Compendium of practice for Commercial Dishwashing

Section 12

Environment and sustainability

Contents

1. Measures to reduce the environmental impact of commercial automatic dishwashing

The objective of commercial dishwashing is to return soiled wash items to a clean, hygienic condition using minimal energy, water and processes chemicals, and to preserve the wash items. Overall, this should be combined with as little environmental impact as possible.

As part of a professional consultation, using process chemicals adapted to the on-site conditions is advised, with the aim of achieving an optimal cleaning result with the lowest possible detergent consumption. Manufacturers of detergents and dishwashers provide dosing and monitoring devices to avoid over / underdosage. Overdosage constitutes unnecessary pollution; underdosage constitutes insufficient cleaning results and may potentially damage the wash item material. Detergents are developed using raw materials with the least possible pollution, which nevertheless satisfy hygiene standards. The engineering industry must meet higher hygiene standards for commercial dishwashing, and at the same time, minimise pollution and increase efficiency. By developing optimised processes, today, commercial automatic dishwashing is performed with considerable savings in energy, water and chemicals.

Decisive measures in the machinery industry to reduce the environmental impact are:

- greater cleaning performance and hygiene with reduced energy consumption through wash systems and pumps with greater efficiency
- lower heat outputs through machine insulation and heat recovery systems for exhaust air and waste water
- considerable reduction of fresh water consumption through optimised rinse water use and / or water management in the machine
- Preparation of the detergent solution through strainer and / or filter systems
- improved workplace conditions for dishwashing staff through lower heat emission of the machine and reduced steam and noise emissions from the wash zones
- very high service life and recycling capability of the machines by using predominantly stainless steel and selected plastics as optimally recyclable materials

Investigations have proven that such highly developed commercial dishwashing has a considerably lower environmental impact than, e.g., using disposable tableware or even hand-washing.

2. Measures of the operator to reduce the environmental impact of commercial automatic dishwashing

The careful pre-cleaning of food residues, sauces, napkins, etc., from the wash item before this is loaded into the dishwasher is hugely important. Even with today's sophisticated automatic machine pre-cleaning and filter technology, excessively soiled material ingress pollutes the waste water and puts strain on the entire process technology of dishwashing.

Reduced ingress of soiled material in the dishwasher saves detergent, water and energy.

Therefore, it must be ensured

- that the dishwasher is operated at full capacity, i.e., racks should be fully loaded and the conveyor belts of flight-type dishwashers should be loaded with dishes to full capacity. Poorly loaded machines consume unnecessary water, energy, process chemicals and result in high operating costs.
- that the dishwashers are operated with programme runtimes and / or transport speeds that correspond to the degree of soiling. Less soiled wash items can be washed with shorter cycle times and / or faster conveyor speeds or weaker detergent concentrations, which saves energy, water and detergent. The cleaning process can also be optimised by controlled dosing technology.
- that the dishwashers are professionally serviced, e.g., they are technically sound, and all functional values have been correctly set (e.g. temperatures, water volumes, detergent doses, etc.).

- that the wash item is washed as soon as possible after use. Dried-on residues require longer action times and increased use of detergent.
- that dishwasher-proof wash items are used, whose shape and material facilitates cleaning.

3. Ingredients of detergents and their environmental relevance

Machine dishwashing detergent can contain the following:

Alkalis

Properties

Alkalis support the cleaning process by swelling and removing starch, protein and fat in food residues.

Environmental relevance

Alkalis give the detergent solution an alkaline pH value. The pH value of the dishwasher waste water is diluted with other acidic waste water within the internal waste water system and reduced to the limit values specified in waste water legislation. Where this is not the case, a neutralisation system can be installed.

Silicates

Properties

The alkalinity of silicates supports the cleaning process and protects the wash item from corrosion.

Environmental relevance

Apart from increasing the pH value in the waste water, no other problematic ecological properties are known.

Phosphates

Properties

Phosphates absorb the hardeners in the water, and their emulsifying and dispersing effect supports the cleaning process.

Environmental relevance

In addition to inorganic nitrogen compounds, phosphates are one of the most important nutrients in water, and excessive intake intensifies bioproduction (eutrophication). Phosphates are largely eliminated in waste water treatment plants with a precipitation phase (3rd phase).

Phosphate substitutes

Properties

Phosphate substitutes, e.g., complexing agents GLDA and MGDA can replace phosphates only in partial areas. They are used like phosphates for water hardness setting / complexing.

Environmental relevance

Critical ecological ratings, e.g., a lack of biodegradability prevent extensive use of possible alternative substances for complexing the water hardness.

Active chlorine substrates

Properties

Active chlorine is used to reduce germs and to bleach the food colouring.

Environmental relevance

As active chlorine is considered a pollutant (see also P. 10), use of this substance should be largely avoided. However, particular attention should be paid to the compliance with hygiene standards (see *Compendium of practice on Commercial Dishwashing Section 11 “Hygiene”, as well as the DIN set of standards DIN 10510 to DIN 10512 and DIN 10522).*

Active oxygen substrates

Properties

Like active chlorine substrates, active oxygen substrates support hygienic cleaning and the removal of the residues specified under active chlorine, but are considerably less effective due to their oxidation potential compared with active chlorine.

Environmental relevance

Active oxygen substrates are low-polluting and disintegrate in oxygen and the carrier substance.

Surfactants

Properties

Surfactants reduce the interfacial tension of the detergent solution and thus support the cleaning effect. Meanwhile, surfactants can suppress foaming caused by food residues.

Environmental relevance

The surfactants must be biodegradable (OECD method) in accordance with the regulations for surfactants, i.e., they are degraded in waste water treatment plants by microorganisms, whereby their surfactant properties are lost.

Enzymes

Properties

Enzymes are catalysts manufactured from living organisms, which degrade soil residues biologically and transform them into a better water-soluble state. Hydrolases can be subdivided into protein-digesting proteases, fat-digesting lipases and starch-digesting amylases and are commonly used in detergents.

Environmental relevance

Standard concentrations of enzymes in waste water are biodegradable in the activated sludge of a waste water treatment plant and represent practically zero water pollution.

Rinse aids can contain:

Surfactants

Properties

Surfactants reduce the surface tension of the rinse water and ensure an even wetting of the wash item and the formation of a thin, fast-running water film.

Environmental relevance

The surfactants must be biodegradable (OECD method) in accordance with the regulations for surfactants, i.e., they are degraded in waste water treatment plants by micro-organisms, whereby their surfactant properties are lost.

Organic acids

Properties

The residual hardness in the rinse water is set by organic acids and thus counteracts scaling.

Environmental relevance

The organic acids used in rinse aids are biologically degradable and pose no environmental hazard.

4. Regulations for the transport of detergents

Detergents, which are classified as hazardous transport goods due to their potential danger to humans and the environment, are marked by the manufacturer in accordance with the European Agreement on the International Carriage of Dangerous Goods by Road (ADR 2003 GGVSE) and must be packaged and transported in accordance with its provisions.

5. Regulations for the storage of detergents

Detergents are subject to the German Water Resources Act due to their potential environmental hazard. They are classified “slightly hazardous” or “hazardous to water” and must be stored in accordance with the provisions of the German Water Resources Act.

6. Regulations for the handling of detergents

In accordance with the principles of the German regulations on detergents and cleaning agents (WRMG), detergent manufacturers must only bring detergents to the market that pose no avoidable risk to the environment. This includes the indication of dosing recommendations for substances.

Under WRMG, however, users also have an obligation to use detergent correctly and responsibly in accordance with the dosing recommendations. Potentially hazardous detergents, e.g., with a risk of chemical burns, are labelled by the manufacturer by using hazard warnings, safety advice and hazard symbols on the containers in accordance with the German Ordinance on Hazardous Substances. Furthermore, suitable personal protective equipment must be provided for employees who handle the detergent. Employers must also give employees instructions for handling in the form of an operating manual. The employer must carry out an annual accident briefing. Safety data sheets, which include hazard warnings and safety advice (GHS hazard statement), as well as ecological and toxicological information, are provided by the detergent manufacturers. Using this information, the operator can ensure proper handling and thus minimise the risk to humans and the environment.

The use of detergents with a lower hazard potential and the use of dosing systems protect staff from the influence of the detergent concentrate, and the automatic dosage monitoring keeps the environmental impact as low as possible.

Regular service by the detergent manufacturer guarantees optimal dishwashing as regards economy and ecology.

7. Disposal of empty detergent containers

Correct disposal of empty containers presumes these are completely empty. As the containers are made of polyethene (PE), they can be sent for recycling (e.g. through the DSD – “Green Dot”).

8. Health impairment of operating a dishwasher

Health impairment on staff can be eliminated through the correct use of detergents and correct operation of the dishwashers, as well as room ventilation. Incorrect handling, e.g., the incorrect use of spray curtains at the inlet and outlet sides when cleaning large-scale wash items in conveyor dishwashers can cause unpleasant odours and if the operator is sprayed with detergent solution at the conveyor machine inlet, he or she may suffer skin irritations. Contact with alkaline detergents and / or detergent solutions can cause skin irritations and must therefore be avoided on both the machine and during operation.

9. Waste water pollution caused by dishwasher operation

Food-processing operations often encounter problems with exceeding the threshold values of waste water parameters after the fat separator.

The most relevant waste water parameters are:

COD (chemical oxygen demand)

The COD value is a basis to characterise the degree of organic waste load. It is an index for

the volume of oxygen required for the full chemical oxidation of the organic substances in the waste water. The COD value is largely determined by the ingress of food and beverage residues. Thus, for example, one litre of raw milk has a COD value of approx. 180,000 mg/l and approx. 40.000 mg/l low-volatile lipophilic substances (low-volatile lipophilic substances, see below). Sauces, dressings, cream, etc., have a much higher value. One sugar cube produces a COD value of 4,500 mg/l in one litre of water. These organic substances are already emulsified and / or dissolved to the extent that separation using the standard principle of gravity separation (fat separator) is not possible, and these appear fully in the waste water value.

Low-volatile lipophilic substances

These are oils or fats from food emulsified or suspended in water. These substances come predominantly from the food residues on wash items. The low-volatile lipophilic substances can lead to blockages or damage to the waste water system. Low-volatile lipophilic substances can be reduced in a sufficiently dimensioned fat separator. Good manual pre-cleaning of the dishes to be washed reduces the amount of these substances in the waste water.

pH value

The pH value is a measure of the acidic or alkali content in the solution.

Sulphide (hydrogen sulphide, hydrosulphide)

Sulphide occurs during microbiological decomposition processes where there is a lack of oxygen, predominantly in the fat separator. This can generate odours.

Phosphate

Firstly, naturally-occurring phosphates are present in food. Furthermore, soft drinks can contain significant volumes of phosphoric acid. If food and beverage residues reach the waste

water, phosphates will be detected. Furthermore, phosphates can be introduced by detergents containing phosphates, particularly dishwasher detergents.

AOX (adsorbable organically combined halogens)

AOX develop as a result of excess active chlorine when implemented with organic soil particles in waste water. Where active-chlorine dishwashing detergent is used, small volumes of AOX can be produced as a side reaction.

These resulting halogenated hydrocarbons have unfavourable ecological properties and are non-degradable. To remain below the threshold values for AOX, an active-chlorine-free detergent must be used, whereby sufficiently high temperatures in the detergent circulation tank must also be ensured to achieve a hygienic wash item (see DIN 10510 to DIN 10512, DIN 10522 and DIN SPEC 10534).

BOD (biochemical oxygen demand)

The BOD value is a basis to characterise the degree of organic soil load. It is an index for the volume of oxygen that is required for the potential biological oxidation of the organic constituents in the waste water and thus a measure of the organic substances that can be degraded by microorganisms in the waste water treatment plant.

The BOD value is largely determined by the ingress of food residues.

Settleable solids

Settleable solids are the result of ingress of soiled material and food residues in the waste water. The volume of settleable solids is limited to prevent premature sludging of the sewer system. The threshold values for these parameters are determined in the communal water regulations. Indicative threshold values are provided in Worksheet A 115 ATV (German Association for Waste Water).

10. Measures to reduce the waste water pollution of the dishwasher

The key recommendation is: **Minimise the ingress of soiled material**!

In practice, this means careful, manual pre-cleaning of the wash item. Furthermore, ingress of soiled material from utensils and surfaces, e.g., tilting frying pans, cooking pots, etc., in the waste water can be minimised via the corresponding collection in containers (empty buckets etc.) and disposal.

Please ensure that the floor is also cleaned accordingly. This drastically reduces the COD / BOD value, the low-volatile lipophilic substances value and the settleable substances.

Furthermore, the functional capacity of the fat separator must be guaranteed in accordance with the requirements of DIN EN 1825-1, DIN EN 1825-2 and DIN 4040-100 as regards design and maintenance:

- Regular drainage, cleaning and refilling at least once per month (logbook) should be guaranteed.
- The inlet temperature of the waste water in the fat separator should (for effective separation of oils and fats) be as low as possible.
- Biologically active agents (e.g. products containing enzymes) may not be supplied directly into the separator system, e.g., for the purpose of self-cleaning.

A functional grease separator has a positive impact on the following waste water parameters:

- pH value
- COD / BOD value
- Settleable solids
- Low-volatile lipophilic substances
- Sulphides

If the pH value of the waste water is outside the legal tolerance values, the pH value can be corrected by neutralising the waste water.

Comprehensive investigations have shown that cleaning products for commercial dishwashing in an appropriate dosage in the cleaning process have only a minor influence on the emulsifying stability and thus on the waste water values. Exceeding threshold limits for AOX and phosphates can be avoided by selecting corresponding products.

11. Function and design of a fat separator

The separation of solid and liquid organic fats and oils from waste water is performed solely by the gravitational force in a multi-tank system comprising sludge trap, fat collection and inspection shaft. Correct dimensioning, design, maintenance and operation are essential for the proper function.

The nominal size establishes the main dimensions of the individual components. A distinction is made between nominal sizes 2, 4, 7, 10, 15, 20 and 25 (see DIN EN 1825-1, DIN EN 1825-2 and DIN 4040-100). DIN EN 1825-2 provides detailed information on determining the nominal sizes. The so-called assessment bases are defined for this purpose. The size of the separator must be based on the volume flow and the type of waste water discharged.

The waste water outflow must take into account:

- Density of the fat to be separated
- Temperature of the waste water
- Influence of the cleaning agent and detergent
- Mass of the fat to be separated and the corresponding volume of floating material

This compendium of practice, which has been drawn up by experts, should remind the reader that commercial machine washing cannot be successfully conducted on a superficial level or without the corresponding input of all persons involved in the cleaning process.

Only the understanding of technical processes, the resulting interrelations and the cooperation of all participants, particularly the dishwasher operator and staff, as well as having regular maintenance of the dishwasher, the dosing equipment and the water treatment system by the manufacturer, can produce the cleaning results expected by the user.

Consistent cooperation between the dishwasher, detergent and dosing equipment manufacturers, as well as the manufacturers of wash items, guarantees constant and optimal adaptation to practical requirements for the benefit of customers and the environment.

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