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Grey Water in Agriculture and the Potential Increase Risk of Pathogen Transport

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Introduction

The purpose of this poster is to investigate grey water in agriculture, as seen in Figure 1, and the potential risk it has on pathogen transport. “Grey water is defined as water collected from sewage discharge of clothes washers, bathtubs, showers and sinks, excluding wastewater from toilets [1].” Reusing grey water in irrigation is cost effective and eco-friendly. However, there are possible risks associated with using grey water. These risks include viruses and bacteria such as Salmonella, Norovirus, Enterovirus, E. coli, Giardia, Pseudomonas aeruginosa, Staphylococcus aureus, Clostridia and Rotavirus. [2].

Figure 1 : Filtration of greywater used in everyday agriculture [5]

Process Description

Greywater goes from the source through processing, possible filtration, and is then either used or disposed of, as seen in Figure 2.

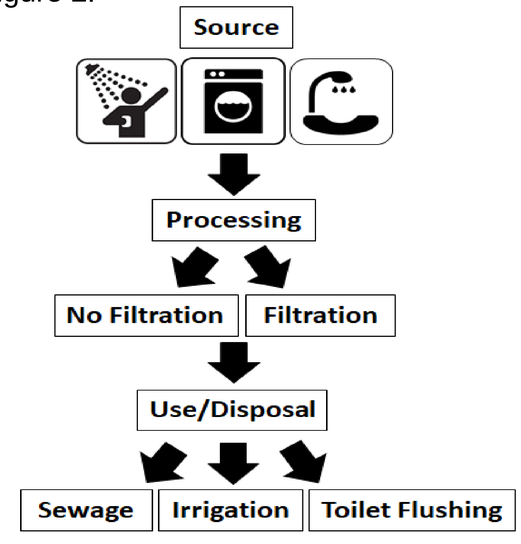

Figure 2: Diagram of Greywater Processes [1]

Potential Impact Eco. Services

The reuse of greywater in irrigation without filtration causes harmful effects on food, water, and soil services.

Greywater contaminated with pathogens, as shown in Figure 3, is used to irrigate crops, which are then consumed by humans. This not only causes negative environmental effects to the crops, but in return causes human health risks.

Figure 3: Artistic representation of pathogens in water [3]

In a microbial risk assessment of greywater for agricultural use, it was found that the level of pathogens and bacteria from bathroom and laundry sources was within acceptable boundaries, while kitchen sources were too high [2]. This causes negative environmental effects to water sources and to those who rely on those sources.

Levels of contamination may also be affected by the types of detergents, soaps, or other materials that interact with the greywater within the home [7].

There is an increased risk of antibiotic-resistant bacteria with the use of greywater for irrigation. If the soil becomes contaminated with this bacteria and spreads it without treatment, it can propagate the antibiotic resistant bacteria [6]. This causes both human health risks and environmental effects to the soil.

Sensitive Unit

One of the key sensitive units in greywater reuse is the presence or absence of a filter. How important this depends on the levels of pathogens and bacteria in the original greywater sample.

In one study that assessed how well plants grew using both filtered and not filtered greywater, there was not a very significant difference between rates of growth for the plants or health of the plants for human consumption. Filtration can help to prevent buildup of metals or other contaminants in the soil [8].

Different filtration systems can be considered to treat the greywater. Gravel filters, pump operated filters, and commonly used industrial filtration systems are all viable options, as seen in Figure 4. Additionally, natural materials such as *Moringa oleifera*, or sawdust, have been shown to reduce the presence of targeted pollutants in the greywater [7].

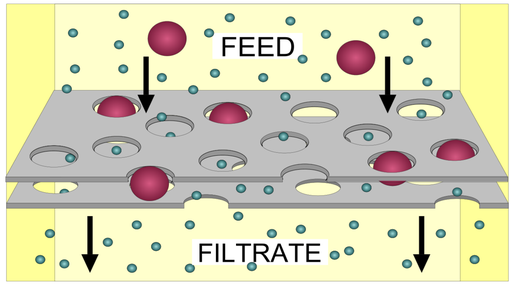

Figure 4: Representation of a filtration method [4]

While considering filtration, it is also important to consider other forms of treatment for the greywater. While antibiotic-resistant bacteria may not be removed by all filtration methods, disinfecting greywater by chlorination can decrease the presence of pathogens as well as help prevent the spread of antibiotic-resistant material [6].

Research

One way in which this topic could be researched further is to conduct more in-depth tests of various filters and filtration systems in order to find more efficient ways to clean grey water than what is currently used. This would increase the cleanliness of the water and decrease the time and money spent in filtering it.

Hypothesis: Heavier and more complex filtration systems will clean grey water more efficiently compared to less complex systems.

Protocol

- Use multiple different filtration systems to filter the water.
- Collect unfiltered water from all methods.

Analysis:

- Samples are tested for possible pathogen levels using microbial risk assessment.
- Compare results between the different filtration systems.

References

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