

The science of dishwashing

Changing habits for a greener world

By making small changes to our domestic habits, we can make a big difference to global energy use and resource consumption. That's the message from a new review report, which shows how rethinking the everyday task of washing up can help private households to become significantly more resource efficient. Led by Dr Lotta Schencking and Professor Rainer Stamminger from the University of Bonn in Germany, the review describes different dishwashing behaviours around the world and identifies best practice tips for both manual dishwashing and washing dishes in an electric dishwasher.

For something we do every day, dishwashing is a chore that most of us think little about. But private households are responsible for a significant proportion of global energy and water use, and given the pressure of diminishing resources, anything we can do to reduce consumption has to be worthwhile.

Dr Lotta Schencking and Professor Rainer Stamminger from the Institute of Agricultural Engineering at the University of Bonn, Germany, reviewed studies of consumer dishwashing behaviour around the world. Most would agree that using an electric dishwasher is less time-consuming and more convenient than manual washing. But which method results in better and

more hygienic cleaning, and which method is more efficient in terms of energy use and the consumption of water and cleaning materials? In short, what can science tell us about best dishwashing practice?

AROUND THE WORLD IN 80 WAYS

The scientific study of dishwashing is relatively new, with most research conducted in the last 20 years. Schencking and Stamminger examined the literature in depth and found significant differences in consumer behaviour.

An American study, for example, found that the amount of work and time spent loading and emptying an electric dishwasher was as low as one-fifth of that spent washing by hand. Other research in six European countries concluded that moving from manual to mechanical dishwashing cut energy consumption, CO₂ emissions, and costs by around 50–60%. Water efficiency is particularly important, and a four-country study found that electric dishwashers use less than half the amount of water per item cleaned than manual washing.

How consumers wash manually is different around the world. For example, researchers found that in the United Kingdom, the United States, and Germany, people tend to wash dishes in a full sink, with detergent in the water. People in Japan favour putting detergent on the dishes, and in Mexico onto the washing-up brush. Another study found that in Spain, people typically wash dishes under a running tap.

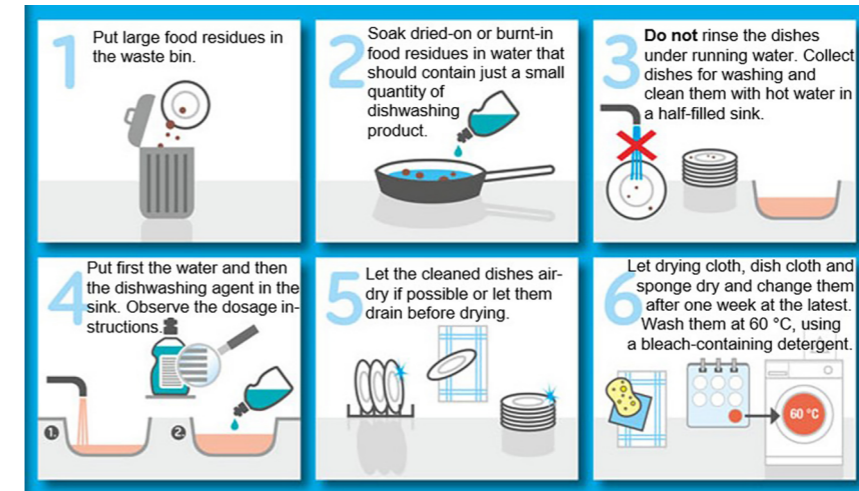


Figure 1. Six golden rules for manual dishwashing.

Even when people own an electric dishwasher, studies showed that many still tend to wash some items by hand – for example, because they think glassware is too fragile for a machine or pans are too dirty to be cleaned effectively in a dishwasher. As for frequency, research suggests that in Italy, Russia, and Argentina, private households tend to run machines once a day, but in countries like Germany and China, with typically smaller households, machines are run one to four times a week.

Research finds less variation in the practice of preparing items to be washed, with around 75% of people disposing of residues before dishwashing. However, this is affected by eating etiquette. For example, leaving an empty plate is considered impolite in China because it suggests the host has not provided sufficient food, but in Germany, it is considered a compliment to the cook to finish everything on the plate. As for the disposal method, an American study found that pre-rinsing items in a dishwasher uses around four litres of water, while manually pre-rinsing items before putting them into the machine consumes 100 litres.

Hygiene is important, too. Research confirms the superior performance of electric over manual dishwashing in terms of utensils appearing clean and being scientifically tested for bacteria. An American study found that items washed by hand had bacterial counts, as measured in 'colony-forming units'

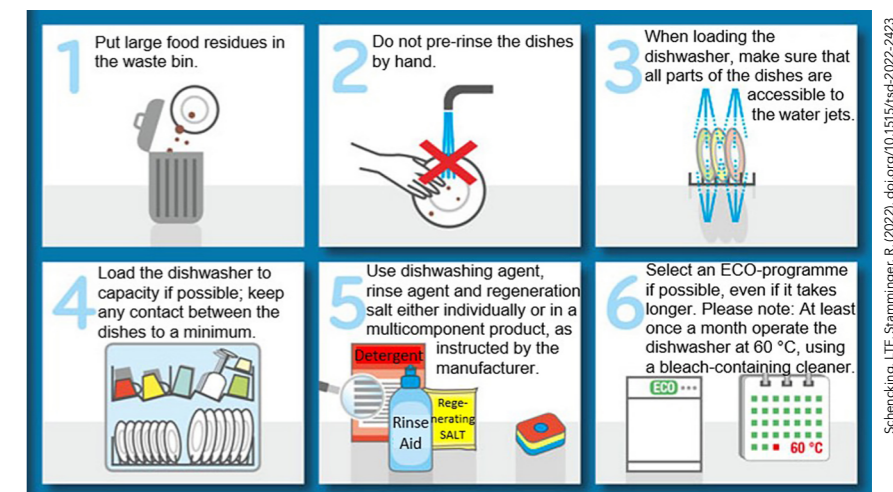


Figure 2. Six golden rules for electric dishwashing.

or CFUs, from 1 to 6,000 CFU, while items washed in a machine had values of below 100 CFU. Dishes dried with a tea towel were found to carry more bacteria than those left to air-dry in a draining rack.

BEST PRACTICE TIPS

Schencking and Stamminger's review of the science shows how rethinking the everyday task of dishwashing has great potential for saving resources. They argue that, whether consumers wash dishes by hand or in a machine, more needs to be done to persuade private

households to change their behaviour to reduce energy use and the consumption of water and cleaning materials.

Advice on dishwashing is already available on European websites, for example the German household organisation 'Forum Waschen.' Previous research by Stamminger also looked at how to optimise manual dishwashing practice in terms of collecting items, soaking, washing, detergent dosage, rinsing, and drying. Insights gained, for example, included that using more detergent did not always lead to better cleaning results because it led to more foam which stuck to items and impeded rinsing.

Moving to automatic dishwashing from manual dishwashing can cut energy consumption, CO₂ emissions, and costs by around 50–60%.



Most participants were concerned about the time it takes to wash dishes, rather than resource consumption.

Scientific tests using such best practice tips for manual dishwashing found that the method consumed 60% less water, 70% less energy, and 30% less detergent. The results were even more impressive when several items were cleaned in one session. Best practice therefore also includes collecting items together, rather than washing them one at a time, and pre-soaking things like dirty pans in water containing a little detergent. It is recommended that dishcloths and sponges are changed at least once a week and washed at 60 °C using a bleach-containing detergent.

Schencking and Stamminger also looked at best practice for using an automatic dishwasher. Research into consumer behaviour in Germany, Italy, Sweden, and the UK suggests that private households should do more to use their machines at full capacity. They should also set them at temperatures lower than the 50/55 °C or 65 °C programmes favoured by most people, and pre-treat items by wiping them before loading rather than pre-rinsing by hand.

Best practice tips for electric dishwashing found by Schencking and Stamminger include first disposing of food residues in a bin and, if dishes are particularly dirty, pre-rinsing them in the machine. Items should then be loaded carefully to ensure water jets are not blocked and can access all parts of the dishes. The dishwasher should be loaded to capacity, avoiding contact between items, and choosing the ECO setting as the default programme. Dishwashing detergents and materials

should be used carefully, for example, not using additional salts and rinse aids if a multi-component cleaning tablet is used. At least once a month the machine should be operated at 60 °C using a bleach-containing cleaner.

Rethinking the everyday task of dishwashing has great potential for saving resources.

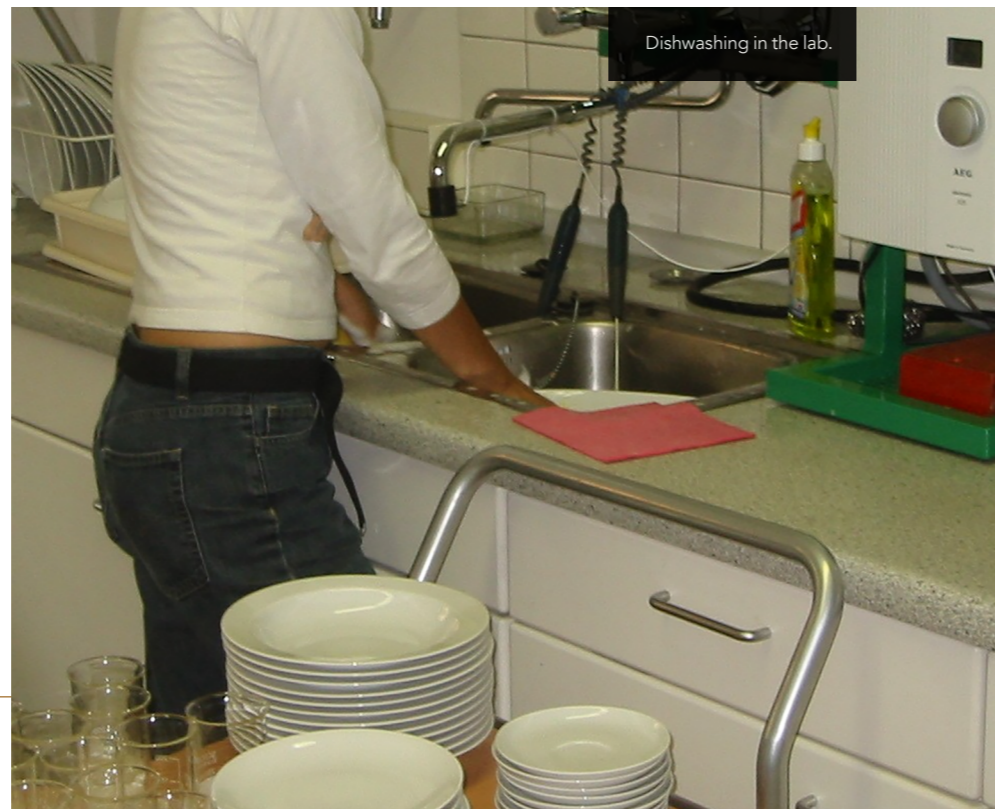
CHANGING CONSUMER HABITS

Schencking and Stamminger's wide-ranging review study confirms that, in addition to saving time, electric dishwashers consume fewer resources than manual dishwashing and achieve the same, if not better, results. However, consumers who continue to wash dishes manually can also do much to become

more resource-efficient as well as hygienic. Whatever the method, much needs to be done to raise consumer awareness of best practice.

Schencking and Stamminger warn that appealing to consumers' better nature is not the only way forward. One study featured in their research found that less than a third of participants were worried about resource consumption, and more were concerned about the time taken to wash dishes, as well as the physical discomfort involved. This suggests that public awareness and advertising campaigns should concentrate on the personal benefits and advantages of changing washing-up practice, and not just on saving resources. Another study confirmed that some consumers mistakenly continue to believe that electric dishwashers consume more energy and water than manual dishwashing.

Schencking and Stamminger conclude, 'Education work is essential [...] though it is still unclear what form this should take, who should be responsible for it, and how it can be done as effectively and sustainably as possible.' Practically, this is a task for everyone who is active in this business and, of course, also for everyone privately when they wash the dishes.



Behind the Research



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Research Objectives

Schencking and Stamminger identify best practice tips for manual and electric dishwashing.

Detail

Bio

Dr-Ing Lotta Kinitz, born Schencking, is a lecturer at Hamburg University of Applied Sciences (HAW Hamburg) and an editor in consumer journalism at IMTEST. After her bachelor's degree in ecotrophology at HAW Hamburg, she completed her master's degree and doctorate at the University of Bonn. Until September 2021, she researched the standardisation of electric dishwashing processes.

Professor Dr Rainer Stamminger has 17 years of practical experience in the development of washing machines and

dishwashers with AEG Hausgeräte, Germany. He is now Professor of Appliance and Process Engineering at the University of Bonn. Main areas of research are consumer behaviour of household work with and without using appliances, new products or features, smart appliances, robots for household application, and questions of sustainability of housekeeping.

Funding

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Collaborators

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Personal Response

What inspired you to conduct this review study?

Rainer Stamminger:

“ I started to work on dishwashing as I recognised that almost nobody is dealing with this issue. Now, after 20 years of work, I think it is time to review what has been achieved for the sake of the next generation of researchers. ”

Lotta Schencking:

“ The household in general and dishwashing in particular still hold great potential for savings that are often not fully exploited. That's why I found it very engaging to compile a summary of previous research on how to be as resource-conserving as possible. Ideally, by taking into account the compiled best practice tips – depending on previous habits – enormous additional amounts of water, energy and dishwashing detergent can be saved. And this can be achieved with relatively small changes in daily behaviour that can even save you time. ”