

CLOSTAT®

Active Microbial

CLOSTAT® contains a proprietary, patented strain of *Bacillus subtilis*, PB6. Kemin selected PB6 — a unique, naturally-occurring probiotic — because it helps maintain the balance of microflora in the gastrointestinal (GI) tract in an array of animals, including dairy and beef animals.

MODE OF ACTION

The PB6 in CLOSTAT has been found to secrete one or more biocidal proteins that are inhibitory towards certain strains of pathogenic bacteria such as *Clostridium perfringens* and other ruminant-specific pathogens. These proteins disrupt the membrane of bacteria, causing leakage of the cell contents and ultimately killing the pathogenic bacteria without harming the beneficial gut microflora.

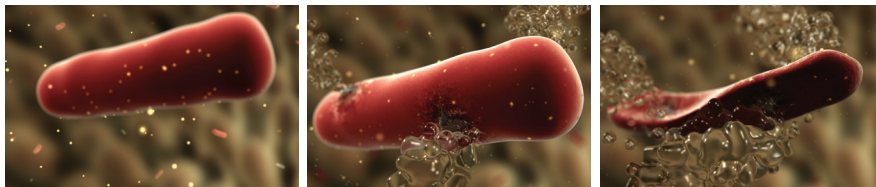


Figure 1: PB6 surfactants impact on *Clostridium perfringens* cell wall structure

WHY IS THIS IMPORTANT?

Pathogenic bacteria like *C. perfringens* create lesions in the small intestine that compromise the integrity of the intestinal lining. Harmful pathogens and toxins can then pass through the intestinal lining into the bloodstream, resulting in intestinal inflammation and disease. By inhibiting the growth of pathogenic bacteria, the PB6 in CLOSTAT helps maintain a healthy microbial balance in the digestive tract.



Figure 2: *C. perfringens* in the intestine

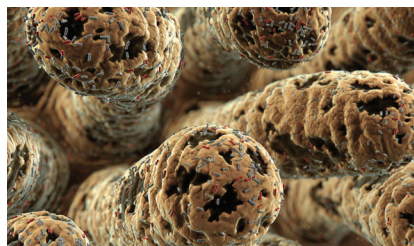


Figure 3: Damaged gastrointestinal villi

CLOSTAT FEATURES

- Contains the probiotic PB6, a unique, patented strain of *B. subtilis*¹
- Research-proven efficacy of PB6 against ruminant-specific pathogens
- Stable under normal pelleting conditions
- Demonstrated safety in dairy and beef cattle^{2,3}
- Stable during processing and packaging
- Stable when blended with other feed ingredients

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PB6 VS. RUMINANT-SPECIFIC PATHOGENS

PB6 has been proven to inhibit the growth of several ruminant-specific bacterial pathogens, including *Clostridium difficile*, *C. perfringens*, *Escherichia coli* and *Salmonella typhimurium*.⁴ In the images below, the antagonistic activity appeared as clear zones between the PB6 (vertical streak) and the bacterial cultures (horizontal streaks).

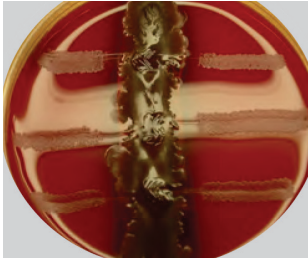


Figure 4: Effect of PB6 against *C. difficile*

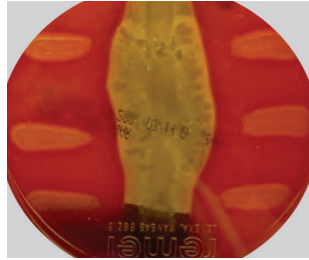


Figure 5: Effect of PB6 against *C. perfringens*



Figure 6: Effect of PB6 against *E. coli*

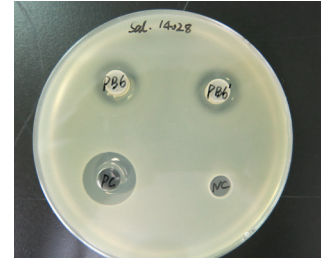


Figure 7: Effect of PB6 against *S. typhimurium*

TO OPTIMIZE ANIMAL HEALTH AND PERFORMANCE, YOU MUST OPTIMIZE INTESTINAL HEALTH.

SELECTING THE RIGHT ACTIVE MICROBIAL

Not all probiotic products are active microbials, and not all active microbials are the same. When evaluating active microbial solutions to fight against intestinal-compromising pathogenic bacteria, four key criteria must be considered:

- 1** **MODE OF ACTION:** Does it have an understood and proven mode of action?
- 2** **PROVEN PATHOGEN INHIBITION AND EFFICACY:** Does *in vitro* and *in vivo* research prove efficacy against a broad spectrum of pathogens or just a few?
- 3** **STABILITY:** What is the product's thermostability and GI tract stability?
- 4** **COMPATIBILITY:** Is the product compatible with common antibiotics and organic acids?



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References:

1. US Patent 63 U.S. 7,247,199.
2. Lin, et al. 2007. United States Patent 7, 247, 299.