

The Keys to Success in the Coatings

Biocide Market

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For many paint and coatings applications, particularly in the architectural segment, biocides play a critical role in preventing microbiological growth in the manufacturing plant, during storage of the final formulation in the can, and in the applied dry film. The consequences of microbial contamination can range from minor to serious. Such consequences include gas production, bulging containers, phase separation, viscosity changes, poor stability, and foul odors in the can, as well as staining, discoloration, and loss of film-forming properties in the applied coating. Biocides manufacturers are challenged by consolidation in the paint and coatings market, an increasingly restrictive regulatory environment, growing consumer demand for "greener" products, and the need to meet customer-specific performance expectations.

In 2012, the global market for formulated biocides used in paint and coatings applications totaled \$500 million, according to David Tierney, global head of sales for the Industrial Solutions Business Unit of Lonza Group. Of that, 70% is attributed to architectural applications and the remaining 30% split equally between marine and industrial uses. The value of the market for the biocide actives, according to Shruti Singhal, director of Global Marketing and Innovation for Ashland Specialty Ingredients, is just over \$310 million. India and China have experienced the greatest growth, but at a much lower level (single digits) than experienced previously. With its continuing economic

difficulties, European demand for biocides used in paints and coatings is likely to remain flat. For the first time in a few years, however, North America is experiencing a modest growth rate of approximately 2%.

In addition to the variation in growth rate from region to region, there are also differences in the types of biocides being demanded for use in paints and coatings around the world. For example, in the United States and Europe, there has been growing concern about certain algicidal actives, and their use has been decreasing in these regions, according to Tierney. In Asia-Pacific, however, where high humidity and extensive periods of regular rainfall are commonplace, the incorporation of anti algal protection into dry-film preservatives is increasing, states Izzy Colon, vice president of Science & Technology with Troy Corporation. In addition, Tierney notes that although big-box stores and do-it-yourselfers are becoming more prevalent in western markets, the vast majority of painting in India and China is done by contractors. In those markets, therefore, paints can be formulated with higher concentrations of biocides because they are being used by trained applicators. Meanwhile, in Europe, the new classification, labeling, and packaging (CLP) regulations will require that products containing sensitizing compounds above certain levels be labeled as such. "Many manufacturers, including paint and coating producers, are trying to formulate their products to minimize the presence of sensitizing actives, and new

biocide products are being introduced to address these needs," remarks Singhal. The company recently introduced Ebotec™ KB biocide as an alternative for customers seeking to address CLP 2015 labeling regulations for in-can biocides. Lonza also has Proxel BZ Plus (a combination of zinc pyrithion and BIT) in its range, which provides effective in-can preservation in compliance with these labeling restrictions.

The leading in-can biocides are based on isothiazolinone derivatives, including 1,2-benzisothiazolin-3-one (BIT), 2-methyl-4-isothiazolin-3-one (MIT), and 5-chloro-2-methyl-4-isothiazolin-3-one (CMIT). Other chemistries are used, including formaldehyde-releasing biocides. However, there is growing concern about the latter compounds because formaldehyde is classified as a human carcinogen. Regulatory agencies are reviewing this issue, and Tierney expects that products based on formaldehyde-releasing biocides will be phased out. For dry-film applications, the leading biocidal actives include salts of pyrrhione, including zinc pyrrhione (ZPT), sodium pyrrhione (NPT), and copper pyrrhione (CPT, for marine applications); 3-iodo-3-propynyl butylcarbamate (IPBC); and the isothiazolinone derivatives octyl isothiazolinone (OIT) and dichlorooctyl isothiazolinone (DCOIT).

Due to the very high cost (\$6–\$10 million) of registering new biocidal actives with regulatory bodies around the world, the development of new chemistries has been severely limited for many years. "The size of the industrial biocide market does not justify the large investment required for the development and commercialization of new active agents," notes Singhal. As a result, most in-can and dry-film biocide formulations consist of blends of two or three different actives in order to achieve optimum performance, according to Tierney. Lonza has, in fact, been pursuing a global evaluation program over the last six or seven years to identify new dry-film technologies for various regions and climates around the world. The first new product for North America will be launched at the beginning of 2014 and will be a three-way blend based on pyrrhione chemistry as a platform. Lonza will also be launching two new products for the Asian market at the ChinaCoat exhibition in November 2013.

According to Singhal, Ashland works to meet its customers' needs by developing unique cocktails

such as its new Nuosept™ BMc412 blend of three isothiazolinone actives for the U.S. market and its Nuosept BIF 4 blend of isothiazolinones and 1,3-bis(hydroxymethyl)-5,5-dimethylimidazolidine-2,4-dione (DMDMH) for fast-acting, long-lasting in-can protection. "When developing new blends, there are many factors to consider. First, the consolidation in the paint industry has resulted in the formation of fewer, global formulators that are looking for globally approved biocide formulations, which are challenging to develop given the disparity of biocide regula-

tions around the world," says Singhal. At the same time, formulators are developing more environmentally friendly products, including water-based, high-solids solvent-borne, and 100% solids paints and coatings, and looking to protect these formulations with lower concentrations of biocidal actives. The demands placed on biocides in these different types of systems vary, however. In particular, prevention of microbial growth in water-based paints is much more challenging, according to Tierney. In addition, while biocides rarely affect coating performance, the ingredients



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in paints can lead to degradation of the biocidal active and reduce performance. Therefore, it is important to choose actives that are stable in a given paint or coating. One new option from Ashland is Nuosept BT10, a convenient 10% water-based BIT solution for easy addition to paints, according to Singhal.

"The archaic idea of a one-size-fits-all biocide cannot meet the complex antimicrobial demands of today's new processes and products," asserts Beth Ann Browne, a North American customer application specialist with Dow Microbial Control. To make the solution development process more efficient, the company developed its proprietary Taunovate™ High-Throughput testing technology, a microbial testing platform designed specifically for aqueous industrial products, including coatings. "With this methodology, efficient, simultaneous evaluation of several biocide combinations is possible, leading to the identification of synergistic combinations and concentration ratios for customized solutions that are not only cost-optimized, but allow for environmentally conscious decision-making," she explains.

One way to reduce the costs of new product registrations is to investigate other types of biocide chemistries that are currently approved for use in other industries and end-uses, according to Tierney.



Lonza is taking this approach by exploring biocides used in wood products and agricultural applications for their effectiveness in paints and coatings. "Because most of the extensive toxicological and environmental fate data that is required should be available, the cost for introduction of this type of new biocide to the paint and coatings market can be reduced significantly," he says.

Dow Microbial Control is one company that has introduced a new biocidal active for use in coating formulations. Extensive testing has shown MBIT (N-Methyl-1,2-benzisothiazol-3(2H)-one) to be a sustainable and effective in-can preservative, accord-

ing to Browne. MBIT is already offered in the product Bioban™ 551S Antimicrobial in regions including Southeast Asia and South America, and Bioban 557 Antimicrobial is scheduled to be released in North America in 2014. "Bioban 557 is suitable for low-VOC, water-based systems to meet all major coating eco-labeling schemes and, importantly, does not contain or release formaldehyde or contain bronopol," says Browne. She also notes that Bioban is a combination product including MBIT that addresses performance gaps of single-active isothiazolinone products and demonstrates long-term in-can preservation efficacy against bacteria and fungi with a fast speed of kill.

In addition to creating novel blends of different actives, most biocide manufacturers are also focusing their research efforts on the development of new controlled release technologies. "The benefits of controlled release technology are (1) a decrease in the leaching of the active material, which is particularly important for algacide actives; and (2) extending the duration of coatings protection," states Clay.

The demand for "greener" biocide solutions is increasing and will remain a major driver in the paint and coatings market for the foreseeable future, according to Tierney. "'Green' labels and certifications will become increasingly important for consumers, including do-it-yourselfers and contractors, in the architectural market. Controlled release formulations have the potential to use less active, thus reducing both environmental impact and formulator cost. The concept is, therefore, highly attractive," he believes.

One approach receiving significant attention is encapsulation of the biocidal active. While the idea sounds simple, the implementation of the concept is challenging. The encapsulant must not interrupt the mechanism of action of the biocide, and it must allow release of the active at the appropriate rate, or the biocide will be ineffective. In addition, incorporation of the encapsulated biocide cannot impact

the properties of the paint or coating in terms of processing, ease of application, and film performance, Tierney observes.

Troy has had success in this area, though. The company recently introduced its Polyphase® and Troysan® CR lines of advanced, high-performance, broad-spectrum dry-film preservatives in Asia, Europe, and the United States, according to Clay. "Polyphase and Troysan CR preservatives have demonstrated remarkably long-term coatings protection at field testing sites located around the world. Leaching tests have also shown that Troy's innovative approach provides superior resistance against active loss into the environment," he says. The company has found that the Troy CR preservatives deliver significantly improved color stability in light colored coatings. Ashland, meanwhile, has introduced to the U.S. coatings market its IPBC-based Fungitrol™ 940CR fungicide with proprietary "Sustained Release Technology" for waterborne coatings.

Whether developing novel encapsulated products or new blends of different biocidal actives, the key to success for biocide producers is developing close relationships with their customers. "The marketplace for biocides is very competitive, and biocide suppliers must have a clear understanding of both their own product chemistries and the processes and performance expectations of their customers," says Singhal.

Maintaining a very high level of customer service is imperative, according to Tierney. Customers expect biocide manufacturers to qualify their biocides in customer formulations and optimize the performance of blends of actives for specific products. Biocide producers also conduct hygiene audits of customer plants to identify any potential microbial contamination that could be an issue during manufacturing of the paints and coatings. In addition, they help customers with extensive analytical support and provide problem-solving assistance related to both manufacturing and product performance issues.

Browne agrees. "Dow is taking an aggressive approach to help customers protect against microbial contamination through customer-specific formulation testing (microbial efficacy for in-can and in film preservation, biocide stability, algal testing, and time-kill testing for product contamination). We also conduct microbiological audits of manufacturing facilities and provide analytical support and in-person and online training," she notes.

"The biocides business is very cost-intensive and requires a long-term view and commitment. Companies that have a short-term outlook will not make the investments that are required to effectively serve customers and remain competitive with high-performing, compliant products," Tierney asserts. ☐