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Dishwashing and Water Conservation: An Opportunity for Environmental Education

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Abstract

Technological advances have continued to improve the cleaning and water efficiency of automatic dishwashers. However, research indicates consumers waste water and energy during the dishwashing process through their actions and decisions. To gain more current information on consumer dishwasher usage, a major university conducted a kitchen usage study that asked questions about dishwashing. The study found that consumers use water unnecessarily by pre-rinsing dishes at the sink before placing them into the dishwasher. Numerous factors underlie this behavior. It seems clear that consumer education about proper dishwashing procedures is needed.

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Dishwashing is a mundane but frequent household task. Automatic dishwashers do most of the work, correct? Well, maybe. New research at the Center for Real Life Kitchen Design at Virginia Tech shows that consumers are not using the available dishwashing technology effectively--and they're wasting a lot of water in the process!

Background

Generations of people struggled with the daily chore of dishwashing, a manual task until the first machine for dishwashing was patented in 1850 by Joel Houghton (Lindsay, 1980; Whirlpool Corporation, 1993). This wooden machine contained a hand-cranked wheel that splashed water on dishes. Following other hand-operated models, a gas-powered dishwasher was introduced in 1911, and a freestanding dishwasher with permanent plumbing was developed in 1920 (Whirlpool Corporation, 1993). Household dishwashers went into production in 1947, soon after World War II, and the appliance became widely available by 1950 (Lindsay, 1980).

Additional advances in technology brought solid-state controls, energy saving, features and increased convenience by the late 1970s. Today's dishwashers are designed with additional improvements in cleaning, water efficiency, and quiet operation.

Improved Water and Energy Efficiency

The implementation of energy standards for appliances by the U.S. Department of Energy established new benchmarks for energy and water efficiency. A significant proportion of the energy savings for today's automatic dishwashers comes from the reduction in hot water use.

Because energy is used to heat water, less water use by a dishwasher also means reduced energy use. In 1978, 83% of a dishwasher's energy use went to heating water, with 10% used for washing and 7% for drying (Enders, 1978). By 1994, only 56% of the energy used by the dishwasher was to heat water (Whirlpool Corporation, 1993). A significant reduction in water usage resulted from designing more efficient wash systems that incorporate direct water delivery and improved soil-handling systems (Dzierwa, 1994).

The average water use per dishwasher cycle decreased from a range of 11-15 gallons per normal cycle in 1978 (Garrett, 1978) to 6-10 gallons per normal cycle in 2000 (Soap and Detergent Association [SDA], 2000). Despite the fact dishwashers are designed to be resource efficient, other significant determining factors on resource usage are the result of decisions of the consumer.

How Consumers Use Dishwashers: Recent Research

Many past studies (Enders, 1978; Garrett, 1978; Sanik, 1990; Whirlpool, 1993) have analyzed how consumers wash dishes and, in particular, how they use their dishwashers. The findings indicate that the actual water and energy usage for household dishwashing is to a large extent controlled by the consumer. Through such decisions as machine versus hand washing, the extent of pre-rinsing dishes, the selection of dishwasher cycles, and how fully and efficiently the dishwasher is loaded, consumers ultimately decide the water and energy use involved in the dishwashing process.

In 2000, the Center for Real Life Kitchen Design at Virginia Tech conducted a large study on kitchen design and use. One part of the study was consumer dishwasher usage. A personal interview of a sample of 78 adults living in an area surrounding the university community and a national random sample of 630 adults contacted by telephone were included in the study. Although *Appliance* (2001) indicates 59% of the U.S. households have dishwashers, this study found a saturation level of 64%. A majority of study participants (93%) operated their dishwasher only when full.

Pre-rinsing

One consumer decision that greatly affects water and energy usage during dishwashing is rinsing the dishes before washing them in the dishwasher. If dishes are pre-rinsed using a dishwasher pre-rinse cycle, approximately one gallon of water is used. Pre-rinsing in the sink under running water, however, uses up to 25 gallons of water for 5 minutes of pre-rinsing--a substantial difference.

In the study discussed here, 93% did some pre-rinsing of dishes in the sink, and 48% rinsed five or more times per week. Generally, the younger the respondent, the more likely they pre-rinse dishes. These results were comparable to a 1978 study where 73% of dishwasher users (Leipnitz, 1980) pre-rinsed dishes before placing them in the dishwasher.

Appliance manufacturers recommend only scraping (and not rinsing) dishes before placing them into the dishwasher, yet the pre-rinse practice continues. Independent testing labs like Consumers Union (*Consumers Reports*, 1993, 1995) generally obtain satisfactory results without the pre-rinsing. So why do consumers continue to include this practice in their daily dishwashing routine? When asked why, consumers in this study gave five major reasons:

- It depends on the food (20%);
- Out of habit (28%);
- From experience dishes do not get clean without rinsing (28%);
- Don't think they will become clean if not rinsed (35%); and
- Dishes will not be washed right away (39%).

The foods study participants perceived as most difficult to remove were baked-on food, eggs, starchy food, melted cheese, greasy foods, and chocolate. Such foods likely received fairly intensive pre-rinsing. In addition, consumers may be pre-rinsing dishes instead of scraping to remove leftover food.

Cycle Choice

Most dishwashers today provide a number of cycle choices so consumers can match a cycle to the type of load, increasing efficiency of both cleaning and resource use. Only 25% of the participants in this study used the water-efficient pre-rinse or rinse-only cycle on their dishwashers.

Cleaning Satisfaction

Another concern of consumers is the overall satisfaction with how well a dishwasher cleans. If satisfactory results are not received, rewashing is needed, and more water and energy are used. Experience with unsatisfactory washing results might encourage consumers to pre-rinse.

Most studies about dishwasher performance state that a majority of the dishwashers do an acceptable job of cleaning (*Consumer Reports*, 1993, 1995; Leipnitz, 1980; SDA, 2000). Approximately 60% of the respondents in the national survey stated they were very satisfied with the performance of their dishwasher, followed by 30% who were somewhat satisfied. However, these satisfied consumers are also consumers who frequently pre-rinse their dishes before placing them into the dishwasher.

Discussion

Pre-rinsing dishes in the sink before loading the dishwasher appears to be a common consumer practice. For half the participants in the study, this was an almost daily practice. With the estimated water use of up to 25 gallons per meal, this practice represents a substantial use of water and energy.

Reasons for the pre-rinse practice included habit, delayed wash, and anticipation of poor performance. Cleaning satisfaction is obviously an important factor in dishwasher use. However, it appears that consumers are failing to maximize use of dishwasher technology to improve performance while using water and energy resources most efficiently.

Selecting the proper dishwasher cycle to match soil on the dishes is important for both cleaning and resource use. The pre-rinse or rinse-only cycle, with or without detergent, improves cleaning for minimal water use. This cycle also prevents dried-on foods in the event of a delayed wash. In addition, choosing a heavy or "pot/pan" cycle may give more cleaning effectiveness and will use less water than pre-rinsing in the sink before loading the dishwasher.

Water temperature can affect dishwasher results. During the energy crisis of the 1970s and 1980s, consumers turned their water heater down. Unsatisfactory results may have occurred because the water was not hot enough for effective washing, and so the habit of pre-rinsing dishes began. Most dishwashers today have booster heaters to raise water temperature and increase cleaning efficiency. However, consumers may not be aware of this option.

Indeed, more research is needed. Information is limited on how important energy and water conserving dishwasher features are to consumers. It would also be of interest to know how consumers use other cycles and features that affect energy and water usage.

Implications for Extension Programming

Despite the improved energy and water efficiency of today's dishwashers, water and energy are wasted because of the poor dishwashing habits and practices of many consumers. Many consumers are still pre-rinsing their dishes in a sink before placing them into a dishwasher, despite manufacturers' instructions stating this is not needed. Such a practice uses many excess gallons of water and energy.

The challenge for Extension educators is to convince consumers that this practice of pre-rinsing is not necessary for good cleaning results. Further, consumers need to be encouraged to scrape off food leftovers from dishes, rather than pre-rinse, thus reducing water and energy use. Persuading consumers to discontinue pre-rinsing in a sink can only be accomplished if the consumer is assured their dishes will become clean.

What additional information needs to be conveyed to consumers so they can achieve satisfactory results without unnecessary pre-rinsing? Many factors impact the cleaning performance of dishwashers.

1. The dishwasher must be designed well. Many low-end models have minimal water delivery to the dishes, so a middle-to high-end machine will deliver superior results. Dishwashers with more features give the consumer a choice of cycles so that when they need extra cleaning power for heavily soiled dishes they can select the proper cycle for this.
2. Consumers need to be convinced to use the choice of cycles for effective cleaning, especially the pre-rinse or rinse only cycle.
3. Proper water temperature is critical for satisfactory cleaning results. The Soap and Detergent Association (2000) recommends a water temperature no lower than 130 degrees F, and other sources recommend temperatures of 140, 150 degrees F. To save energy as well as provide a safer water temperature for family use, many households have lowered their water heater temperature to 120 degrees F or lower. It is advised that consumers purchase dishwashers with an auxiliary or booster heater that increases the water temperature in the dishwasher to 140 to 160 degrees F. Such features may add to the cost of the dishwasher initially, but the energy savings from reducing the temperature on the home water heater will pay for the feature many times over.
4. Consumers need to follow manufacturers recommendations for effective use of dishwashers, including fresh detergent; loading dishes properly so that water can reach all of the dishes; filters, if present, kept clean; and use of a rinse agent.

Automatic dishwashers are labor saving and resource efficient. Through education, consumers can learn to use these appliances effectively, actually saving time and reducing the waste of water and energy.

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