Press release

Intelligent coatings: Evonik draws a cloak of invisibility over ships

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- New coating to make ships invisible to microorganisms
- Evonik Competence Center investigating the biofouling problem
- Biofouling on ship hulls increases costs and CO_2 emissions worldwide

Essen, Germany. In a double benefit for the global economy and world climate, Evonik plans to make ship hulls invisible to microorganisms and so to protect them against biofilms, algae, and bivalves. Growths of this kind, referred to as biofouling, push up fuel consumption in shipping, and thus also CO_2 emissions on the world's oceans. The International Maritime Organization estimates that the annual costs caused by biofouling lie in the billion-dollar range. Evonik is working on a solution to the problem in the form of new eco-friendly coatings that counteracts biofouling. The coating tricks microorganisms into perceiving plain water in front of them, rather than the ship's hull; as a result they often make no attempt to settle on the hull.

Biofouling has long been a problem for shipping companies the world over: Organisms settle on the ship's walls, changing the smooth surfaces into a rough and ragged shell. This increases frictional resistance in the water, so that biofouling slows down ships. These then need more energy to maintain their speed, which is bad news for both fuel costs and the environment. Marine transport accounts for about 90 percent of global freight forwarding.

"Biofouling is one of the last unsolved problems in the coatings industry. Up to this point we had not succeeded in finding the optimal solution for ship coatings that are efficient as well as eco-friendly. This is why antifouling coatings are a core topic at our new 'Smart Surface Solutions' Competence Center," says Stefan Silber, head of Innovation Management Coating Additives in Evonik's Resource Efficiency Segment. The work of the experts here is not confined to marine coatings; it also covers topics such as anti-icing protection, antimicrobial coatings, and dirt-repellent surfaces.

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To protect ship hulls against biofouling, Evonik's scientists are exploiting a trick in the new coating: In it, they combine a water-repellent (hydrophobic) silicone with a water-loving (hydrophilic) polymer. This results in the formation of amphiphilic polymers, in which hydrophilic and hydrophobic domains alternate. The hydrophilic domains attract water to the ship's hull. This builds a sort of water shell around the polymers, camouflaging the hull from the organisms. The alternation with water-repellent domains further confuses the organisms: They can no longer clearly recognize the surface, nor distinguish the hull unambiguously from sea water. As a result of this uncertainty they usually stay away from the hull altogether.

If the microorganisms do nevertheless try to settle on the hull, the second defense mechanism of the hydrophobic domain—its anti-adherent action—should come into play: The base material for the new solution against biofouling, the SILIKOPON® EF silicone hybrid resin from Evonik's portfolio, makes it difficult right from the start for the organisms to settle on the hull. This is because the very low surface tension and extremely smooth surface of the silicone give it easy-clean properties. The organisms cannot readily adhere to the hull, and the few that do succeed should be dislodged by the water stream, even at low ship speeds.

"We're thus using a tried and tested product in a new way and at the same time expanding Evonik's expertise. So we're succeeding in developing new solutions for coatings to protect ships against biofouling—and without attacking the organisms directly," says Silber.

The researchers are making good progress in developing their innovation: Field tests under real conditions have already proven the basic efficacy of the new hybrid systems. The scientists are now working jointly with customers in the industry on coatings based on the new systems.

They are also confident of being able to increase the interval between successive applications of the coating in the future. This would enable shipping companies to reduce maintenance costs as

well as the negative effects of biofouling, such as high fuel consumption.

Company information
Evonik is one of the world leaders in specialty chemicals. The focus on more specialty businesses, customer-orientated innovative prowess and a trustful and performance-oriented corporate culture form the heart of Evonik's corporate strategy. They are the lever for profitable growth and a sustained increase in the value of the company. Evonik benefits specifically from its customer proximity and leading market positions. Evonik is active in over 100 countries around the world with more than 36,000 employees. In fiscal 2016, the enterprise generated sales of around €12.7 billion and an operating profit (adjusted EBITDA) of about €2.165 billion.

Evonik's international activities are organized into six regions. The Asia Pacific North region consists of China, Taiwan, Japan & Korea, and is headquartered in Shanghai. Sales in Asia Pacific North reached 1,947 million euros in 2016. Evonik regards China as one of the driving forces of the global economy and we consequently endeavor to grow our business here. The company now employs about 3,000 employees and has in total of 10 production sites in China.

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