Heraeus

Innovative Antimicrobial Technology AGXX® Prevents Microbial Infestation and Biofilm Formation

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Harmful organisms such as bacteria, viruses, fungi, or other germs can cause considerable damage to human health and the economy. This is of particular relevance in the areas of paints & coatings, products made of plastic, textiles and, above all others, in water supply. As pathogens multiply easily in liquids, filter systems can be an effective countermeasure. AGXX catalyst technology can be integrated easily into filter systems to prevent the spread of dangerous microorganisms and to protect the filter itself from biocorrosion. This approach is centered around a completely new catalytic process based on precious metals.

Microorganisms are ubiquitous in everyday life. While the presence of some microorganisms is not harmful to humans or even beneficial in the context of biological metabolic processes, some strains of bacteria, viruses or fungi pose a serious threat to human health and cause severe economic consequences every year due to biocorrosion and fouling. In order to prevent biocorrosion and fouling, antimicrobial technologies are used to ensure the functionality of equipment and enhance the quality of the goods produced. AGXX reduces these risks in paints & coatings, polymers, textiles and various other applications. One promising example for the application of AGXX, is the fight against pathogens in aqueous media. Ensuring a high-quality water supply is one of the basic needs of civilized societies. Water filtration plays a crucial role in this context in various fields, such as wastewater treatment, drinking water supply, household filter applications, and swimming pool water treatment. However, filters are susceptible to contamination by microorganisms and biofouling, which not only endangers consumer health but also shortens product life. Especially with the spread of multi-resistant germs and the dwindling supply of effective antibiotics and approved biocides, it is more important than ever to protect filters from bacterial growth and improve water quality through innovative antimicrobial technologies.

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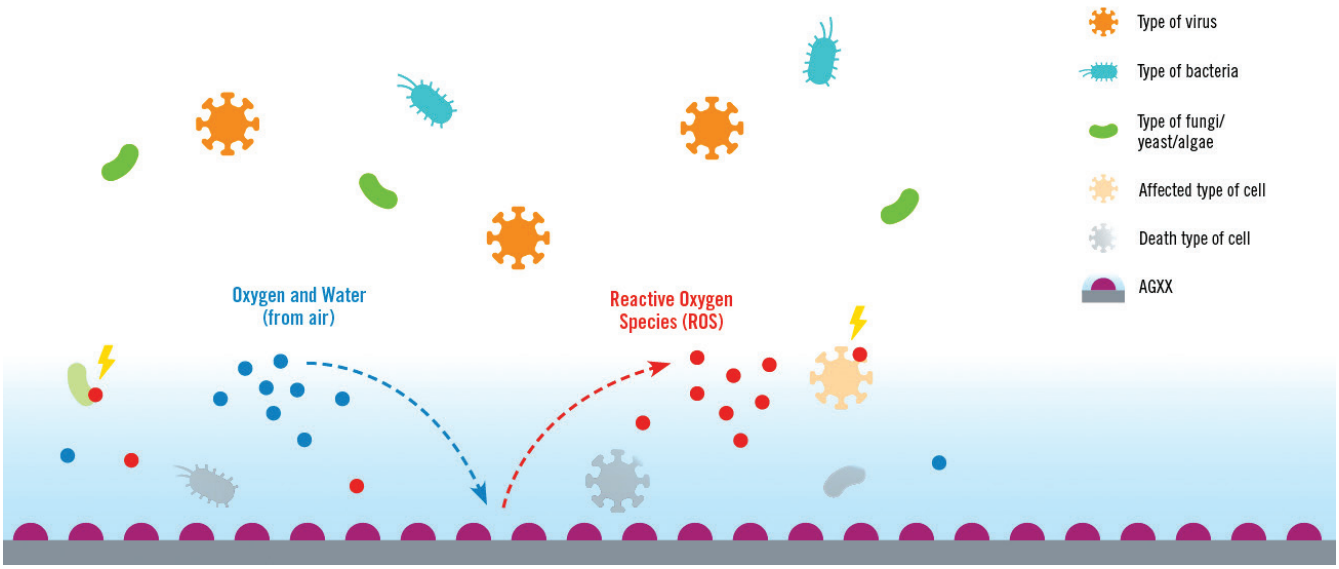

Figure 1: Antimicrobial mechanism of AGXX. AGXX acts against all types of microorganisms by generating reactive oxygen species, inducing a microelectric field, and oxidizing organic matter as part of its circular redox system.

AGXX – a highly effective antimicrobial technology based on precious metals

AGXX is a new antimicrobial technology based on the catalytic generation of reactive oxygen species (ROS) from water and oxygen. This reaction is caused by the electrochemical interaction between the two precious metals silver and ruthenium. In addition, a microelectric field between the two precious metals enhances the antimicrobial effect.

Compared to conventional biocides, such as silver ion technologies, AGXX is not based on the release of metal ions or harmful compounds into the environment. AGXX is not self-consumed as part of the catalytic redox reaction and therefore provides long-lasting protection.

To date, antimicrobial activity has been demonstrated against more than 130 microorganisms, including bacteria, viruses, algae and fungi. In this context, AGXX has also been successfully used against silver-resistant E. coli strains, the multi-resistant germ methicilin-resistant S. aureus (MRSA) or CoV2 viruses, which can be attributed to the catalytic mechanism of action and the generation of oxygen free radicals. The application of AGXX also prevents biofilm formation, which has already been successfully demonstrated in use against Legionella.

AGXX for water filtration

AGXX can be integrated into a wide range of applications as a particle-based system. The technology is available in various product forms that are optimized for different product types. For this purpose, the precious metals are deposited on different carrier materials. AGXX grades based on fine powders of inorganic carriers such as activated carbon powder, aluminum oxide or titanium dioxide are well suited for incorporation into textile filters. In addition, AGXX can also be successfully impregnated onto various types of activated carbon granules and pellets, which can be easily used in activated carbon-based water filters.

AGXX activated carbon granules showed excellent antimicrobial efficacy in ASTM E2149 and laboratory water filtration tests. Currently, samples of AGXX-modified activated carbons are being tested in wastewater treatment and for cleaning systems in swimming pools at the Fraunhofer Institute UMSICHT and the IWW Center for Water, respectively. Both the potential of AGXX to kill germs in water filtration and the influence of the AGXX coating on the filter properties of the activated carbon are being tested.

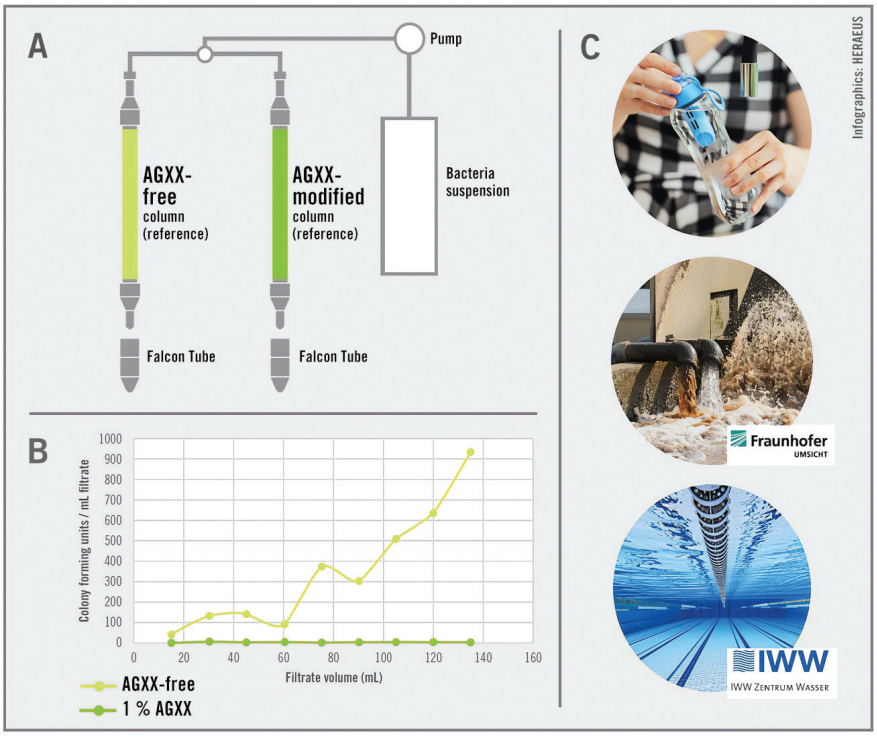

Figure 2: Application of AGXX in water filters. (A) Experimental setup in the laboratory. (B) Laboratory-scale antimicrobial efficacy of AGXX activated carbon in water filtration. (C) Initiated field tests of AGXX in swimming pool water filtration and wastewater treatment.

As a particle-based system, AGXX can be integrated into filter applications in a variety of ways and offers the possibility of effectively preventing the spread of pathogens over a long period of time, thus protecting the health of humans and animals. In addition, longer product lifetimes can be expected due to the prevention of biofilm formation on the filter material.

AGXX can also be used effectively in other applications: the wide range of applications includes not only filters but also plastics, paints and coatings, air-conditioning technology, protective masks, medical products, or sanitary equipment.

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