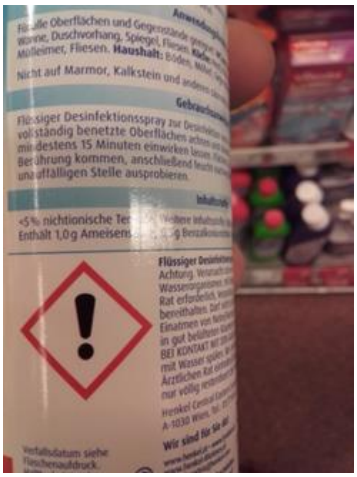
DISINFECTION IN THE HOUSEHOLD
(Executive Summary)

BENEFITS AND RISKS OF DISINFECTING HOUSEHOLD PRODUCTS



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Introduction

Retailers offer a range of products with biocidal or antimicrobial efficacy for the household sector. In the shelves all-purpose cleaners, wipes and sponges, gels, soaps and detergents with labelled disinfecting efficiency can be found. Such is indicated by “antibacterial”, “disinfecting”, “eliminates 99.99% of bacteria” or “eliminates germs, bacteria, viruses and mould”. Due to such a labelling the products belong to the product group *Disinfectants* and are subject to the Biocidal Products Regulation (BPR)[1].

The BPR classifies biocidal products into 22 biocidal product-types, in the study at hand only product-type 1 and (partly) product-type 2 are considered. Product-type 1 covers products for human hygiene such as hand disinfectants, antimicrobial soaps and cleansing lotions, disinfecting wipes and refreshing tissues or deodorants, antiseptic mouthwash as well as anti-bacterial coating. Product-type 2 comprises disinfectants for surfaces, devices and laundry, antibacterial household and toilet cleaners, dishwasher detergents, hygienic rinse agents, products for the disinfection and algae control of pools, disinfection of air-condition as well as products to disinfect waste and chemical toilets. Product-types 1 and 2 both cover professional and private application. The study at hand only considers products for private use. In the private area again focus is put on products for the household – so products for the disinfection of pools and air conditioning are not considered.

Between professional and private application of disinfectants there are some significant differences which are worth mentioning in advance: In the public health sector disinfectants are applied by a well trained staff on the basis of hygiene plans while the application in the household is not controlled. It can be doubted that applicators in the household have a profound knowledge about infection risks and the need for disinfecting measures. In summary this means that the risk of an improper or unnecessary application in the household is higher than in public healthcare. In specific cases disinfection in the household is clearly indicated: For instance if a family member suffers from a highly contagious disease or if persons have a weakened immune system due to (for instance) chemotherapy or advanced age. In principle the application and selection of antimicrobial products should be carefully considered since such products do not only kill microorganisms selectively but may also affect the essential micro-flora of human skin and/or imply a hazard potential to human health and the environment. Disinfectants which are disposed into the wastewater may – depending on their persistence and eco-toxicity – burden sewage treatment plants, surface waters or sediments.

So for selection and application of antimicrobials products in the household the following decision criterion is offered: The ratio of potential benefit (i.e. the contribution to the prevention of infection) to potential risks (i.e. adverse effects to health and environment) should be high (“favourable”) or at least moderate (“acceptable”). The main outcome of the study is a benefit to risk ratio for biocidal active ingredients found in household disinfectant. A further outcome is a proposal for better managing availability and use of household disinfectants.

[1] https://echa.europa.eu/regulations/biocidal-products-regulation/legislation

Themes and outcomes of the study

The document at hand refers to the study *Desinfektion im Haushalt – Nutzen und Risiken von desinfizierenden Haushaltsprodukten* available in German only on the webpage of the Vienna Ombuds Office for Environmental Protection[2]. It summarises therein discussed topics (chapters) and cites the main outcomes of the study. Reference (italic, bold) is made to the title of the corresponding chapter.

Chapter ***Legal Framework*** *(Rechtlicher Rahmen)* deals with the Status Quo of the approval of antimicrobial ingredients and products. Both disinfectants for the household as well as for the professional sector have to pass the approval procedure of the Biocidal Products Regulation (BPR). The implementation of BPR requires a transitional phase which will not end until 2024. So many disinfectants and a significant share of active ingredients are actually not yet reviewed and approved. Due to transition rules they are allowed to stay on the market. The national notification of biocidal products in Germany[3] or Austria is not equivalent with an approval according to BPR[4].

Information about the consumption of disinfectants in the EU is scarce. Available data are from a Danish study and cited in ***Consumption Data*** *(Verbrauchsdaten)*. The study estimates an annual Danish consumption of 390 to 420 tons actives substances for the private sector and 710 to 1150 tons for the public sector.

The ***Efficacy*** *(Wirksamkeit)* of disinfectants is evaluated in the course of the product approval by the ECHA or by national authorities. The currently made statements and claims on the product (packaging) are in the responsibility of the manufacturer and the main information source for the private user. In contrast to that the efficacy of disinfectants for the professional sector (hospitals, doctor's offices) is usually tested and certified by an independent body[5]. In principle the certificate is public accessible.

Private use by non-trained persons and with not standardised equipment (e.g. washing machines) increases the probability for improper use. In particular an applied concentration which insufficiently eliminates germs may contribute to the ***Induction of Resistance*** *(Resistenzinduktion)*. Active ingredients induce resistance to a varying extent: Induction is more likely for Quaternary Ammonium Compounds (QAC), biguanides and silver and less likely or unknown for oxygen releasers, sodium-hypochlorite and aldehydes.

The meaningfulness of ***Disinfecting Measures in the Household*** *(Desinfizierende Maßnahmen im Haushalt)* is discussed with regard to food processing and laundry washing. In case of food the relevant literature ascertains that kitchen specific do not afford routine disinfection. Similar is assumed for the treatment of laundry: As long as cases of disease do not call for enhanced hygienic measures the use of ordinary washing powder respectively liquid is sufficient. Only if the laundry requires to be washed at 30°C the application of a hygienic laundry rinse makes sense. For conventional laundry trials have shown that with application of conventional detergent both at 40°C and 60°C a reliable germ reduction is achieved. Analogous trials shows that even in the case of

[2] http://www.wua-wien.at/images/stories/publikationen/desinfektionsmittel-im-haushalt-studie.pdf.

[3] https://www.biozid-meldeverordnung.de/offen/

[4] https://echa.europa.eu/information-on-chemicals/biocidal-products

[5] Examples are: The Austrian Society for Hygiene, Microbiology and Preventive Medicine (ÖGHMP); Verbund für Angewandte Hygiene (VAH/Germany)

fungal infections of skin and nails washing with a conventional washing detergent containing bleach at 40 to 60°C results in a safe decontamination. Infection risk originates from persons with infectious gastrointestinal diseases (e.g. salmonella) or common colds (e.g. influenza viruses). Vice versa persons in chemo or radiotherapy or after organ transplantation are exposed to an enhanced infection risk. Since many infections are transferred by personal contact, mostly via hands alcoholic rub-in disinfectants are commonly indicated. It is questionable if antimicrobial liquid soaps are advantageous compared to conventional soaps. Some of their active ingredients burden the environment and case studies show that their efficacy in killing germs may be too low. A disinfection of surfaces may be reasonable because surfaces are also a medium for the transmission of germs. However this applies only to surfaces which are touched by hands or skin. Hence the disinfection of toilet bowls or floors do not significantly contribute to the prevention of infection. In case that there is no major pollution a surface cleaning with conventional detergents would be sufficient.

The German Bundesinstitut für Risikobewertung (BfR) collected and evaluated ***Poisoning and Accidents with Disinfectants*** *(Vergiftungen und Unfälle mit Desinfektionsmittel)* over a period of 20 years. Most of the reporting concerns eye injuries. Compared to the professional sector the incidence of health damages caused by disinfectants in the private sector is by a factor 10 to 100 lower. The data further indicate that children are not outstandingly threatened by disinfectants.

Since no consumption data of disinfectants in households are available the ***Estimation of Consumption for Vienna*** *(Verbrauchsabschätzung für Wien)* mainly relies on assumptions. One is that the ratio of consumption of disinfectant cleaners compared to that of conventional cleaners is 1 to 10. Applying a population of 1.73 million the inhabitants of Vienna would annually consume about 442 tons of disinfecting cleaners and the same amount of hygienic laundry rinses.

Product Research *(Produktrecherche)* records and analyses the range of antimicrobial products offered the shelf spaces of retailers and chain stores in Vienna and Graz. In total 78 products were documented and classified into:

- 31 disinfectant cleaners (ready for use) for surfaces, baths, kitchens or toilets
- 9 disinfectant cleaners (sprays) for of surfaces, baths, kitchens or toilets
- 9 disinfection-wipes for hands and surfaces
- 7 hygienic laundry rinses used together with conventional laundry washing or alone
- 7 liquid antimicrobial soaps (rinse off)
- 7 sponge wipes and chopping boards with antimicrobial efficacy
- 4 antibacterial hand gels (leave on)
- 3 hand disinfectants (leave on)
- 1 hand dishwashing detergent with antimicrobial efficacy

The identification of the active ingredients relies on the specifications made by the manufacturer on the product packaging and was not further verified (e.g. by chemical analysis or request). The ingredients too were classified, preferential applications identified and additionally the concentration given on the packaging recorded. Overall results can be seen in Table 1.

Table 1

Ingredient class	Ingredients	found in products (total: 78)*	Preferential application	Concentration on packaging (% resp. g/100g)
Alcohols	ethanol, propan-1-ol, propan-2-ol	28	hands	5 – 45
Organic acids	lactic acid, formic acid	16	hands, surfaces, dishes, bath & toilets	0.5 – 8.5
Quaternary Ammonium Compounds (QACs)	didecyldimethylammonium chloride (DDAC), benzalkoniumchloride (BAC)	23	laundry, surfaces, hands	0.1 – 2.4
Silver	silver chloride or not further specified	7	dishes, surfaces	?
Sodium hypochlorite	-	10	bath & toilets, surfaces	1 – 3.6
Oxygen releasers	hydrogenperoxide, peracetic acid	5	laundry, surfaces	1 – 15
Miscellaneous	sodium pyrithione, glyoxal, triclosan/Microban, chlorhexidine, 2-phenyphenol, phenoxyethanol	6	bath & toilets, surfaces, dishes	< 1

*… product may contain more than one ingredient

Chapter ***Assessment of Ingredient Classes*** *(Bewertung der Wirkstoffgruppen)* describes and analyses each ingredient (class) into detail, the criteria are: Efficacy profile, CLP/GHS-classification, data concerning human toxicity, data concerning entry into and behaviour in the (aquatic) environment as well as an estimation of resistance development.

The ***Benefit of Application*** *(Abschätzung des Nutzens)* was estimated as follows: First it was differentiated between an indicated and a non-indicated application. An indicated application is justified by an enhanced risk of infection. The (enhanced) risk may arise for instance from persons with infectious gastrointestinal diseases (e.g. salmonella) or common colds (e.g. influenza viruses). Vice versa persons in chemo- or radiotherapy or after organ transplantation are exposed to an enhanced infection risk. Hence an indicated application depends on such an occasion and is not carried out routinely. An analysis of scientific articles and guidelines show that the majority of experts reject a non-indicated or routine disinfection in the household. Moreover there are no studies available confirming that persons in household with routine disinfection significantly suffer less from infectious diseases. Additionally the spectrum of activity, applied concentration and preferential application were used to estimate the potential benefit of an application.

Finally a benefit to risk ratio was estimated to get identify ingredients which are preferential possibly in conjunction with a certain indication. Results are given in Table 2

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Table 2

Ingredient class	Benefit (of application)	Health hazard potential	Environment hazard potential	Share to resistance development	Benefit to risk ratio
Alcohols	high if indicated neutral for routine hand disinfection	rather low since irritating properties are tolerated with regular skincare	low because of ready biodegradability and little aquatic toxicity	not know and not expected	high with indication moderate for routine application
Organic acids	high if indicated neutral for routine disinfection	moderate due to toxic and corrosive properties	low to moderate due to ready biodegradability	not know and not expected	overall moderate
Quaternary Ammonium Compounds (QAC)	high if indicated: Fungal contaminated laundry only allowed to wash at 30°C Low for routine application	moderate to high in case of regular exposure due to toxic and sensitising hazard potential	high due to considerable aquatic toxicity and uncertainty about (bio)degradation	cannot be excluded	overall low (exemption: Fungal contaminated laundry only allowed to wash at 30°C)
Silver	unclear since proof of efficacy for household application is lacking	low in case of silver and silver salts, unclear for Nano-silver	moderate to high for silver salts, unclear for Nano-silver	cannot be excluded	overall low
Sodium hypochlorite	moderate if indicated low for maintenance cleaning	moderate to high in case of regular exposure (inhalation)	moderate to high due to formation of secondary degradation products	not expected	moderate with indication low for routine application
Oxygen releasers	high if indicated, neutral for routine application	moderate due to irritating and corrosive hazard potential	low to moderate due to ready biodegradability	not expected	high with indication neutral for routine application
Miscellaneous	-	Glyoxal: high due to sensitising and CMR hazard potential	Triclosan: high due to aquatic toxicity (but no longer relevant as biocidal active substance)	-	overall low

Based on the benefit to risk ratio ingredient classes are separated into two categories:

Ingredient classes with an overall low (unfavourable) benefit to risk ratio

Quaternary Ammonium Compounds (QACs) in cleansers, sprays, hygienic laundry rinses, wipes and liquid soaps: Disinfection of laundry with QACs containing hygienic rinse seems only justified in case of temperature sensitive and already contaminated clothes. Similar a low benefit is also concluded for surface disinfection with QACs. The potential risks are as follows: Human exposure via clothes, indoor air and household dust arising from the low vapour pressure, surface-active properties and abrasion is reasonable. QACs carry a considerable skin-sensitising hazard potential, degrade inadequate and pose considerable aquatic toxicity. There are indications that QACs after entering sediments and the aquatic environment induce antibiotic resistance. Silver in kitchen sponges and sponge wipes: The provided information does not allow an estimate about the mobility of silver in the matrix. It is at least indicated by studies that impregnations of silver in textiles are finally washed out. The product labelling does not inform about the type of silver. The health risk is assumed to be rather low but eco-toxicity is high and there are indications for resistance development. Hence unnecessary use of silver in household compromises reasonable applications in healthcare (e.g. wound dressing). Sodium hypochlorite in cleaners: The benefit to risk ratio without indication is estimated to be low, since adverse effects after inhalation cannot be excluded and toxic degradation products may occur after use and disposal. Glyoxal in cleansers: There is a rather inherent risk due to classification as skin sensitising and (supposed) mutagenic potential.

Ingredient classes with a neutral or high (favourable) benefit to risk ratio

Alcohols, organic acids and oxygen releasers: For application without indication the benefit to risk ratio is assessed to be at least moderate (neutral). The benefit to risk ratio for alcohols and oxygen releasers is high if an application for hand and surface disinfection is indicated. The only danger arises from irritating and corrosive properties which can be avoided by careful handling, adequate clothing and gloves. Due to ready biodegradability environmental risks are overall low.

Finally the study proposes ***Intervention Measures*** *(Vorschlag für Lenkungsmaßnahmen).* The measures should discourage disinfection in the household without indication and reduce the use of biocidal active ingredients with a low (unfavourable) benefit to risk ratio. Proposals concern the information of consumers, regulation of the access and the product approval. So the sale of products such as hygienic laundry rinses should be transferred from supermarkets to pharmacies and there combined with competent costumer service. Concerning the implementation of the EU Biocidal Products Regulation - household applications should be checked and scrutinized by hygienic experts. Additionally the size of the product should be adjusted to the indicated application and the packaging should provide appropriate use instructions.