January 2023

AMFEP Information sheet

Contribution of enzymes to reduce emissions – Detergent solutions

Enzymes are used in a variety of industrial and professional applications such as food & beverage, animal nutrition, detergents, and/or textile production. They support and accelerate a number of bio-chemical reactions that drive environmental efficiency across many diverse EU industrial sectors, in small to large companies.

The present document highlights the sustainability benefits of enzymes implementation when used in detergent applications.

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Contents

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1. From technical roles to sustainability assets

In the detergent industry, enzymes provide high performance, under mild conditions such as low temperature, on stain removal, whiteness, freshness, colour and fabric care from their detergents. Enzymes help the breakdown of larger molecules into smaller fragments, that can then be easily removed by other ingredients in the formulation, thereby contributing to the overall cleaning performance.

Diverse enzymes exert diverse targeted effects in the detergent application (in alphabetic order):

- **Amylases** break down starch-based stains commonly caused by pasta, potatoes and baby food, which are commonly found on dishes.
- **Cellulases** improve overall cleanness for cotton fabrics by reducing redeposition of particulate soils such as soot, clay, and rust during the wash. In addition, cellulases also provide fabric and color care.
- **Lipases** target fat-based stains such as butter, oil, and human sebum. These types of stains can cause unsightly marks after washing. Fat based stains can also contribute to increased appearance of staining after repeated washes.
- **Mannanases** degrade stains containing mannans. These stains are commonly caused by things like barbecue sauce, chocolate, ice cream and toothpaste.
- **Pectate lyases** act on pectin-based stains from fruits and vegetables, jams and other food containing thickeners.
- **Proteases** degrade stains comprised mainly of protein, such as grass, blood, egg, and others, giving clothes a clean appearance.

Enzymes are a special class of proteins produced either by fermentation of microorganisms or by extraction from animal or plant tissues. They enhance the biological reactions that support Life. Some enzymes have been isolated and are industrially produced to assist biochemical reactions required for given applications. Enzymes are used as small selective scissors to break down targeted substrate into sub-elements.

All enzymes are readily biodegradable only needed in very low concentrations to be effective. They generally exhibit no specific environmental toxicity. Industrial enzymes have an excellent safety profile, with little ability to cause adverse responses in humans and in the environment and those risks are controlled. For detailed information about enzymes and their technical, food and animal feed uses, see here About enzymes: definition, how they work and more - AMFEP

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2. Improved sustainability through the use of enzymes

Using enzymes in detergent products help abate different environmental impacts of washing clothes and using automated dish washers, from climate change to water quality.

2.1. Reduction of GHG emissions

The energy consumed by the washing machine and the dishwasher to heat the wash water is the largest environmental impact of washing across all life cycle stages. Thus, washing at lower temperatures is a pivotal driver to improve the overall sustainability profile of the washing process. Lower wash temperatures reduce CO_2 emissions and save energy.

The average temperature for washing in Europe in 2020 was 42.4°C. Data collected through a campaign promoting washing at 30°C estimated a saving of 1307.9 GWh/year of current total laundry energy in the five campaign countries, based on a 3°C reduction of the average wash temperature (1), (2).

2.2. Reduction of chemical load to environment & Reduction of water pollution

Enzymes are active in water therefore no need for adding phosphates and phosphonates, to achieve cleaning performance (3).

Compaction means that the product is in a form that reduces weight and packaging to be used, because it is more concentrated. Enzymes contribute to an optimal use of ingredients in the detergents, and thus reduced transport, savings in packaging and reduced CO_2 emissions. Note that enzymes work catalytically, performing their function over and over again, whereas traditional surfactants form micelles that are used up during the washing process (4).

Combined with chemistry, enzymes allow to make detergents more efficient and compact, reducing resources used in production, logistics and application.

2.3. Reduction of water consumption

Automatic and hand dishwashing detergents contain enzymes that remove food soils effectively with only mild mechanical action required. This allows reduced usage of water.

Industrial dishwashing products have begun to introduce enzymes for improved cleanliness by means of recirculated wash water maintenance as well as less time cleaning and reduced water use.

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2.4. Improved durability of the garment & equipment

Enzymes remove stains effectively under mild conditions. Clothes can last longer and keep a good appearance, thereby reducing the need to replace them.

Specific types of enzymes improve the appearance of fabrics (color care and smoothening the surfaces) which helps to prolong their lifetime.

Industrial cleaners also benefit from using enzymes as they are non-corrosive and do not harm instruments, membranes etc., so the equipment stays functional longer.

3. Contribution to sustainability ambitions

3.1. Green Deal

Implementation of enzymes in detergent applications supports

- The reduction of carbon emissions [Climate law]
- The zero-pollution ambition for a toxic free environment- as enzymes allow reducing the resorting to chemicals and are themselves readily biodegradable

3.2. Sustainable development goals

Implementation of enzymes in detergent applications supports

- SGD6 [Goal 6. Ensure availability and sustainable management of water and sanitation for all] because enzymes in detergent applications contribute to replace some elements (P) which would finally leak in water disposal [Target 6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally]
- SDG12 [Goal 12. Ensure sustainable consumption and production patterns] because enzymes in detergent applications contribute to
  - ensure sustainable consumption and production patterns through WASHING performance under milder conditions, [Target 12.2: By 2030, achieve the sustainable management and efficient use of natural resources]
  - with longer lasting clothes and washing/cleaning equipment [Target 12.5: By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse]
    - to expand the lifetime of garments [Target 12.5: By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse]

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- SDG13 [Goal 13. Take urgent action to combat climate change and its impacts] because enzymes in detergent applications contribute to energy efficiency/GHG reduction by allowing wash cycles at low temperatures to achieve the same result.

4. Enzymes are essential sustainability enablers for detergent applications

Enzymes are used safely for decades in detergent applications. They became essential to nowadays users for the technical performance they deliver, sparing energy consumption and raw materials.

Wash-performance would decline considerably if enzymes were removed from detergents. The wash performance gap cannot be closed on all parameters even if chemical use and wash temperatures were increased considerably.

Enzymes will become further critical for an extended number of detergents producers to improve the environmental footprint of washing steps, at household level or in industrial applications. Such improvement will happen, be it from a regulation push or from a consumer pull, be it in Europe or in other part of the world.

5. Bibliography

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4. COMPACTION OF HOUSEHOLD LAUNDRY DETERGENTS HAS ENABLED SIGNIFICANT ENVIRONMENTAL SAVING (20190410111600-aise_factsheet-2019_compaction_def.pdf)

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