes. This antimicrobial (**BioPledge AMP**) acts on contact with organisms and can do so again and again. One can think of the bound antimicrobial like a sword that is capable of repeated use. In comparison, a conventional antimicrobial /disinfectant treatment is more like a gun with limited ammunition. Since a bound antimicrobial (**BioPledge AMP**) is fixed to the surface it continually operates at full strength. This means the genetic adaptation process, which is an inherent problem with conventional antimicrobial/disinfectants, cannot and does not occur with **BioPledge AMP**.

BioPledge AMP is unique to the industry. BioPledge has been able to combine the benefits of both the bound and unbound.

How important is this? This is extremely important. Within the health-care industry they require the quick "killing" action of unbound products, but do NOT want the side effects of the conventional disinfectant chemicals (strong smell, damages surfaces, short lived, toxic and harmful to the user). With the **BioPledge** product line also adding the bound function all in one-step, there is a level of durability that can be provided that did not exist before. By combining these two processes thru a proprietary formulation, which is clean, stable and very versatile, **We have been able to make a "game changing" product.**

BioPledge AMP provides continuous protection that does not promote genetic adaptation by the organisms and that does not pose unnecessary risk to the ultimate organisms being protected...us.