

Cold Wash – Do Prejudices Impede High Energy Savings?

Barbara Josephy, Eric Bush, Jürg Nipkow, Karin Kleeli, Sandro Glanzmann

Topten International Services TIS, Mibelle Group, Federation of Migros Cooperatives

Abstract

The main share of washing machine electricity consumption is used for heating cold tap water to 30°C, 40°C, 60°C or even 90°/95°C. Washing at lower temperatures (max. 20°C) uses 70% less electricity compared to a 60°C cycle. The EU Eco-design regulation accounts for the high energy savings potential and requires that «from 1 December 2013 household washing machines shall offer to end-users a cycle at 20°C».

Appropriate washing machines and detergents for «cold wash» are already available to residential consumers. Therefore this paper will first give an overview on best-performing washing machines (Best Available Technology BAT) available on the European market according to www.topten.eu. Detergents designed for «cold wash» are available as well. Washing performance at low temperatures is crucial. Based on the experiences of a Swiss detergent manufacturer, it can be said that in cases of slightly and normally soiled laundry «cold wash» is effective.

In practice, it is consumers who opt for the washing temperature and thus determine by their behaviour the amount of energy that can be saved. Although for slightly and normally soiled laundry the washing performance at low wash temperatures is absolutely perfect, most consumers still wash at higher temperatures. Prejudices, which impede high energy savings, will be discussed in the following pages.

The paper also illustrates the experience of a large Swiss retailer, who promoted «cold wash» in 2008 as one of the first through a large Swiss-wide marketing campaign.

We conclude with recommendations for various stakeholders such as EU policies, producers, retailers, NGOs, science and test institutes, how to strengthen the implementation of «cold wash».

Introduction

The washing of clothes and textiles is part of our everyday routine. But by using energy and water it puts a strain on our environment. Consumers have the power! By making a conscious decision to change their washing habits, they can generate a profound impact on the environment and costs, simply by choosing a lower washing temperature or by adding the appropriate dosage of detergent. It may be worthwhile to rethink the everyday routine, because with low washing temperatures, up to 70% electricity can be saved.

This tremendous energy and CO₂ savings potential can – concerning washing – through no other measure be reached so easily. This savings potential, however, lies idle. From the point of view of the authors it is important to take up the issue of «cold wash» EU-wide and to push its implementation.

The aim of this article is to give an overview of the subject and to discuss the status of literature, the popularity of «cold wash» in and outside Europe, the savings potential, the availability of energy-efficient washing machines and of detergents, which are also effective at low washing temperatures, prejudices of consumers against «cold wash» and conclusions of a «cold wash»-campaign carried out in Switzerland. Based on this, recommendations will be derived, how the issue «cold wash» could be pushed and promoted across the EU.

Status of Literature

The topic «washing» has been researched extensively in the context of the Eco-design preparatory study Lot 14 [1]. The developments of washing machines in the EU are regularly analyzed by Paolo Bertoldi and his team [2], [3]. For many years the topic «washing» has been also intensively studied by Prof. Rainer Stamminger and his team [4], including user behaviour (e.g. [5]). A representative and often-cited study on «washing behaviour in Germany» was carried out on behalf of the Energy Efficiency Initiative (Berlin) [6].

Specifically on the topic of «cold wash» there is, at least in German speaking Europe, little scientific literature. An often-cited study was prepared by the Oeko-Institut (Germany) [7].

It is obvious that the washing performance at low washing temperatures is crucial. There are only few published tests on the washing performance of detergents at 15°/20°C (e.g. 2008 [8], 2010 [9], 2012 [10], 2013 [11]). However, these tests focus primarily on how well stubborn stains are removed at low washing temperatures. Their validity, therefore, is limited because the present article is focused on the wash performance for slightly and normally soiled laundry, which is the normal case. Additionally, formulations of detergents have changed in the meantime and some products are no longer available.

Source of numerous contributions on the topic of «cold wash», which sometimes reference some of the above mentioned studies and tests, is the internet (e.g. The German Federal Environment Agency [12], [13], Forum Waschen [14], Bund der Energieverbraucher e.V. [15], Umwelt Briefe [16], n-tv [17], N24 Nachrichten [18]).

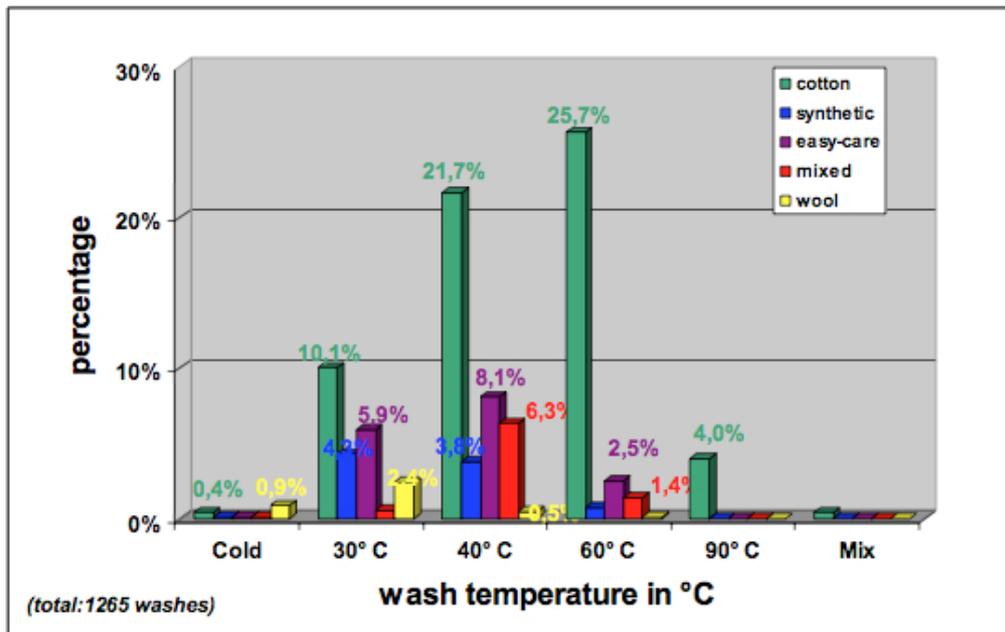
Cold Wash is Widespread in the United States, Japan, China and Spain

In the United States, Japan and China, for example, «cold wash» is common.¹ In Europe, the dissemination of «cold wash» differs. In Spain, «cold wash» is common. Also in Italy and France consumers do wash cold, but far less than consumers in Spain.²

In Germany, Austria, Switzerland and in Eastern Europe «cold wash» is not a common practice [19]. In Switzerland, for example, around 5% of the consumers still choose the boiling wash cycle. 80% of the laundry is washed at 60°C or 40°C. The 30°C cycle is chosen by around 15% of the consumers and only a marginal percentage of the consumers use «cold wash» (< 0.5%) [20]. Alike data were found in Germany [1], [6]. We estimate that the average washing temperature in Europe is around 40°C.

¹ The washing machines often do not have their own heating element. In the United States, washing machines usually are provided with the warm water from hot water heater storage tanks, in Japan and China cold water flows in from the main.

² In countries in which «cold wash» is widespread, often highly alkaline chemicals which strongly stress the environment are used to achieve a good washing result (e.g. javel water, peroxide). Additionally, the washing machines used in these countries usually consume a lot of water (e.g. in the United States: 100 – 150 litres for 5 kg laundry [21]).



Distribution of wash cycles and temperature in Germany [1]

70% Less Energy Consumption at 20°C instead of 60°C

The most energy intensive process during washing is the electric heating of the cold tap water up to 30°C, 40°C, 60°C, 90°C or even 95°C. Thus, «cold wash» uses by far the least electricity.³

The electricity consumption of the washing machine depends primarily on the selection of the washing temperature. Washing with a typical appliance (energy efficiency class A+) at 20°C instead of 60°C saves 70% electricity [20]. The savings potential depends also on the energy efficiency class of the washing machine (according to the EU energy label [22]) and the individual model. In best performing models the saving tends to be smaller. The temperature of the inflowing tap water also has an impact. The lower it is, the smaller the savings. Furthermore, the amount of water to be heated is decisive.

Energy Savings Potential of 15 – 25 TWh per year in Europe

The EU-27 washing machine stock in the residential sector was estimated to be around 167 million units in 2005 [2], [23]. Their energy consumption is estimated at around 51 TWh per year [1], [2], [3].

If the most commonly selected washing temperatures of today (40°C/60°C [1], [6], [20]) are shifted down, significant savings will result: If in the mid-term the 60°C cycle only is selected every tenth wash and the rest of the laundry is washed at 40°C and 20°C (approximately fifty-fifty), the electricity consumption is reduced by about 30% (conservatively calculated) [20]. Depending on the household size, this results in a saving of around 50 to 150 kWh or around 8 to 22 Euros per year.⁴ In some cases, this does not sound very impressive, but in total it takes on another dimension: relative to the EU-27 savings of around 15 TWh per year (15 billions kWh) are possible in the mid-term. This equals 1,5 times the annual production of the nuclear power plant Grundremmingen bloc B (10,3 TWh per year) or almost half of the annual production of the 4 nuclear power plant-blocs in Cattenom (37 TWh per year).

³ Energy is also used for the motor (e.g. rotation of the washing machine drum, spin-drying of the laundry) and for standby/left-on. «Cold wash» needs (almost) no electrical heating, which raises the share of energy used by motor and standby/left-on.

⁴ Assumption electricity tariff: 0.15 €/kWh, there however can be large differences depending on country or electrical utility.

In the long term, if «cold wash» is even more frequently used⁵, a savings potential of 50% is possible [20]. For EU-27 this would correspond to around 25 TWh less energy consumption per year (25 billion kWh), which corresponds to the double annual production of the nuclear power plant Isar block 2 (about 12 TWh per year) or two-thirds of the annual production of the 4 nuclear power plant-blocks in Cattenom (37 TWh per year).

Consumers that use low washing temperatures, continually contribute to 30% – 50% less electricity consumption and CO₂ emissions caused by washing and thus contribute to the sustainable conservation of the environment.

Energy Efficient Washing Machines are the Trend in Europe

www.topten.eu – Overview on the Most Energy Efficient Washing Machines in Europe

Washing machines are continuously optimized, particularly regarding their energy and water consumption. Today's best appliances are characterized by best energy efficiency (A+++), and best spin-drying efficiency (A) according to the EU energy label for washing machines [22].⁶ Additionally, their water consumption is low.⁷

An overview of the most energy efficient washing machines available on the European market, is presented by the international online search-tool Topten – www.topten.eu [25]. Topten also declares whether the washing machine offers a «cold wash» cycle.

Brand	V-ZUG Adora SLQ-WP	V-ZUG Adora SLQ	Electrolux WA SL2 E	V-ZUG Adora SL	Electrolux WA GL6 E	AEG Bella 3661	AEG Regina 2661	V-ZUG Adora S	Miele W Supertronic	Bosch WAY32740CH	Bauknecht WAE 8748	Miele W 59-61
Other models						Bella 3461	Regina 2461	Adora L		WAY32840CH	WAE 8848	W 58-90 CH / W 58-92 CH
Costs for electricity and water (€15 years)	653	688	708	741	801	801	759	786	880	841	857	876
Capacity (kg)	8	8	8	8	8	8	8	8	8	8	8	8
Energy efficiency class	A+++	A+++	A+++	A+++	A+++	A+++	A+++	A+++	A+++	A+++	A+++	A+++
Energy Efficiency Index	27.1	31.7	32.6	36	37.7	37.7	38.9	40.9	42.5	44	44.6	44.7
Spin-drying class	A	A	A	A	A	A	A	A	A	A	A	A
Energy (kWh/cycle)	116	136	141	155	162	162	163	175	182	189	191	192
Energy (kWh/cycle) 60 / 40 / 20	0.62 / 0.48 / 0.43	0.78 / 0.62 / 0.37	0.83 / 0.54 / 0.43	0.94 / 0.67 / 0.37	0.90 / 0.65 / 0.49	0.90 / 0.65 / 0.49	0.89 / 0.74 / 0.49	1.0 / 0.7 / 0.58	0.91 / 0.76 / 0.66	0.99 / 0.81 / 0.69	0.98 / 0.78 / 0.63	0.94 / 0.94 / 0.6
Water (litres/year)	9900	9900	9899	9900	11031	11031	9899	9900	11880	10500	10780	11220
Programme time (min) 60 / 40 / 20	170 / 155 / 155	225 / 220 / 215	220 / 194 / 179	210 / 190 / 190	208 / 156 / 156	208 / 156 / 156	223 / 190 / 171	210 / 190 / 190	179 / 149 / 119	205 / 170 / 170	240 / 19 / 180	179 / 179 / 179
Left-on-off (h)	0	0	1 / 0.05	0	1 / 0.6	1 / 0.6	1 / 0.05	0	1.5 / 0.2	0.05 / 0.05	2.32 / 0.11	2.5 / 0.2
Max spin speed (rpm)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
30° C for cotton	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Hot/Rain water supply	no / option	option / option	no / no	option / option	no / no	no / no	no / no	option / no	no / no	no / no	yes / no	no / no
Countries available	on demand	on demand	on demand	on demand	on demand	on demand	on demand	on demand	on demand	on demand	on demand	on demand

Screenshot www.topten.eu: Example washing machines of 8 kg. The best appliance in this category (V-Zug, Adora SLQ-WP) due to its integrated heat pump has an Energy Efficiency Index (EEI) of around 27. This is 40% better than the EEI-limit (46) for the best class A+++. www.topten.eu lists the best performing washing machines with a capacity of less than 8 kg, 8 kg, and more than 8 kg.

⁵ 75% at 20°C, 20% at 40°C and 5% at 60°C.

⁶ The washing efficiency is not declared on the EU energy label, because the class A is mandatory according to the EU-Ecodesign-regulation [24].

⁷ E.g. best performing 8 kg-appliances according to www.topten.eu [25] use 9'900 litres of water for 220 standard uses (declaration according to the EU energy label). This is on average 45 litres per cycle.

20°C Cycle is Mandatory from 2014

In older washing machines the 30°C cycle for delicates or woolly laundry-items is often the lowest washing temperature that can be selected. However, this must not be an obstacle for consumers to wash cold: in this case the laundry can be washed in the 30°C cycle for delicates⁸ and can be spun again at higher spin-speeds – especially when the laundry will be dried by machine (tumble dryer, air dryer).

Already in 2011 several machines offered a 20°C cycle [26]. In the meantime, some manufacturers have even gone a step further and for their latest generation of appliances created a 15°C cycle. Thus, even less heating energy is needed. Whether 20°C or 15°C, these cycles are specifically designed for «cold wash» and include correspondingly optimized mechanics and extended washing time to achieve good washing results.

The EU has recognized the high energy saving potentials of «cold wash». Therefore, the EU-Ecodesign-regulation states that from December 2013 a 20°C cycle for washing machines is mandatory [24].

Detergents for Low Washing Temperatures are Available on the European Market

Nowadays all known European detergent manufacturers offer detergents designed for the washing temperature range of 15°/20°C to 60°C or 90°/95°C [19].⁹ Such detergents exist as heavy-duty detergent (with / without bleach) and colour detergent.

There are Some Prejudices against Cold Wash

On a rational level, consumers may be aware that «cold wash» is meaningful and both washing machines that run a 15°/20°C cycle, as well as detergents for low washing temperatures are available on the European market.

However, the emotional level is often much stronger and supercedes the rational level, because washing also has a lot to do with tradition and habits [19]. The reason why washing habits cannot easily be changed from hot to cold has a lot to do with the fact that there remain some reservations about the «cold wash». The concerns are related to the detergent, such as doubts about the washing result at low washing temperatures, dosage and chemicals, and to hygiene of clothing and textiles, the formation of biofilm in the washing machine.

Prejudices against the Detergent

Detergency: does the laundry get clean at 15°/20°C?

Clothing and textiles shall be clean after washing.¹⁰ However, many consumers fear that their laundry at 15°/20°C does not get clean. Is this true? And what type of laundry is suitable for «cold wash»?

⁸ The use of the wool cycle for non-woolly laundry-items is not recommended. The wash temperature is low but it lacks the necessary movement of the laundry to achieve a good washing result for non-woolly laundry-items.

⁹ Henkel, Mibelle Group (largest Swiss detergent manufacturer), Procter & Gamble, Unilever.

¹⁰ According to the Sinner circle – the mechanism of action, with which the cleaning processes (e.g. in the washing machine) are organized and accomplished [27] – a good washing result always depends on the interaction of the four factors mechanics (i.e. the agitation of the laundry in the drum), temperature, time, and chemistry. Mechanics, wash temperature and wash time are controlled by the washing machine and by the selected washing cycle, respectively. The chemistry is given by the chosen detergent. All four factors are interdependent, but inter-changeable in size. If one of the factors is changed, it must be

With detergents designed for 15°/20°C cycles slightly and normally soiled clothing and textiles get clean at these washing temperatures [19].¹¹ This is thanks to the improved and more effective formulations in recent years.¹² «Cold wash» thus is suitable to all the clothing for office life, but also underwear, bed linens, kitchen linen and towels.¹³

Regardless of the effective wash performance of a detergent, the consumers ultimately decide whether the laundry from their point of view has become clean or not. If a wash result is judged as unsatisfactory however, it is not necessarily the low washing temperature that is at fault. The washing result is also significantly influenced by the pre-sorting of the laundry, the (pre-)treatment of stains¹⁴, the correct loading of the washing machine¹⁵, the usage of a suitable detergent¹⁶, the correct dosage of the detergent¹⁷ and the correct cycle selection¹⁸. Thus, washing requires a broad knowledge by the consumer – regardless of the washing temperature!

compensated with one or more other factors in order to achieve the same satisfactory washing result. If, for example, the wash temperature is lowered to 15°C/20°C, it needs either higher mechanics, so that the laundry is milled enough or an extended wash time, so that the detergent has enough time to have its full effect, or improved chemistry of the detergent.

¹¹ The statement that slightly and normally soiled clothing and textiles get clean at 15°C/20°C is based on the knowledge of [19]. Published tests, as mentioned in the section «Status of Literature», have only a limited relevance as they primarily focus on the removal of stubborn stains, which is not the usual case. All detergent manufacturers do test the wash performance of their detergent regularly [19]. However, these results are intended for internal purposes and therefore are not citable here. There are two methods to measure the wash performance (cleanliness): a standardized and a non-standardized method. The standardized test method measures the remissions of soiled fabric strips (for bleach, surfactants (oil), etc.) before and after washing. Observed differences base on measurements and usually are not recognizable by the naked eye. The measured values of various test institutes are difficult to compare because each institution is testing slightly different. The non-standardized method is based on so-called in-home use tests in which the washing result is visually judged by eye. The assessment is subjective, because each household has its own test stains and feelings, which means clean.

¹² The detergency at «cold wash» significantly was increased during the last few years. Progress was made especially in the area of enzymes and surfactants [19]. For the latest generation of low-temperature detergents other enzymes are used than few years ago and the proportion of enzymes that are effective particularly at low temperatures has been increased. In addition, other surfactants and combinations are used as before, which act even better in cold temperatures. Enzymes are proteins or protein body. They reduce contaminants as protein, fat, starch, etc. by splitting these specifically. They are made from genetically engineered organisms. Some manufactures declare this. Surfactants are surface-active substances (dirt solver). They take over the main task when washing. They accelerate the wetting of the fibres, replace dirt and prevent it settles back on the fabric. Surfactants are usually either produced from fossil resources (oil) or renewable resources (palm kernel oil).

¹³ For heavily soiled clothing and textiles (what usually only is rarely the case) one is with a 60°C-cycle and bleach-containing detergent on the safe side. In this category are e.g. filthy rags, working clothes of workmen, clothes of children playing outside, and baby clothes.

¹⁴ (Pre-)treatment of stains: Stains – from egg to fat splashes up to berries – have to be removed and the laundry-item has to be washed as soon as possible. The stain shall not be allowed to dry. If given, stains – especially oil and edges on shirts – have to be pre-treated with an agent (with / without bleach). If visible stains are dry and were not treated before washing, they are often immediately recognizable also after washing – regardless of the chosen wash temperature. Stains due to environmental contamination and skin fat are not seen at «first sight», but are noticed only after a certain time [19].

¹⁵ Loading of the washing machine: At the best, the washing machine is fully filled according to manufacturer's instructions (exceptions: delicates and woolly laundry-items). Once the drum is overfilled, the laundry can not move enough. Furthermore less water is available per washing item, and so the laundry can not absorb enough water. Both lead to a reduced wash effect. In contrast, poorly filled washing machines stress the fabrics by the increased movement of the drum.

¹⁶ Usage of a suitable detergent: When washing cold, detergent designed for low wash temperatures shall be used. Washing powder tends to wash better than liquid detergent. However, at short cycles they sometimes do not dissolve completely.

¹⁷ Dosage of the detergent: At the best, the dosage is followed according to manufacturer's recommendations. If the dosage is too scarce, the laundry gets a greyish shimmer (greying). Generally it applies: as much as necessary, as little as possible.

¹⁸ Cycle selection: For «cold wash» the use of the wool cycle for non-woolly laundry-items and short cycles is not recommended. The wash temperature of the wool cycle is low but it lacks the necessary movement of the laundry to achieve a good washing result. In short cycles the exposure time is shorter, so one may have to accept compromises in the washing result. On top of that, short cycles usually are no energy saving cycles.

Dosage: is more detergent needed when washing at 15°/20°C?

In general, among consumers often there is uncertainty regarding the amount of detergent they have to fill in. But must the dosage even be increased for «cold wash» so that the laundry really gets clean?

Detergents do not need to be dosed higher at 15°/20°C cycles than at other washing temperatures. It is best to adhere to the dosage recommendations of the manufacturers for slightly, normally and heavily soiled laundry.¹⁹ The degree of soiling of the clothing and textiles is often overestimated by the consumers. Therefore, they often and independently of «cold wash» do overdose [19].

The detergent manufacturers generally are working to minimize the dose by using a synergy of enzymes and surfactants. Lower doses add up to tons, which do not need to be produced and which also do not go back into the environment [19].

Chemistry: Are stronger chemicals needed for washing at 15°/20°C?

In the context of «cold wash» and the Sinner Circle²⁰ also raises the question: Do detergents that are effective even at such low temperatures of 15°/20°C contain particularly strong chemicals?

For a good washing result at low washing temperatures no water-polluting javel water is necessary. In the detergents designed accordingly for 15°/20°C of all known European detergent manufacturers this task is performed by enzymes which are active and effective especially at low temperatures and little water [19]. Their use is classified as non-problematic for the environment [28].

The other ingredients in the common detergents for regular laundry (not wool or silk) are essentially the same everywhere: surfactants, builder, bleach, alkalis, processing aids, foam regulators, anti redeposition agent, dye transfer inhibitor, optical brighteners, perfumes and fragrances.

Detergents thus constitute a certain burden on our environment and waters.²¹ However, the impact does not get higher with «cold wash».

Prejudices against the Hygiene

Is the laundry contaminated with germs after «cold wash» and does this harm the consumers health?

From the side of consumers in connection with «cold wash» there often exists some scepticism about hygiene.

Washing at low washing temperatures in private households with healthy individuals is considered as safe concerning hygiene [19].²² The contact with microorganisms and bacteria is normal and is usually not dangerous for health.²³

¹⁹ The dosage of detergent depends on the degree of soiling of the clothing and textiles as well as from the water hardness. Usually detergents contain around 30% substances for softening the water. In countries with very soft water (e.g. Nordic countries of Europe) sometimes builders are omitted entirely in the detergent, so that the amount of detergent required is automatically less there [19].

²⁰ See footnote 10.

²¹ The EU Ecolabel [29] and the Nordic Swan [30] label especially environmentally friendly detergents. The «Charter for Sustainable Cleaning» [31] is the commitment of the manufacturers in the field of sustainable production and is an A.I.S.E. voluntary sustainability initiative (International Association for Soaps, Detergents and Maintenance Products, the official representative body of this industry in Europe [32]).

²² This is different in public institutions such as hospitals and care facilities. There basically measures against a possible spread of pathogenic germs must be taken. These also cover the cleaning of textiles. But it does not make sense to transfer these measures to private households [13].

The laundry hygiene is positively supported when occasionally²⁴ a 60°C cycle is run with the addition of a detergent containing bleach.²⁵ This measure also prevents the formation of biofilm. In the situation where different households share the washing machine, such as in the laundromat or in the laundry room for joint use (as is common in Switzerland) and in case of concerns towards hygiene, it is recommended best to start the wash day with a 60°C cycle.

What about the risks of biofilm?

Consumers have also serious concerns about the formation of biofilm in the washing machine.

In the washing machine, there are always residual water deposits in which possibly not killed microorganisms find an ideal breeding environment – especially on plastic parts, hard to reach places and on the drum. This may in time lead to an unhygienic biofilm in the machine. Once inside the machine, it is very difficult to remove. So in order to prevent any bacteria and fungi from further multiplying after washing in the humid environment the laundry should always be taken out and dried as soon as possible. It is also recommended to wash occasionally at 60°C with a detergent containing bleach. Furthermore, the washing machine door and the rinse tray is best left open after washing to allow the remaining moisture to evaporate.

Experience from Campaigns on Cold Washing

In 2008, the Swiss retailer Migros was one of the first sellers who was strongly dedicated to the topic of «cold wash». From June to November 2008, Migros conducted a Switzerland-wide «cold wash»-campaign for the newly developed detergents by Mibelle Group which wash also at low temperatures. Posters were hung, advertisements switched, and on TV were shown add-ons displaying the positive message about the «cold wash» detergent. The conclusions on this campaign are [33]:

- The success of such campaigns is not measurable – there are too many other influences at play such as the washing machine, prejudices, point of views and experiences of friends and neighbours, etc.
- In addition, the detergent market is heavily dependent on sales promotions and there is a constant high price war. Sometimes it is tried to cut costs by reducing quality and amount of the enzymes because these are the most expensive component in the detergent.
- For example, if consumers use less fat during frying, they get an immediate visual and sensory feedback. This is different when washing. The consumers here have no way to find out for themselves whether the washing performance is good. Instead, they have to believe that the washing machine and the detergent do their job well.
- Washing habits are usually passed from mother to daughter to granddaughter. It is important to disconnect this line. However, it takes a lot of time to get the consumers used to something new.
- Older consumers are generally very difficult to convince that something new is better. Therefore one has to start educating about the benefits of «cold wash» with the younger generation.
- The consumers need to be reminded again and again about the benefits of «cold wash», there needs to be a constant repetition and education. This is the only way the prejudices against the «cold wash» can be changed in the minds of consumers in the long-term.

²³ To regularly wash with 60°C is recommended only for households in which people live with weakened immune system, contagious disease (e.g. diarrhoea) or a dust mite allergy. If in doubt one should consult the treating physician [13].

²⁴ Depending on the source «occasionally» means e.g. every 14 days, once or twice a month, every fifth laundry.

²⁵ If these recommendations are followed, the use of hygiene cleaners and of a hygiene cycle (75°C) is not necessary [19].

Recommendations to Promote Cold Wash

In this article it was shown that washing machines with a 15°/20°C cycle and appropriate detergents for low washing temperatures are available on the European market. The 15°/20°C cycle of modern washing machines are optimized for «cold wash» and the latest generation of detergent designed for «cold wash» is appropriate to wash slightly and normally soiled laundry at these low washing temperatures. In the case a consumer perceives the washing result as insufficient, it is not the fault of the «cold wash», but may have a number of other causes such as laundry sorting, treatment of stains, loading of the washing machine, etc. It is mainly prejudices, but also tradition and custom, that impede consumers from implementing the step towards using «cold wash» in their everyday lives.

The authors are convinced that «cold wash» is a good way to wash. The tremendous but still dormant savings potential cannot be so easily reached by any other measure of this magnitude in the whole washing process. Not seizing this opportunity, would be passing up on an opportunity where you have nothing to lose. Especially given the likely increasing electricity prices in the future, it should be an incentive for many consumers to begin using the «cold wash» in there everyday washing routine.

To promote the topic of «cold wash», the following measures are recommended:

- EU policies, washing machine manufacturers, detergent manufacturers and retailers: active and continued advertisement of «cold wash», ongoing optimization of the 15°/20°C cycles, of the detergents and of the purchasing of detergents.
- Environmental organizations, consumer organizations, energy agencies: active and continued information and education of the consumers regarding washing performance of detergents at low washing temperatures, dosage, chemicals, hygiene.
- Science, test institutes: Publication of studies (consumer and technical), continuing tests on «cold wash».

References

- [1] LOT 14: Domestic Washing Machines and Dishwashers. Task 1 – Task 7. 2007 – 2008. Download: <https://circabc.europa.eu/faces/jsp/extension/wai/navigation/container.jsp>
- [2] Bertoldi Paolo, Bettina Hirl, Nicola Labanca: Energy Efficiency Status Report 2012. Electricity Consumption and Efficiency Trends in the EU-27. 2012.
- [3] Bertoldi Paolo, Bogdan Atanasiu: Electricity Consumption and Efficiency Trends in European Union – Status Report 2009. European Commission DG Joint Research Centre. 2009.
- [4] Stamminger Rainer, Publication overview under www.landtechnik.uni-bonn.de/forschung/haushaltstechnik/publikationen/publikationen-rainer-stamminger
- [5] Berkholz Petra, Anna Brückner, Anke Kruschwitz, Rainer Stamminger. Verbraucherverhalten und verhaltensabhängige Einsparpotentiale beim Betrieb von Waschmaschinen. Bonn: Shaker Verlag. 2007.
- [6] Bevölkerungsbefragung zum Thema: Waschen in Deutschland. Eine Studie im Auftrag der Deutschen Energie-Agentur GmbH (dena) im Rahmen der Initiative EnergieEffizienz für private Haushalte. Erhebungszeitraum: Oktober / November 2005.
- [7] Rüdener Ina, Dr. Ulrike Eberle, Dr. Rainer Griesshammer. Ökobilanz und Lebenszykluskostenrechnung Wäschewaschen. Vergleich des Waschens bei durchschnittlichen Waschttemperaturen mit Waschen bei niedrigeren Waschttemperaturen. Endbericht. Im Auftrag der Procter & Gamble Service GmbH. 2006. Download: www.oeko.de/oekodoc/289/2006-008-de.pdf
- [8] K-Tipp 12/2008 (17. Juni 2008): Kalt und sauber klappt nicht immer (Download: www.ktipp.ch/tests/1033026/Colorwaschmittel_kalt); Kassensturz 17. Juni 2008: Dreckige

Wäsche: Waschkraft-Test bei 20 Grad (Download: www.srf.ch/konsum/tests/kassensturz-tests/dreckige-waesche-waschkraft-test-bei-20-grad).

- [9] test 10/2010: Colorwaschmittel – eine kleine Sensation.
- [10] test 2/2012: Vollwaschmittel – Weisses wird grau.
- [11] test 2/2013: Flüssigwaschmittel – Viele sind überflüssig.
- [12] The Federal Environment Agency (Germany) / Deutsches Umweltbundesamt: www.umweltbundesamt.de/chemikalien/waschmittel/sparsam.htm
- [13] The Federal Environment Agency (Germany) / Deutsches Umweltbundesamt: www.umweltbundesamt.de/chemikalien/waschmittel/waschtemperaturen.htm
- [14] Forum Waschen – eine deutschlandweite Initiative für nachhaltiges Handeln beim Waschen, Spülen und Reinigen im Haushalt: <http://forum-waschen.de/waeschewaschen.html>
- [15] Bund der Energieverbraucher e.V.: www.energieverbraucher.de/de/Zuhause/Hausgeraete/Waschmaschinen/Kalt-waschen__2108
- [16] Umwelt Briefe. Aus Kommunen und Forschung: www.umweltbriefe.de/docs/ub_17_11/buergerinfo.html
- [17] n-tv: www.n-tv.de/ratgeber/Waschen-bei-20-Grad-article1407386.html (3rd September 2010)
- [18] N24 Nachrichten: www.n24.de/n24/Nachrichten/Verbraucher/d/1383976/waschgang-bei-20-grad-frischt-kleidung-nur-auf.html (21.10.2011)
- [19] Mibelle Group, www.mibellegroup.com
- [20] Josephy Barbara, Eric Bush, Jürg Nipkow: Kaltwaschen – Verhindern Vorurteile das grosse Energiesparpotential? Swiss agency for efficient energy use S.A.F.E. / Schweizerische Agentur für Energieeffizienz S.A.F.E., July 2013.
- [21] <http://de.wikipedia.org/wiki/Waschmaschine>
- [22] European Commission. Commission Delegated Regulation (EU) No 1061/2010 of 28 September 2010 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of household washing machines. In: Official Journal of the European Union, 30. 11. 2010.
- [23] European Commission, Working Document, Impact assessment, Accompanying document to the Draft Commission Regulation implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for household washing machines).
- [24] European Commission. Commission Regulation (EU) No 1015/2010 of 10 November 2010 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to Ecodesign requirements for household washing machines. In: Official Journal of the European Union, 11. 11. 2010.
- [25] Topten: www.topten.eu – Best Products of Europe
- [26] Josephy Barbara, Eric Bush, Jürg Nipkow, Sophie Attali: Washing machines: Key Criteria for Best Available Technology (BAT). Paper for the proceedings of Energy Efficiency in Domestic Appliances and Lighting, 24-26 May 2011, Copenhagen.
- [27] http://de.wikipedia.org/wiki/Sinnerscher_Kreis
- [28] Waschen heute. Informationen zum Thema Waschen und Umweltschutz. Schweizerischer Kosmetik- und Waschmittelverband SKW. 2010.

- [29] EU Ecolabel, www.ecolabel.eu
- [30] Nordic Swan, www.nordic-ecolabel.org
- [31] A.I.S.E. International Association for Soaps, Detergents and Maintenance Products, the official representative body of this industry in Europe: www.asie.eu
- [32] Charter for Sustainable Cleaning: www.sustainable-cleaning.com
- [33] Federation of Migros Cooperatives / Migros-Genossenschafts-Bund (Switzerland), www.migros.ch

Acknowledgements

The Topten project team gratefully acknowledges the support from

- European Climate Foundation ECF, www.europeanclimate.org
- Elektrizitätswerke des Kantons Zürich EKZ, www.ekz.ch
- WWF Switzerland, www.wwf.ch