KEMIN INSPIRED MOLECULAR SOLUTIONS™

FAQ (Frequently Asked Questions)

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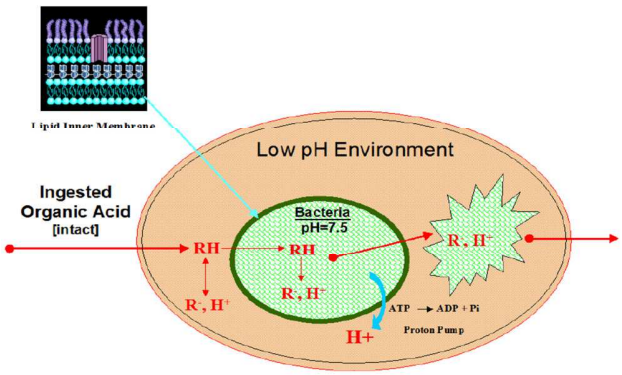
KEM SAN® Liquid Antimicrobial is a blend of organic acids proven to kill a broad spectrum of pathogenic bacteria in livestock and poultry drinking water and has been shown to reduce biofilm and mineral deposits in water lines.

How do organic acids work?

Organic acids are effective against a broad spectrum of bacteria. The bactericidal activity is a four step process as indicated in **Figure 1**.

- Step 1: Intact (undissociated) acid passively diffuses across bacteria's cell wall and across lipid inner membranes.
- Step 2: Once inside the bacterial cell, organic acids dissociate increasing the levels of H+ ions (protons).
- Step 3: Bacterial intracellular pH rapidly drops.
- Step 4: Energy is used to remove H+. Due to the excess H+, the bacterium depletes energy reserves in an attempt to stabilize the pH. Depletion of energy and low pH in the cell causes the cell to die.

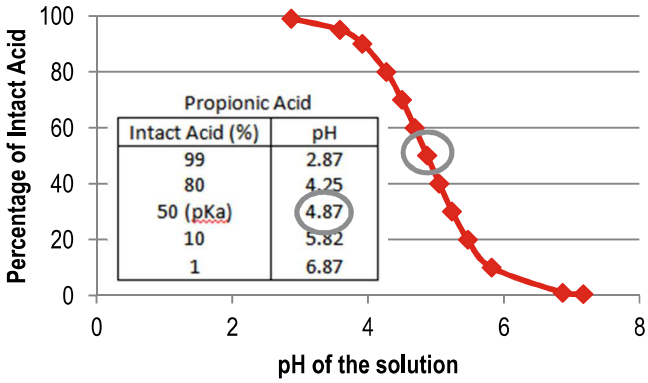
Figure 1. Bactericidal mode of action of organic acids[1]



What makes an organic acid bactericidal?

An important difference in the effectiveness of an antimicrobial is bactericidal (kills bacteria) vs. bacteriostatic (keeps bacteria from growing). A key factor of the bactericidal activity of an organic acid is its pKa. The pKa is the pH at which half of the acid is intact and half is dissociated. As shown above, in order to provide the bactericidal action the acid must be in the intact state. An acid's dissociation curve illustrates how much acid will be dissociated or intact at a given pH (**Figure 2**). Organic acids with a high pKa, in a low pH environment will be most effective, as the majority of the acid is intact and able to cross the lipid inner membrane. By combining specific organic acids with the optimal characteristics a highly effective product can be achieved. KEM SAN is a combination of the most effective organic acids balanced by their pKa and buffered to an optimal pH.

Figure 2. Dissociation curve for propionic acid



What bacteria is KEM SAN effective against?

KEM SAN is effective against a wide variety of bacteria as shown in **Figure 3**. In this study, 30 microliters of KEM SAN were added to 5 mm diameter paper disks. These disks were added to plates inoculated with stock culture of various organisms and incubated in triplicate. The diameter of the inhibition area was measured 24 hours post inoculation and averaged. Larger diameters of inhibition represent higher sensitivity of the bacteria to KEM SAN.

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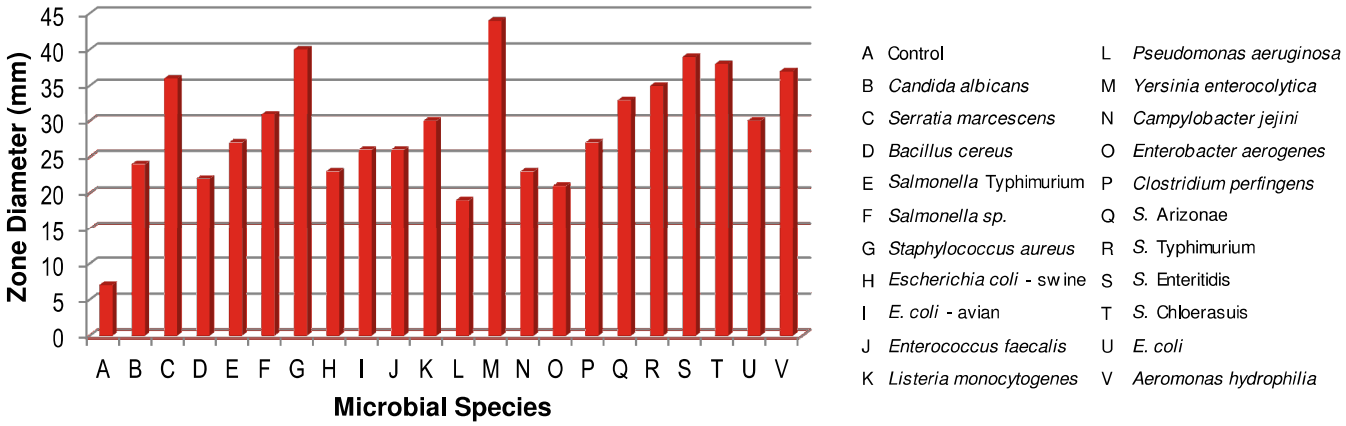
Figure 3. Relative effects of KEM SAN Liquid Antimicrobial in inhibiting the growth of various organisms[2]



Will KEM SAN be corrosive to my equipment?

KEM SAN is a buffered product maintaining a pH of approximately 4.5 even as concentration increases, as shown in **Figure 4**. Because KEM SAN is buffered, it is safe for equipment. **Figure 5** below shows in a simple weight-in vs. weight-out corrosion test, KEM SAN has virtually no detrimental effects to 301 or 304 stainless steel in a 21-day immersion trial. Corrosion of mild and galvanized steel was 1.3% and 1.04% respectively.

Figure 4. pH Values for KEM SAN at various concentrations[3]

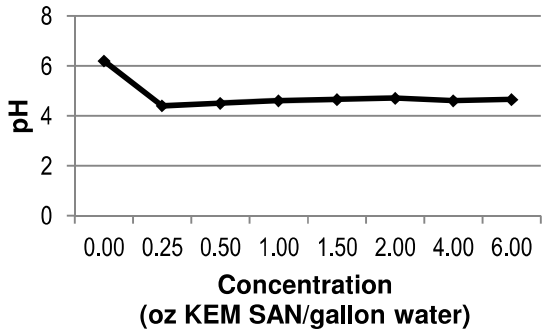
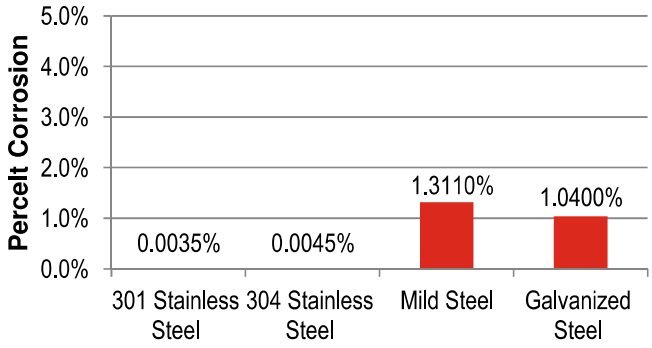


Figure 5. Corrosion of steel by KEM SAN[3]



Are there regulations with using an antimicrobial product in the water?

A product used in water and making antimicrobial claims such as pesticide, fungicide or bactericide products must be registered with the Environmental Protection Agency (EPA). Products receive EPA registration based upon extensive scientific data showing safe and effective use without posing unreasonable risks to people or the environment. In today's regulatory environment, it is especially important to use products that fit with your compliance programs. KEM SAN is approved and registered with the EPA; therefore, it may be suitable for use in your operation (EPA No. 8596-31).

References

1. Clifford A. Adams. Nutricines, Food Components in Health and Nutrition. Nottingham University Press. 1999.
2. Kemin Internal Document, TL-11-00089.
3. Kemin Internal Document, TL-11-00087.