Principles of clothes washing and washing machine design

To choose a method of washing clothes with minimum cost, environmental impact and effort requires an understanding of the underlying processes.

General principles of cleaning

Principles of dishwashing and dishwasher design § General principles of cleaning.

More of any of these will help to clean more effectively:

- Water (or other cleaning fluid) - The environmental impact depends on quantity and also how it is reused or disposed of.
- Detergent - Using less water achieves a greater concentration of detergent and thus less impact. The choice of detergent is also important.
- Heat - This can greatly increase cleaning effectiveness, but causes carbon emissions, unless using solar hot water, or water heated with renewable energy.
- Time - This is usually a matter of managing the process so that there is maximum time for dirt, grease etc. to dissolve, and has no environmental cost.
- Physical motion (scrubbing or agitation).

Using more of one component can help reduce the amount used of the others. Allowing time to soak and dissolve is one of the most important tools in effective and low-impact cleaning, as it reduces the impact of the other components.

Principles of washing machine and cycle design

Washing efficiency can be increased by:

- Leaving the clothes to soak for a long time period, both in the washing stage (to loosen and dissolve dirt and oils) and in the rinsing stage (to remove adsorbed detergents.
- Minimizing use of water in each stage, especially where detergent is used. Updating to a new energy star certified clothes washers , [1](Accessed: 3/31/2015).*</ref> uses 10 gallons less of water per full load and will also save money on the electric bill.*
- Washing full loads of laundry at a time instead of several small loads.
- Using the countercurrent principle for rinsing, and using multiple stages with minimal amounts of water rather than one big rinse; or having a spin-spray cycle (possibly less efficient). It is hard to fully implement the countercurrent approach without storage for the different stages of used water, which may or may not be efficient and practical, depending

on cost of storage, availability of water, nature of water disposal, and possible side-effects (e.g. breeding mosquitos if the storage isn't perfectly sealed and maintained).

- Rotating the clothes on a horizontal axis (as in a front-loading washing machine) is more efficient in water, detergent, and energy than on a vertical axis (conventional top loading washing machine). Less water is used as the clothes are picked up and repeatedly passed through the small amount of water, rather than having to be all covered in water.
- The downside is cost - why is this? (Needing the door to be more carefully sealed, made to higher standards?)
- How can a cheaper washing machine be made that rotates on the horizontal access? Note that "front loading" is not the factor that makes it efficient - this is just the most obvious way of doing it. It's hard to imagine how to find another way of loading, unless the tub can be raised somehow (which adds complexity and may or may not be cheaper than the front-loading design).

Pedal powered washing machines

Ease of use is obviously key. A pedal powered washer, if designed well, could potentially reduce effort and time needed compared to hand washing. If compared to an electrically powered washer it will be much more work, so if that is an alternative, there will need to be a strong motivation for the pedal powered washer to be used.

See:

- HSU Bike powered washing machine
- The Gymdrette
- Communal washing machine