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From the aspect of sustainability:

Benefits of biocidal products

Introduction

With Regulation (EU) No 528/2012 (BPR¹, applies from 1 September 2013) biocidal products are regulated uniformly inside the European Union¹ for the first time. The BPR distinguishes between 22 different product-types (PTs) which are grouped in five main groups. All biocidal products have in common that they are intended to control or deter harmful organisms.¹¹ As disinfectants or pest control agents they provide protection against dangerous diseases or their carriers. They are also used to protect perishable goods. A complex authorisation procedure ensures that the manufacture and use of biocidal products have no harmful impacts on human or animal health and no unacceptable impacts on the environment.

Where they are used in a sustainable manner, biocidal products offer major economic, ecological and societal benefits. These benefits of the various groups of biocidal products are explained in more detail in the following text.

Main group 1: Disinfectants

Disinfectants make an important contribution to health protection by preventing the spreading of infections by harmful micro-organisms.

PT 1: HUMAN HYGIENE

Product-type 1 includes, for example, hand disinfectants. They serve, inter alia, to prevent nosocomial infections (infections acquired in hospitals) and for prophylaxis in pandemics. In its recommendations the Robert Koch Institute (RKI, the central institution of the German federal government for disease monitoring and prevention) highlights the importance of hand hygiene especially in hospitals.^{2,3,4} The advantages of hand disinfection, as compared to thorough washing with soap, are pointed out explicitly. At the global level, the World Health Organization (WHO) wants to help prevent health care-associated infections (HCAI) with its programme “*Clean Care is Safer Care*”.⁵ In Germany, this WHO-initiated programme is implemented with the “*Aktion Saubere Hände*”.⁶ Also in the non-clinical private sphere, hand disinfection can make sense in many cases, as prophylaxis to protect certain groups of persons.⁷

¹ The BPR also applies in Iceland, Liechtenstein and Norway.

¹¹ BPR, Article 3(1): ‘Biocidal product’ means any substance or mixture [...] with the intention of destroying, deterring, rendering harmless, preventing the action of, or otherwise exerting a controlling effect on any harmful organism ...

PT 2: DISINFECTANTS AND ALGAECIDES NOT INTENDED FOR DIRECT APPLICATION TO HUMANS OR ANIMALS

PT 2 products are algaecides or disinfectants for all kinds of surfaces which are not in direct contact with food production.

In the medical sector – in hospitals or doctors' practices – the disinfection of work areas (e.g. operating theatres) is of enormous importance, in order to prevent infection transmission to patients and staff. Disinfection of waiting rooms or sanitary facilities can be advisable too.⁸ Here, the need to disinfect is not just limited to “hard” surfaces like furniture or floors; this need is also given for “soft” materials like textiles. Especially the hygienic treatment of textiles for the health sector calls for laundry methods with disinfecting laundry detergents. In this respect, the guidance by the Robert Koch Institute lays down detailed requirements to the hygiene of laundry.⁹ Due to the increased occurrence of nosocomial infections, the requirements to hygiene have been severely tightened in Germany with the amendment of the infection protection act (Infektionsschutzgesetz) of 2011.¹⁰

The targeted use of anti-microbial cleaning products can make sense also in private households, especially to protect certain groups of persons (infants, toddlers, pregnant women, older persons or immunocompromised persons – due to e.g. disease or medicines intake – who are particularly at risk of infection). One relevant example is the disinfection of toilets and bathrooms for very high hygiene requirements, e.g. in the event of infectious gastrointestinal diseases. In certain cases of disease, where this was recommended by the doctor or the local health authority, the Federal Institute for Risk Assessment (BfR) advises for the use of special disinfectants in private households.⁷

As regards mould infestation of articles or walls, taking mould removal measures is essential for health protection. Disinfection is a rapid possibility to prevent further spreading of the mould and to eliminate health-harming spores.

Beside the direct protection of human health, surface disinfection is also necessary in the production of many products: In the manufacture of pharmaceuticals and medical devices and also in the cosmetics industry, sterile surfaces ensure the production of “safe” products by preventing product contaminations.

Another example of the use of PT 2 products contributing to sustainability is the maintaining of water quality in swimming pools and baths. The hygiene requirements for public bathing facilities include water treatment.¹¹ Processes and use of products are regulated in a number of provisions.^{12, 13} This contributes to health protection and has a positive influence on the duration of use.

PT 3: VETERINARY HYGIENE

The use of disinfectants creates a hygienic environment in animal keeping and in the production of foodstuffs of animal origin. Animals are kept in optimal health, and the spreading of both animal epidemics and human diseases is prevented in a precautionary approach.

Ongoing discussions and initiatives to reduce the use of antibiotics in animal keeping are possible only with the help of optimal hygiene, supported by the appropriate use of disinfectants.

PT 4: FOOD AND FEED AREA

PT 4 products are intended for the disinfection of materials directly connected with the production and storage of food or feedstuffs. Utensils and work surfaces need to be disinfected both in industrial and commercial food production.

For example, Regulation (EC) No 852/2004 on the hygiene of foodstuffs¹⁴ prescribes the following for all articles, fittings and equipment which come into contact with food: “... *Cleaning and disinfection are to take place at a frequency sufficient to avoid any risk of contamination.*” Disinfection is required in the processing of fresh fish and fowl to avoid e.g. salmonella.^{15,16,17}

High hygiene standards are indispensable in areas of large-scale catering – restaurants, canteens, hospitals or catering businesses. Wherever food is prepared professionally for large numbers of persons, hygiene measures need to be taken to protect consumer health. The use of disinfectants enables the cleaning and disinfection of surfaces, tableware, working utensils and hands in such a manner that not only optical cleanness but also a microbiologically impeccable state can be achieved. This necessity is emphasised by the resurgence of diseases caused by noroviruses.⁹

Disinfection in private kitchens – e.g. of work surfaces in direct food contact, shelves or storage surfaces in refrigerators or of electrical kitchen equipment in direct food contact – can make sense too, especially for certain groups of persons (such as infants, pregnant women, older persons or immunocompromised persons – due to e.g. disease or medicines intake – who are particularly at risk of infection).⁹

PT 5: DRINKING WATER

Clean and safe drinking water for humans and animals is an essential prerequisite for health. Waterborne pathogens would rapidly reach and infect many people. Therefore, this risk needs to be kept very low.¹⁸ This can be achieved only by way of careful fresh water treatment with the help of disinfectants, as is demanded and regulated at the European level by the European Drinking Water Directive¹⁹ and nationally by the drinking water ordinances²⁰. Usually, the basis in the relevant pieces of legislation is a targeted and monitored disinfection directly at the waterworks. It is laid down which disinfection methods are used for drinking water.^{21,22} Additionally, drinking water supplies on ships are subject to further provisions.¹⁷

The recurrence of legionella shows that drinking water is a sensitive field. Control of such bacteria in the system is possible with appropriate disinfection measures.²³

Main group 2: Preservatives

Main group 2 comprises product-types which improve the quality of various products and prolong their lifespan. Quite often, these are complex products and processes

which require high inputs of raw materials and energy. The use of protective agents reduces materials consumption, makes industrial processes more efficient and, consequently, helps preserve valuable energy and raw material resources.

PT 6: PRESERVATIVES FOR PRODUCTS DURING STORAGE

PT 6 products are called (in can) preservatives: They prolong the shelf-life of products and enable their intended use also after prolonged storage.

Usually, water-based consumer products need preservatives to be fit for storage and use over sufficiently long periods of time. This need for preservatives is also attributable to the fact that, for example, certain substances used in such consumer products have to be readily biodegradable. Moreover, water is used as a solvent quite predominantly. Both points make these products susceptible already during storage, e.g. to bacteria and mould fungi. Adding preservatives extends their usability and brings about their safety for consumers. In this way, early disposal can be prevented which, obviously, reduces resource consumption.

PT 7: FILM PRESERVATIVES

Biocidal products of PT 7 protect various surfaces against microbial deterioration or algal growth. Some relevant examples are facade or wood coatings with preventive resistant film protection.^{III} As compared with untreated coatings, there is less growth in unfavourable weather conditions. Such growth is not only visually unappealing, it can also cause damage. Applying systems with preventive resistant film preservatives can clearly prolong the renovation cycle of facades and thus preserves resources such as wood, plaster and paint.^{24,25,26,27}

PT 8: WOOD PRESERVATIVES

Wood preservatives contribute to a much longer useful life of wood products. Outdoor wood products from local conifers – e.g. wooden terraces, carports, fences, facade elements and also garden furniture – are exposed to weathering and need protection against wood-destroying or wood-discolouring organisms (such as fungi or insects) to maintain their long functioning.

Also those wooden construction elements which are sheltered from rain and moisture – such as roof trusses – can require the use of PT 8 biocidal products to protect them against wood-destroying organisms. For example, construction timber treated with a wood preservative can make essential contributions to maintaining the structural safety of buildings and thus to protecting their inhabitants.²⁸ Where unprotected wooden construction elements are attacked by harmful organisms – e.g. wood-destroying insects or real dry rot – such attack can be controlled with suitable biocidal products.²⁹

This prevents a spreading of the attack, the damage is limited, and the building structure or valuable wooden objects are preserved.

^{III} Preventive resistant film protection ensures that the surface is also protected against mould attack / green film / fungi.

In many cases, economically viable uses of local types of wood of low natural durability are made possible by the use of wood preservatives in the first place. The longer useful life of thus protected types of wood helps preserve natural resources and makes a positive contribution to the CO₂ balance. Furthermore, wood preservatives also contribute to reducing the use of tropical wood.

PT 9: FIBRE, LEATHER, RUBBER AND POLYMERISED MATERIALS PRESERVATIVES

PT 9 biocidal products protect a range of various materials. They reduce attack by micro-organisms; in this manner, they prolong the lifespan of many different articles.

One field of application is the use of biocidal products on cleaning cloths. In their own use, cleaning cloths absorb many different kinds of dirt and soiling. As there is usually wet cleaning, bacteria find a favourable environment for more growth. A biocidal finish protects the fibre material of the cloth so that bacteria cannot take hold.

With the use of wash-resistant finishes, the above-described effect is kept up even after many washings. As bacterial growth on the cleaning cloth is inhibited, no unpleasant odours – due to metabolites of bacteria – form during the service life of the cleaning cloth. Consequently, the lifespan of such cloth is prolonged and consumption is lowered. Yet another positive effect: Contamination during cleaning activities is reduced.

PT 10: CONSTRUCTION MATERIAL PRESERVATIVES

Biocidal products of PT 10 are used in order to protect masonry or other construction materials. These biocidal products are not only intended to prevent attack by mould fungi, algae or other micro-organisms and to keep the treated construction materials in an optically good state; they also ensure their functioning during their use phase. Construction materials need to be protected by PT 10 biocidal products especially where such materials are exposed to moisture and wetness, either permanently or over prolonged periods of time. This is the case e.g. for weathered exterior parts of buildings (facades or similar; also see PT 7).

PT 11: PRESERVATIVES FOR LIQUID-COOLING AND PROCESSING SYSTEMS

PT 11 biocidal products are used e.g. in cooling systems against algal attack. This also prevents the occurrence of legionella. This measure enables the use of cooling water in a cycle over an extended period of time, reducing the input of fresh water as compared with the use of untreated cooling water. As a result, processes requiring cooling can be performed at less cost and in an environmentally sounder manner. Suitable measures are described in various standards and guidance documents.^{23,30,31}

PT 12: SLIMICIDES

Microbial slime forms in particular in industrial processes where water is used as a production aid. Such slime makes processes inefficient and causes disruptions and

damage to industrial plants. In the relevant processes – e.g. in pulp and paper production or in secondary oil production – the use of biocidal products brings every year savings of large quantities of fresh water. Moreover, plant corrosion due to microbial slime is reduced.

PT 13: WORKING OR CUTTING FLUID PRESERVATIVES

Functioning metal working fluids and cooling lubricants are indispensable in modern machinery. They enable the precise processing of metal raw materials which are produced with high overall energy requirements.

During their use, cooling lubricants are exposed to many negative influences; these are conducive to microbial growth. Microbial contaminations of water-mixed cooling lubricants lead to technical disruptions and pose health and safety risks to processing staff. Moreover, such contaminations can lower the pH value of the system. This causes impairments in corrosion protection and emulsion stability. The consequences are unfavourable processing performances and shorter service lives of tools and systems.

The use of biocidal products reduces microbial growth and its impacts. In their intended application, PT 13 biocidal products contribute to sustainable use overall by minimising waste volumes (ecology), enabling longer service lives (economy) and enhancing industrial health and safety (social).

Main group 3: Pest control

Pests like rats, mice and fleas are a risk to human health. Their role in the transmission of diseases should not be underestimated. They also affect food stocks by contaminating or destroying foodstuffs. They can destroy human property and cause technical defects.^{32,33}

Main group 3 includes biocidal products for the control of various pests. These products make important contributions to preserving health and quality of life (social component of sustainability).

PT 14: RODENTICIDES

Being health and hygiene pests, rodents can impair human health. For example, over 100 different diseases can be transferred from rats to humans.³⁴ As storage and material pests, they cause damage by destroying or contaminating stocks or by rendering articles unusable. Many items of information about rat control show that these rodents continue to pose a widespread problem. In February 2014 the Lower Saxony Ministry of Food, Agriculture and Consumer Protection published a guidance document for an effective rat control strategy. This document describes the use of rodenticides as “without alternative”.³⁵ Moreover, in most municipalities the owners of buildings or plots of land are obliged to control health pests under §17 of the infection protection act (Infektionsschutzgesetz).^{10,36}

PT 18: INSECTICIDES and PT 19: REPELLENTS AND ATTRACTANTS

Insects can be harmful to humans in various ways: Large numbers of diseases – malaria, dengue fever or West Nile fever – are transmitted e.g. by mosquitoes.³⁷ The danger of epidemics grows in particular after flood disasters when the mosquito populations rise in the affected regions. Therefore, after the flood disaster in May 2014 in the Balkans the WHO warned against an outbreak of the West Nile virus and discussed prevention measures with the impacted countries. The control of mosquito populations and their larvae was an important instrument in this effort.³⁸

Insect bites can involve risks even without flood disasters. The use of repellents improves protection against insects (such as mosquitoes and gadflies) and ticks and thus helps prevent bites. Insect bites are not only bothersome or dangerous in case of disease transmission; they can also cause skin infections – either directly through the bite or indirectly if the skin is broken caused by scratching the itch.^{39,40}

Other health effects are caused by the oak processionary moth. The poisonous hair of the oak processionary caterpillar leads to allergies in humans and – especially in children – to serious health problems. Therefore, it is imperative in the vicinity of kindergartens to take measures against the oak processionary moth and its caterpillars. The targeted use of suitable biocidal products can provide effective protection for risk groups.^{41,42,43}

In other instances, insects are no direct health threat but they can cause a lot of damage. Some relevant examples are clothes moths and fur beetles; they cause material damage through their feeding habits. There are also food pests such as cockroaches, ants or bread beetles. Due to them, large quantities of foodstuffs can perish or become unfit for consumption. Beside the economic damage, such cases also mean health risks. Considerable economic losses can be averted by using pheromone traps which prevent pest attack.

Main group 4: Other biocidal products

PT 21: ANTIFOULING PRODUCTS

PT 21 products are used, inter alia, to prevent growth of e.g. algae or shells on ships (“fouling”). This positively influences the cruising performance of a craft and makes major contributions to reducing the power needed to operate a vessel. This also means that with the same distance travelled, fewer CO₂ emissions are released into the environment. According to the International Maritime Organization (IMO), fouling of the hull increases fuel consumption by up to 50% due to higher resistance to movement.⁴⁴

Another positive effect is a reduction in the risk of introducing non-indigenous species (e.g. plants or shells). Container ships usually travel large distances and can carry such “stowaways”. The use of antifouling products lowers this risk, and the introduction of invasive species is prevented.

Protecting ships against fouling by maritime organisms constitutes an important ecological and economic factor.

Conclusion

Biocidal products are intended to be effective against various harmful organisms. They should be used carefully and for their intended purposes.

The Biocidal Products Regulation (BPR) applies in the European Union¹. This piece of legislation regulates the making available on the market and use of biocidal products. The BPR also covers the placing on the market of treated articles.

Prerequisites for marketing and use are the approval of the active substances and the subsequent authorisation of the products for the respective product-types. The authorisation procedure makes sure that the products are safe while they do not pose any unacceptable risk to humans and environment. Numerous further pieces of legislation need to be observed in both manufacture and use of such products inside the European Union. These legal provisions protect humans and environment and ensure the safe handling of chemicals.

Biocidal products are indispensable for high health and hygiene standards in our society. As highlighted in the various examples, biocidal products are of major socio-cultural, economic and ecological importance and greatly significant to health. Hence, they bring sustainable benefits.

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