



Nederlandse Voedsel- en
Warenautoriteit
*Ministerie van Landbouw,
Natuur en Voedselkwaliteit*

Biological cleaning products Investigation into the applications and the safety risk

Biological cleaning products are cleaning products based on microorganisms or enzymes. These biological cleaning products must not pose any health risk. Use of these cleaning agents has become increasingly popular in recent years.

The Netherlands Food and Consumer Product Safety Authority (NVWA) believes that the market segment for organic cleaning products requires further examination. The NVWA has conducted a market study to discover which organic cleaning products are available on the consumer market in the Netherlands, and the applications for which they are intended. We looked at the bacteria that are used in these products, the concentrations, the claims on the label, the intended applications and their form of use. This fact sheet contains the results of the 2019 market study.

Background

Products are available on the market that, through bacteria or enzymes, are designed for the purpose of freshening. These products can be used to clean objects in and around the home or as hygiene products for the human body. A mixture with a high concentration of bacteria or enzymes ensures that the nutrient medium that unwanted bacteria require is eliminated, thereby preventing further growth. This in turn eliminates foul odours from mould, urine and sweat.

In accordance with the Biocides Regulation (Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products), a biocide is defined as a product, substance or mixture with the intention of destroying, rendering harmless, preventing the action of or otherwise exerting a controlling effect on any harmful organism. Whether or not an biological cleaning product can be considered a biocide depends on the claim, specific effect and type of bacteria. It must, therefore, satisfy specific safety requirements and conditions of use. It is unclear which products are being offered to consumers. This gave the NVWA cause to carry out an investigation in 2019.

Risks

Biological cleaning products can contain one or multiple types of bacteria in very high concentrations. When using these products, consumers are at risk of the bacteria entering their body through inhalation, hand to mouth contact or contact with food. This can result in health risks. In some people, certain bacteria can act as sensitizers, which means that they can cause a hypersensitivity reaction.

Procedure

Products

Between May and July 2019, the NVWA sampled a total of 27 different biological cleaning products. We purchased these products via the Internet and in regular offline shops. The products were made by 19 brands that are available to consumers in the Netherlands. We visited 12 different online shops and one offline shop.

Sample choice

The market study concentrated on biological cleaning products, and not on washing agents/detergents, based on bacteria and enzymes. The study encompassed products intended for cleaning objects in and around the home, such as organic waste containers and animal enclosures, as well as products intended to overcome odours such as sweat and urine.

Investigation

The NVWA laboratory investigated the biological cleaning products to check for the presence of bacteria, namely:

- the colony count, to determine the number of aerobic microorganisms per millilitre;
- the characterisation with the aid of MALDI-TOF. This is a technique in which the composition of proteins is used as a fingerprint to detect microorganisms.

In addition, the NVWA also assessed the claims on the label affixed to the biological cleaning products.

Legal requirements

Cleaning products based on surface-active substances must satisfy Regulation (EC) No 648/2004 of the European Parliament and of the Council of 31 March 2004 on detergents. Most biological cleaning products are not based on surface-active substances.

Biological cleaning products may also be used as biocides. In that case, they must satisfy the Biocides Regulation (Regulation (EU) 528/2012) and have authorisation from the Dutch Board for the Authorisation of Plant Protection Products and Biocides.

Biological cleaning products have not yet been categorised as cleaning agents or as biocides. Even if the product does not yet fall under the scope of the Regulation on detergents or the Biocides Regulation, it must still be a safe product in accordance with the General Product Safety (Commodities Act) Decree.

Results

The results for each product are described in Appendix 1.

Microorganic investigation

Colony count

Microorganisms were found in concentrations of 4 to $330 \cdot 10^6$ cfu·mL⁻¹ in 23 of the 27 products (85%). There is no explanation for the wide variation in concentration in view of whether or not to dilute and aerosolise, atomise or pour. The four products that did not contain microorganisms were products based on enzymes. Figure 1 shows the frequency distribution of the numbers of cfu·mL⁻¹ in the products in which microorganisms were found.

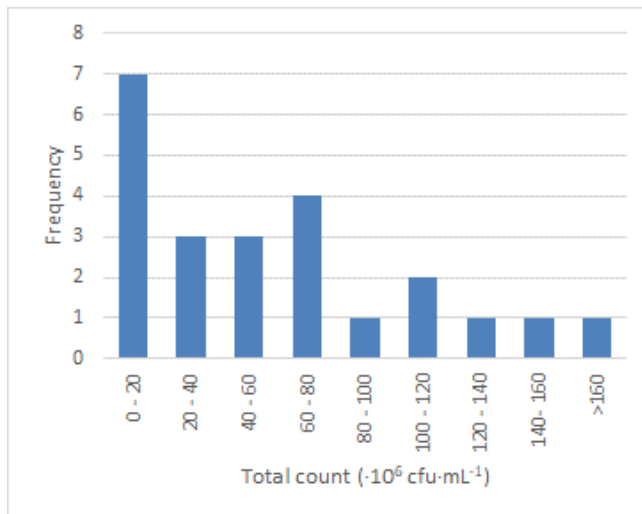


Figure 1: Frequency distribution of the numbers of cfu·mL⁻¹

Characterisation

For all products in which microorganisms were found, the microorganism was a *Bacillus* strain or a combination of two or three *Bacillus* strains. The strains were *Bacillus subtilis* (14 products), *Bacillus licheniformis* (10 products), *Bacillus amyloliquefaciens* spp. *plantarum* (7 products), *Bacillus mojavensis* (1 product), *Bacillus altitudes* (1 product), *Bacillus cereus* (1 product), *Bacillus pumilus* (1 product) and *Bacillus megaterium* (1 product).

Label assessment

Based on the information on the label, the products can be used:

- to remove dirt (12 products);
- to overcome odours of sweat and urine (4 products);
- or a combination of the two (9 products);
- to clean/protect the skin (2 products).

Of the products, 13 were a concentrated liquid that must be mixed with water and then atomised (6 products) or applied to a cleaning cloth (5 products) to clean the object. For two products, the application method was not clear. Of the other products investigated, 13 were ready-to-use liquids that must either be atomised (5 products), used as an aerosol (3 products) or applied directly to the object or surface being cleaned (5 products). One product was a powder that is applied either through atomisation or through pouring, after first being dissolved in water.

A warning to the user was displayed on 25 of the 27 (93%) products, drawing attention to potential health risks. In three cases, the warning was not in Dutch, and in three cases, only the sentence "For professional use only" was present. The majority of warnings concentrated on keeping the product out of the reach of children, skin irritation, eye injury and protecting the body by using gloves, protective clothing, eye protection and face protection.

Measures

No measures have been taken, as this was a market study and there is no clear legal framework.

Conclusion

Biological cleaning products are available on the market in the Netherlands for the cleaning of surfaces, including floors and sanitary areas, but also for cleaning the skin, toothbrushes, dentures and air-conditioning systems. The majority of cleaning products contain *Bacillus* bacteria in order of size from 10 to 100 ·10⁶ cfu·mL⁻¹. The cleaning products are offered in different application types, including as a concentrated liquid, as a spray and for atomisation. In the majority of cases, the products bear warnings, drawing attention to potential health risks.

Further investigation is required to determine the status of the product as a cleaning agent, biocide or commodity. Based on the results of this market study, we shall conduct further investigation into the health risks of the use of bacteria as a biological cleaning product.

Follow-up approach

An investigation question has been submitted to the National Institute for Public Health and the Environment (RIVM), prompting them to look at the health risks of biological cleaning products. If a health risk is demonstrated, each product will be assessed to determine whether it is a cleaning agent, biocide or commodity. This will allow the legal framework for each product to be determined.

Appendix 1: Colony count and characterisation of microorganisms and label assessment of organic cleaning products

| identification number | Microbiological assessment | | Label | |
|-----------------------|--|--|---|---|
| | Colony count [10 ⁶ cfu·mL ⁻¹] (10 ⁶ = 1 million) | Characterisation | Product type/claim | Warnings drawing attention to risk to the user |
| 87230325 | 330 | <i>Bacillus amyloliquefaciens</i> spp. <i>plantarum</i> <i>Bacillus licheniformis</i> | Spray (atomise) – multipurpose cleaner for all types of sports floors, mats, punching bags and pillows. Not harmful to material and biodegradable. Microorganisms clean at microscopic level and continue to work for three – five days after use. | Yes - May cause an allergic reaction. - Keep out of reach of children. - If intending to seek medical advice, ensure that the packaging or label is retained. |
| 87230333 | 57 | <i>Bacillus mojavensis</i> <i>Bacillus subtilis</i> | Spray (aerosolise) – for safe and effective prevention of sweat odour on the basis of good bacteria. Safe for people, nature and the environment. The bacteria, which remain active for three – five days after use, help to preserve the life of sports products. | Yes - Keep out of reach of children. - If intending to seek medical advice, ensure that the packaging or label is retained. |
| 87230341 | 14 | <i>Bacillus amyloliquefaciens</i> spp. <i>plantarum</i> <i>Bacillus licheniformis</i> | Concentrated liquid (mix, direct contact) – microorganic deodorisation preparation with cleaning properties. Teamwork by bacteria helps to clean and has a long-term effect. Safe. | Yes - For professional use only. |
| 87230368 | 8.2 | <i>Bacillus altitudis</i> <i>Bacillus licheniformis</i> | Concentrated liquid (mix, direct contact or spray) – powerful multipurpose cleaner/degreaser with depth effect for complete degreasing of water-resistant surfaces. Microorganisms convert dirt and grease into water and oxygen. | Yes - For professional use only. |
| 87230376 | 68 | <i>Bacillus subtilis</i> | Concentrated liquid (mix, atomise) – interior cleaner for water-resistant surfaces with environmentally beneficial effect. Makes the surface clean and actively overcomes odours. The microorganisms are 100% natural. | Yes - For professional use. - Concentrated product, not for use in an atomiser. - The product is suitable for all water-resistant surfaces that are not used for the preparation of food |
| 87230384 | 74 | <i>Bacillus amyloliquefaciens</i> spp. <i>plantarum</i> <i>Bacillus cereus</i> <i>Bacillus licheniformis</i> | Concentrated liquid (mix, atomise) – sanitary cleaner for all sanitary areas and toilets with environmentally beneficial effect. Cleans joints, actively combats odours and prevents limescale accumulation. The microorganisms are 100% natural. | Yes - For professional use. - The product is suitable for all water-resistant surfaces that are not used for the preparation of food - Concentrated product, not for use in an atomiser. |

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|-----------------------|--|---|---|--|
| | Colony count [10 ⁶ cfu·mL ⁻¹] (10 ⁶ = 1 million) | Characterisation | Product type/claim | Warnings drawing attention to risk to the user |
| 87230392 | 40 | <i>Bacillus amyloliquefaciens</i> spp. <i>plantarum</i> <i>Bacillus subtilis</i> | Spray (atomise) – powerful cleaner based on enzymes and bacteria for removal of urine stains and foul odours without risk to people or animals. | Yes, not in Dutch. |
| 87230406 | 13 | <i>Bacillus licheniformis</i> | Spray (atomise) – cleaner with natural non-pathogenic bacteria for effective and organic removal of organic stains and the unpleasant odours of urine, faeces and vomit. | Yes, not in Dutch. |
| 87230414 | 130 | <i>Bacillus subtilis</i> | Concentrated liquid (mix) – cleaner for toothbrushes and dentures with a <i>Bacillus</i> ferment. | Yes - Keep out of reach of children. - If intending to seek medical advice, ensure that the packaging or label is retained. |
| 87230422 | 120 | <i>Bacillus amyloliquefaciens</i> spp. <i>plantarum</i> <i>Bacillus subtilis</i> | Spray (aerosolise) – environmentally beneficial skin spray with <i>Bacillus</i> ferment that supplies the skin with healthy microflora and reduces the risk of infection. | Yes - Keep out of reach of children. - If intending to seek medical advice, ensure that the packaging or label is retained. |
| 87230449 | 55 | <i>Bacillus subtilis</i> | Concentrated liquid (mix, direct contact) – multipurpose cleaner based on enzymes and <i>Bacillus</i> ferments that overcomes dirt and odours for days. | Yes - Keep out of reach of children. - If intending to seek medical advice, ensure that the packaging or label is retained. |
| 87230457 | 20 | <i>Bacillus licheniformis</i> <i>Bacillus subtilis</i> | Concentrated liquid (mix, direct contact) – bath foam based on <i>Bacillus</i> ferment for gentle cleaning of the body. Protects against drying out, has a refreshing effect and forms healthy microflora on the skin. | Yes - Keep out of reach of children. - If intending to seek medical advice, ensure that the packaging or label is retained. |
| 87230465 | 9.5 | <i>Bacillus licheniformis</i> <i>Bacillus subtilis</i> | Concentrated liquid (mix, direct contact) – a highly concentrated environmentally beneficial washing agent based on <i>Bacillus</i> ferment. Has a strong degreasing effect and prevents unpleasant odours and blockages in the drain. Is also mild on and protects the hands. | Yes - Hazard: Causes skin irritation. Causes serious eye damage. - Wear protective gloves, protective clothing, eye protection, face protection. - In the event of contact with the skin, wash with plenty of water and soap. - In the event of contact with the eyes, rinse carefully with water for several |

| identification number | Microbiological assessment | | Label | |
|-----------------------|--|---|---|---|
| | Colony count [10 ⁶ cfu·mL ⁻¹] (10 ⁶ = 1 million) | Characterisation | Product type/claim | Warnings drawing attention to risk to the user |
| | | | | <p>minutes; remove contact lenses, if possible; continue to rinse. Call a poison centre or doctor immediately.</p> <ul style="list-style-type: none"> - In the event of skin irritation, consult a doctor. - Remove contaminated clothing and wash before reuse. - Keep out of reach of children. - If intending to seek medical advice, ensure that the packaging or label is retained. |
| 87230473 | 92 | <i>Bacillus subtilis</i> | Concentrated liquid (mix, atomise) – multipurpose cleaner based on Bacillus ferment that breaks down organic dirt and protects surfaces from future contamination. | <p>Yes</p> <ul style="list-style-type: none"> - Hazard: May cause an allergic reaction. Causes serious eye damage. - Wear protective gloves, protective clothing, eye protection, face protection. - In the event of contact with the eyes, rinse carefully with water for several minutes; remove contact lenses, if possible; continue to rinse. Call a poison centre or doctor immediately. - Keep out of reach of children. - If intending to seek medical advice, ensure that the packaging or label is retained. |
| 87230481 | 42 | <i>Bacillus amyloliquefaciens</i> spp. <i>plantarum</i> <i>Bacillus subtilis</i> | Spray (aerosolise) – a versatile spray for optimal hygiene and protection of the living environment. Minimises the risk of infection through bacteria and house mite allergy, overcomes odours and is suitable for all kinds of textile and all materials for domestic pets. | No |
| 87230503 | 15 | <i>Bacillus megaterium</i> <i>Bacillus subtilis</i> | Spray (atomise) – cleaner based on Bacillus ferment for cleaning heavily soiled surfaces such as bedpans, urinals, toilet seats and residual dirt in toilets. Safe for all washable surfaces, skin and clothing and is biodegradable. | No |

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|-----------------------|--|--------------------------|--|---|
| | Colony count [10 ⁶ cfu·mL ⁻¹] (10 ⁶ = 1 million) | Characterisation | Product type/claim | Warnings drawing attention to risk to the user |
| 87230546 | - | | Spray (atomise) – an organic and environmentally-friendly cleaning product based on enzymes for the removal of all dirt and scale of atmospheric origin. It is not harmful to people, animals or the environment. | Yes <ul style="list-style-type: none"> - Pure product: Causes serious eye irritation. - If intending to seek medical advice, ensure that the packaging or label is retained. - Keep out of reach of children. - Wear eye protection. - In the event of contact with the eyes, rinse carefully with water for several minutes; remove contact lenses, if possible; continue to rinse. If eye irritation persists, consult a doctor. - Contains enzymes – may cause an allergic reaction. |
| 87230554 | - | | Powder (mix, atomise or pour) – cleaner to overcome scale and stains on all surfaces based on a mixture of enzymes. | Yes <ul style="list-style-type: none"> - Causes serious eye damage. - Keep out of reach of children. - In the event of contact with the eyes, rinse carefully with water for several minutes; remove contact lenses, if possible; continue to rinse. - Contains amylase/subtilisin. May cause an allergic reaction. |
| 87230562 | 110 | <i>Bacillus subtilis</i> | Concentrated liquid (mix, unknown) – a foam cleaner based on Bacillus ferment for cleaning all kinds of animal enclosures. Cleans deep into the surface and ensures targeted removal of foul odours. | Yes <ul style="list-style-type: none"> - Hazard: Causes serious eye damage. Wear protective gloves, protective clothing, eye protection, face protection. - In the event of contact with the eyes, rinse carefully with water for several minutes; remove contact lenses, if possible; continue to rinse. - Call a poison centre or doctor immediately. - Contains: lauryl diethanolamide sodium lauryl ether sulphate 2- |

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|-----------------------|--|-------------------------------|--|--|
| | Colony count [10 ⁶ cfu·mL ⁻¹] (10 ⁶ = 1 million) | Characterisation | Product type/claim | Warnings drawing attention to risk to the user |
| | | | | methyl-2Hisothiazol-3-one Subtilisin. Keep out of reach of children. - If intending to seek medical advice, ensure that the packaging or label is retained. |
| 87230589 | 4.0 | <i>Bacillus subtilis</i> | Liquid (no preparation needed) – urine carpet cleaner based on bacteria for the removal of stains and foul odours. The cleaner is free of chemicals. | Yes - Please note: Avoid contact with the eyes, skin or clothing. - Do not use as an air freshener. - Keep out of reach of children. - Do not spray at people or domestic pets. - First aid: Skin – wash carefully with plenty of water. - Eyes – rinse carefully with water for several minutes. Remove contact lenses, if possible. Continue rinsing. If eye irritation persists, Consult a doctor. - Ingestion – rinse mouth thoroughly. Do not induce vomiting! Please contact your general physician. - Inhalation – seek fresh air and stay calm. Please contact your general physician. - Contains 1,2-benzisothiazolin-3-one. May cause an allergic reaction. |
| 87230597 | 76 | <i>Bacillus licheniformis</i> | Concentrated liquid (mix, atomise) – cleaner based on microorganisms for breaking down odour residues originating from domestic pets, such as urine, faeces and anal gland excretion. | Yes, not in Dutch. |
| 87230619 | - | | Concentrated liquid (mix, atomise) – cleaning agent based on enzymes to combat green deposits. | Yes - Pure product: Causes serious eye irritation. - If intending to seek medical advice, ensure that the packaging or label is retained. - Keep out of reach of children. |

| identification number | Microbiological assessment | | Label | |
|-----------------------|--|---|---|--|
| | Colony count [10 ⁶ cfu·mL ⁻¹] (10 ⁶ = 1 million) | Characterisation | Product type/claim | Warnings drawing attention to risk to the user |
| | | | | <ul style="list-style-type: none"> - Wear eye protection. - In the event of contact with the eyes, rinse carefully with water for several minutes; remove contact lenses, if possible; continue to rinse. If eye irritation persists, consult a doctor. - Do not eat, drink or smoke while using this product. - Always wash hands after using this product. - Keep away from food, drinks and animal feed. |
| 87230627 | 26 | <i>Bacillus pumilus</i> <i>Bacillus subtilis</i> | Liquid (preparation unknown) – maintenance agent comprising a mixture of bacteria and enzymes for sewers, septic tanks and grease traps. Breaks down natural and mineral oils and greases. | Yes <ul style="list-style-type: none"> - H318: Causes serious eye damage. - P280: Wear protective gloves/protective clothing/eye protection/face protection. - P310: Immediately call a POISON CENTRE or doctor/physician. - P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. - Intended for professional use. |
| 87230635 | - | | Liquid (atomise) – foam cleaner and degreaser for heavily soiled heat exchangers and air-conditioning (HVAC) systems. 100% green and safe for people and animals. | Yes <ul style="list-style-type: none"> - Causes serious eye damage. - Wear protective gloves, protective clothing, eye protection, face protection. - In the event of contact with the eyes, rinse carefully with water for several minutes; remove contact lenses, if possible; continue to rinse. Call a poison centre or doctor immediately. - If intending to seek medical advice, ensure that the packaging or label is retained. |

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| | Colony count [10 ⁶ cfu·mL ⁻¹] (10 ⁶ = 1 million) | Characterisation | Product type/claim | Warnings drawing attention to risk to the user |
| 87230643 | 69 | Not determined | Liquid (atomise) – foam cleaner and degreaser for soiled heat exchangers and air-conditioning (HVAC) systems. Ensures a stable, healthy and microorganic environment and helps to prolong the service life of your system. 100% safe for people and animals. | Yes <ul style="list-style-type: none"> - Keep out of reach of children. - Causes serious eye damage. - Wear protective gloves, protective clothing, eye protection, face protection. - In the event of contact with the eyes, rinse carefully with water for several minutes; remove contact lenses, if possible; continue to rinse. Call a poison centre or doctor immediately. - If intending to seek medical advice, ensure that the packaging or label is retained. |
| 87260801 | 160 | <i>Bacillus amyloliquefaciens</i> spp. <i>plantarum</i> <i>Bacillus licheniformis</i> | Concentrated liquid (mix, atomise) – cleaning agent for suppressing ammonia, fine particulate and unpleasant odours. Biodegradable and creates a more pleasant environment for people and animals. | Yes <ul style="list-style-type: none"> - For professional use only. |
| 87260925 | 39 | <i>Bacillus licheniformis</i> | Liquid (no preparation) – unblocker based on microorganisms for blocked drains, which dissolves food residue, dirt and grease with ease. Neutralises foul odours. | Yes <ul style="list-style-type: none"> - Keep out of reach of children. - Do not mix with other products. |

