The Keys to Success

In the Coatings Market

For every paint and coatings application, particular 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 microbiological contamination can range from minor issues such as the growth of mold, fungus, or bacteria to major issues including gas production, bulging containers, phase separation, viscosity changes, poor adhesion, and fouling of the product. This paper highlights the role of biocides and biocides manufacturers in combating these issues.

In 2012, the global market for formulated biocides used in paint and coatings applications totalled $500 million, according to David Tebey, 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 industry, according to Shreed Sinha, 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 previously experienced. 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 type 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 algalic activities, and recent use has been decreasing. In these regions, according to Tebey, in Asia-Pacific, however, where high humidity and extensive periods of regular rainfall are commonplace, the incorporation of anti-algal agents into dry-film preservatives is increasing, including those based on copper, iron, and silver. As a result, most in-can and dry-film biocide formulations consist of blends of two or three different active ingredients to achieve optimum performance, according to Tebey.

Due to the high cost ($6-$10 million) of registering new biocidal additives with regulatory bodies around the world, the development of new chemistries has been severely limited for many years. The site of the industrial biocide market does not justify the large investment required for the development and commercialization of new active agents, notes Sinha. As a result, most in-can and dry-film biocide formulations consist of blends of two or three different active ingredients to achieve optimum performance, according to Tebey. Lonza has, in fact, just completed a global expansion program over the last six years to identify new dry-film technologies for various regions and climates around the world. The initial new product for North America will be launched at the beginning of 2014 and will be a three-way blend based on pyridino seaweed chemistry as a platform, Lonza is testing two new products for the Asian market at the ChinaCoat exhibition in November 2013.

According to Sinha, Ashland works to meet its customers' needs by developing unique cocktail products such as its new Nuscept™ BMc412 blend of three isothiazoline actives for the U.S. market and its Nuscept™ BMc414 blend of isothiazolines and 1,3-dimethyl-2-hydroxypropyl-3,5,5-trimethylcyclohexanone-2,4-dione (OMOH) 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 diversity of biocide regulations around the world," says Sinha. At the same time, formulators are developing more environmentally friendly products, including water-based, high-solids solventborne, and 100% solids paints and coatings, and are 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, preserving microbial growth in water-based paints is much more challenging, according to Tebey. In addition, while biocides are rarely affected by algae in water-based paints, the use of biocides in high-metal paints is much more challenging.

"The archaic idea of a one-size-fits-all biocide cannot meet the complex antimicrobial demands of today's new processes and products," adds Beth Ann Brown, a North American customer application specialist with Dow Microbial Control. To make the solution development process more efficient, the company developed its proprietary Tauonelle™ High-Throughput Screening (HTS) 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 more efficient in controlling microbial growth but also less 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 Trebey.
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, and even during application. Such consequences can range from minor to serious. Such consequences include gas production, off-color, and loss in aesthetic appeal. Other consequences include mold, unpleasant smells, and loss of occlusion in the application. In some cases, biocides are used to extend the shelf life of the product.

In addition to the variation in growth rate from region to region, there are also differences in the types and concentrations of biocides being demanded for use in paints and coatings different applications. For example, in the United States and Europe, there has been growing concern about the type of biocides being used. In particular, there is concern about the use of formaldehyde in paints because it is a known 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 pyrithione, including zinc pyrithione (ZPT), sodium pyrithione (NPT), and copper pyrithione (CP). For marine applications, 3-iodo-2-propynyl butylcarbamate (IPBC); and the isothiazolinone derivatives of chloroimidazoline (CIT) and dichloromethyl isothiazolinone (DCMIT). The high cost 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 registration 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 pyrithione 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 Singh, Ashland works to meet its customers' needs by developing unique cocktails such as its new Nuosept™ BN+412 blend of three isothiazolinone actives for the U.S. market and its Nuosept B14 blend of isothiazolinones and 2,6-bis(hydroxymethyl)-4,5-dimethylimidazoline-2,4-dione (DNMOH) for fast-tracking, 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 biocidal formulations, which are challenging to develop given the disparity of biocide regulations around the world," says Singh. At the same time, formulators are developing more environmentally friendly products, including water-based, high-solid solvent-based, and 100% solids paints and coatings, and trying 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 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 BITC, a convenient 10% water-based BIF 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 BioAdvisor® 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 cost 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.
Lonz is taking this approach by exploring biocides used in wood products and agricultural applications for their effectiveness in paints and coat-ings. “Because most of the extensive toxicological and environmental fate data that is required should be avail-able, the cost for introduction of this type of new biocide to the paint and coatings market can be reduced sig-nificantly,” he says.

Dow Microbial Control is one company that has introduced a new biocidal active for use in coating formu-lations. 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 Bloban™ 5515 Antimicrobial in regions including Southeast Asia and South America, and Bloban 557 Antimicrobial is scheduled to be released in North America in 2014. “Bloban 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 Bloban is a combination product including MBIT that addresses performance gaps of single-active isothiazolone 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 focus-ing their research efforts on the development of new controlled release technologies. “The benefits of con-trolled release technology are (1) a decrease in the leaching of the active material, which is particularly important for algalicide 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, ac-cording 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, incor-poration of the encapsulated biocide cannot impact the properties of the paint or coating in terms of processing, ease of application, and film perfor-mance, Tierney observes.

Troy has had success in this area, though. The company recently introduced its Polyphase™ and Troyen® CR lines of advanced, high-performance, broad-spectrum dry-film preservatives in Asia, Europe, and the United States, according to Clay. “Polyphase and Troyen 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™ 9400 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 market-place 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 cus-tomers with extensive analytical support and provide problem-solving assistance related to both manufactur-ing and product performance issues.

Browne agrees, “Dow is taking an aggressive ap-proach to help customers protect against microbial contamination through customer-specific formulation testing, (microbial efficacy for in-can and in-film pres-ervation, biocide stability, ailing 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.

Ashland Specialty Ingredients offers industry-leading products in its Coatings product line. Ashland is a complete additive provider of innovative solutions for waterborne architectural coatings, including rheology modifiers, defoamers, surfactants, dispersants and biocides. Have more questions on your mind? Call our Ashland representatives at 800 345 0447 / 302 594 5000 or visit ashland.com/coatings

* Regional management, business development, corporate environmental, health, and safety responsibilities have changed since this report was written. New management, agents, or representatives, if any, have not been identified.