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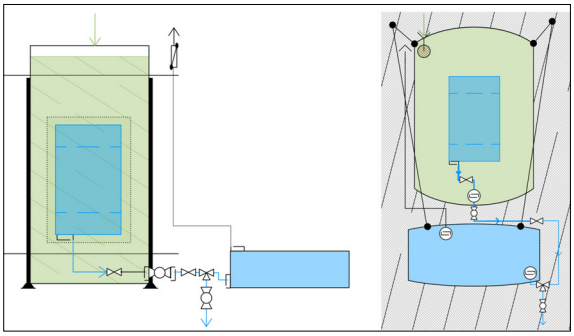
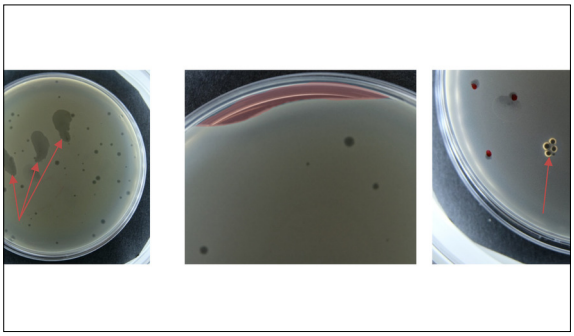
Subject Area	Wasseraufbereitung

Decentralised drinking water treatment and solar-assisted groundwater for households

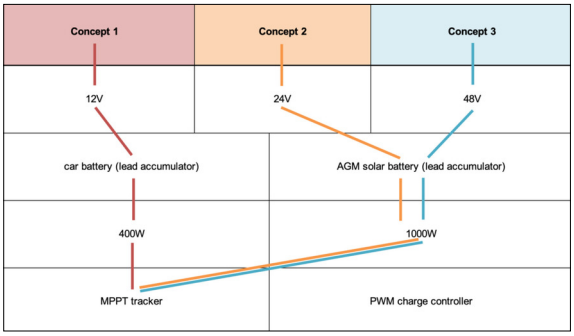
Solutions for sustainable supply of drinking water in Liberia



Scheme for a GDM system in housholds
Own presentment



Factors in counting (left to right): "lakes" of condensed water, inhomogeneous distribution of agar, agglomerates
Own presentment



Morphological box to evaluate the concept for the solar generator: voltage, battery, power of the generator, charger
Own presentment

Definition of Task: Gravity-driven membrane filtration (GDM) delivers safe and disinfected drinking water. A GDM system to be developed for households in Liberia is a promising tool which is orientated at a previously installed GDM plant in Monrovia, Liberia. The concept is addressing households, meaning the sizes of the system need to be down-scaled. The system should be a "Do-it-Yourself" kit easily be shipped and assembled by anyone.
The flow of the developed GDM has been tested (flux and permeability) as well as the retention of microorganisms. The membrane used has an area of about 1.75m^2 and a pore size of 0.04 micrometres. As a reference, a commercial product using ultrafiltration membranes was tested (KENT).
Additionally, solar energy can supply electricity for a borehole pump linked to a GDM plant and substituting a gasoline generator. With solar energy, the GDM plant in Monrovia can be operated fully independent.

Result: Two GDM designs with foldable tanks were developed (hanging tanks vs. stand-alone tanks). During the robustness testing, the stand-alone performed significantly better. The removal tests with E. Coli bacteria were successful. The permeate fulfilled the Swiss limit value for drinking water of 0 cfu/100 ml. Viruses, namely MS2 phages (ca. 30 nm size), were not fully removed either with the developed GDM systems nor the KENT product. The finalized plant has a raw water tank volume of 50 litres. A permeate tank of 40 litres can be connected. The plant has a flux of about 27 l/m^2*h. Due to the non-static test conditions the permeability was not constant. It should be noted that an unused membrane was tested. For this reason the reproducibility is only conditionally given.
To provide solar energy for the GDM plant, a technical concept was created for PV, battery, and pump. The concept based on calculations that were made according to specific situation and a list of components that are required. The system includes a sophisticated data collection system to analyse the energy consumption. The energy storage systems are designed in such a way that the system can be operated to a large extent without a petrol generator. The 24V system reduces the electrical currents and allows the purchase of cheaper components.

Conclusion: The designed GDM systems have the great advantage that they can be stowed very compactly for transport. The materials (e.g. PE) used were checked for their food safety. The flux and permeability of the self-constructed system were in line with previous UF-test results. The flux in KENT was smaller than expected to hydrostatic pressure in GDM ultrafiltration. The retention of microorganisms was the same for both KENT and the new GDM system. The developed system can easily cover the defined drinking water demand for a household (30 litres per day). If the system is refilled several times a day, water for several households can be filtered. The solar assisted pump fulfills its function. The concept is addressing a modular structure. If the system is successful, the generator can be expanded easily.