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ALTERIN BIOCIDES™

HIGHLY EFFECTIVE AND LONG LASTING ANTIMICROBIAL ADDITIVE SYSTEMS

PRODUCT OVERVIEW

ALTERIN BIOCIDES™ provide a new approach to protection against a wide range of adverse effects caused by various microorganisms:

- Designed for use as antibacterial and antifungal agents in a wide range of industrial, pharmaceutical, and agricultural applications.
- Highly efficient and safe antimicrobial systems that are effective against a broad spectrum of microorganisms
- Environmentally friendly antimicrobial compositions that provide a long lasting antimicrobial effect when added to composites.
- Multicomponent antimicrobial additive systems that when added to plastics or coatings provide excellent antimicrobial properties, good dispersibility and discoloration resistance.
- Intended to provide the customer with a full range of products for every processing need. The product line offers antibacterial compositions and fungicides against mold and mildew.

MARKET FOCUS:

ALTERIN BIOCIDES™ compositions are applicable to any industrial, agricultural, and cosmetic products which require the annihilation or the prevention of propagation of bacteria and fungi. The many applications include thermoplastic and thermosetting polymers for plastics moldings and extrusions, and polymeric compositions; paints, coatings, adhesives, paper, cement, concrete; fibers, leathers, woods, cosmetics, medical appliances, home electric appliances, industrial equipments, building material (putty, caulks, sealants, fiber boards, paper boards, gypsum wall boards), water filtration systems, food packaging etc.

UNIQUE TECHNOLOGY

ALTERIN BIOCIDES™ additive systems

- Satisfy the increasing demand in recent years for a safe, clean and comfortable living environment, by effectively preventing and reducing the adverse effects of some microorganisms.
- Contain organo-mineral complexes that give highly effective antimicrobial protection to the products to which they are added. They contain FDA approved inorganic and organic antimicrobial agents.
- Use inorganic components with active ingredients such as biocidal ions (silver, zinc, copper) and organic antimicrobial agents that impart remarkable antimicrobial efficacy, and improve thermal and light stability and the dispersibility of the antimicrobial composition.
- Form a complex compound coordinated to the antimicrobial metal ion of the inorganic antimicrobial agent, and the high antimicrobial efficacy is accompanied by an improved heat resistance, reduced discoloration with ageing, and improved ultra violet stability.

ALTERIN BIOCIDES™

HOW THE ANTIMICROBIAL MECHANISMS WORK

ALTERIN BIOCIDES™ inhibit the outgrowth of both bacterial and fungal cells by inhibition of the essential metabolic reactions and by interacting with multiple binding sites on their surfaces.

These are the theories explaining the effectiveness of ALTERIN BIOCIDES:

- ALTERIN BIOCIDES™ destroy the cell wall of the microbe - membrane disruption and thus killing the microbe.
- ALTERIN BIOCIDES™ are ingested into the microbe, interrupting the RNA replication and thus preventing the microbe from reproducing.
- ALTERIN BIOCIDES™ interact with the binding sites on the surface of the microbe wall, therefore preventing cellular “respiration” and thus killing the microbe.
- ALTERIN BIOCIDES™ antimicrobial inorganic active components are biocidal ions (silver, zinc, copper) bonded to the inorganic matrix (zeolite). The biocidal ions are released at a slow and steady rate thus insuring long term protection.

PRODUCT ADVANTAGES

- Highly efficient antimicrobial composition against a broad spectrum of bacteria, yeast, fungi and molds.
- Environmentally safe, durable, long lasting antimicrobial effect
- Long term antimicrobial protection It has been estimated that it will constantly be effective for decades, depending on the product it is used in.
- Reduced heat and light -induced discoloration
- Highly cost effective
- Excellent dispersibility
- Applicable in a wide range of industrial, agricultural and cosmetics applications

INDEPENDENT COMMERCIAL LABORATORY TESTED

The effectiveness of ALTERIN BIOCIDES™ active antimicrobial ingredients have been confirmed in an approved independent testing laboratory against a broad spectrum of bacteria, yeast, fungi and molds.

BROAD SPECTRUM CONTROL

Unlike certain other antimicrobials now being used in this way, ALTERIN BIOCIDES™ antimicrobial compositions are organo-mineral complexes, thus reducing the risk of developing antibiotic resistance

ALTERIN BIOCIDES™ antimicrobial compositions also have several major advantages over competitors' antimicrobial compounds used in the manufacturing process.

They remain effective longer and have been proven more effective in the laboratory against a significantly broader spectrum of bacteria.

ANTIMICROBIAL PROPERTIES OF ALTERIN BIOCIDES™

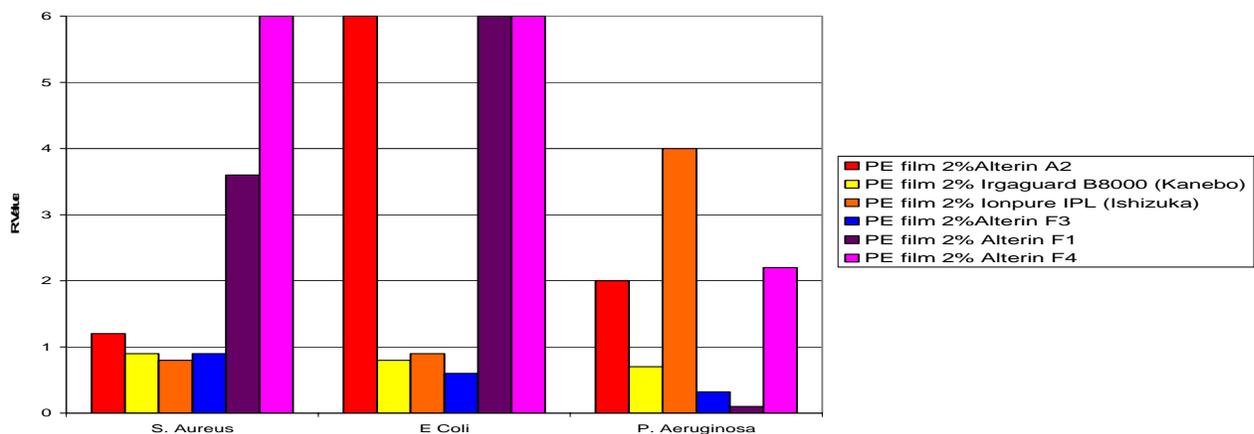
Japanese Industrial Standard methods (JIS Z 280 1: 2000) were conducted to evaluate the antimicrobial efficacy of ALTERIN BIOCIDES™ and of two competitive antimicrobial products against *Staphylococcus aureus* (A TCC 6538), *Escherichia coli* (A TCC 8139), and *Pseudomonas aeruginosa* (A TCC 15442). The bacteria were inoculated at a concentration of 2.5×10^5 cells in 0.4 ml of diluted nutrient broth onto the treated films as well as onto untreated films used as controls. The number of viable cells of bacteria was determined for each sample after incubation with the test products at 35°C for 24 hours (Table 1).

TABLE 1

Sample	Viable Cells Count			Remarks
	S. Aureus	E. Coli	P. Aeruginosa	
Sample PE control	8.7×10^6	9.5×10^6	1.2×10^7	
Sample PE with 2% A12	1.1×10^6	1.5×10^6	2.6×10^6	Irgaguard B8000 (Kanebo)
Sample PE with 2% A13	1.5×10^6	1.2×10^6	2.2×10^3	Ionpure IPL (Ishizuka Glass)
Sample PE with 2% A2	6.1×10^5	<10	1.1×10^5	
Sample PE with 2% F3	1.2×10^6	2.5×10^6	8.4×10^6	
Sample PE with 2% F1	2.0×10^3	<10	9.1×10^4	
Sample PE with 2% F4	<10	<10	7.7×10^4	

Value of antimicrobial activity (R value) of ALTERIN BIOCIDES™ compared with the competitive antimicrobial products on the market was derived from the log of the ratio of the average number of viable cells of bacteria on the untreated product to that of the treated test products. The maximum antimicrobial activity R value is 6 and the minimum 0.

Value of Antimicrobial Activity (R Value) of ALTERIN Biocides



ANTIFUNGAL PROPERTIES OF ALTERIN BIOCIDES™:

The fungicidal activity of the ALTERIN™ antimicrobial compositions were tested in paper coatings. The evaluation was done according to ASTM D3273-94 but for 12 weeks instead of the standard 4 weeks test. Over thirty competitive products were also tested but all failed the tests.

MOLD AND MILDEW TESTS

Visible effect ratings of ALTERIN BIOCIDES™ after 12 weeks of exposure.

Samples	Rating		
	1	2	3
Sample Control Coating with no biocides	7	5	4
Sample Coating with 2% Alterin F1	10	10	10
Sample Coating with 2% Alterin F2	10	10	10
Sample Coating with 1% Alterin A7	10	10	10
Sample Coating with 2% Alterin A 7	10	10	10

ALTERIN antimicrobial compositions have excellent antimicrobial and antifungal properties good dispersibility and discoloration resistance

SAFETY

ALTERIN BIOCIDES™ are safe. All the components are EPA registered materials and FDA approved materials.. ALTERIN™ antimicrobial compositions have been recognized by the FDA to be effective in all types of food-contact polymers.

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