

# Optimization of a Decentralized Dry-Toilet

## A project in cooperation with AKYAS sanitation

### Graduate



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**Initial Situation:** Over 1.7 billion people do not have access to basic sanitation services, such as private toilets or latrines. These challenges often occur in rural or informal urban living areas, where high tech toilet solutions are unsuitable due to a lack of water and sewerage systems and low financial means. Together with AKYAS Sanitation this study aims to tackle such challenges with an affordable, low tech, onsite treatment toilet facility that is resistant to environmental disruptions such as flooding and droughts and does not require high maintenance. AKYAS has developed a toilet system that includes a liquid diverting toilet pan, for a seated and squatted use, and a specific powder-mix to accelerate the drying process of the fecal matter stored inside a breathable bag and promote disinfection. The fecal matter is further processed in a greenhouse to produce a substrate fertilizer for industrial use.

**Approach:** This thesis is addressing the optimization of the desiccation and disinfection process both in the toilet and the greenhouse. It is comparing the different components of the powder-mix, the best composition and concentration to quickly dry the sludge and reach microbial inhibition to produce a safe fertilizer. To evaluate the different desiccants, an experimental series with artificial faeces was conducted comparing different powder concentrations and mixtures. The effect of the powder on microbial activity in faeces was determined by experiments with *E. coli* as an indicator organism. Further, the evaporation through the permeable bag was studied in a four week experiment inside a climate chamber.

**Result:** Both the desiccation as well as the microbiological experiments highlight the importance of certain components in the powder mix to enable a safe and easy use of the substrate. The solubility in water definitely has a strong impact on the drying process. For a reduction of the microbial activity in faeces it should be focused prior on effects in pH and temperature than the toxicity of the powder. The results lead to a possible adaption of the powder composition combined with an economical benefit. As a follow-up, such mixtures should be tested as well as the factors triggering the drying in the bag consisting of renewable material.

### Examiner

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### Subject Area

General environmental  
technology, Water  
treatment

### Project Partner

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### Installation of an AKYAS toilet facility

Photo: Toilet board coalition, July 2021



### Desiccation experiments

Own presentation



### Experiments with *E. coli*

Own presentation

