An innovative greywater treatment system for urban areas – International transferability of a German approach, installed in GIZ's headquarters in Eschborn

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Introduction

The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH installed a greywater treatment system within the research project SANIRESCH in its headquarters located in Eschborn, Germany (Winker & Saadoun, 2011). Greywater is domestic wastewater excluding toilet water, therefore easily recyclable. The system is based on the technology of membrane bioreactor (MBR), a method which provides a very good cleaning capacity and effective removal of contaminants (Mallevialle et al., 1996), developed by company HUBER SE. After MBR treatment, the purified water fulfils the regulations of the EU directive 2006/7/EG for bathing water quality. The water is then called process water. It can be used optimally for irrigation, toilet flushing or laundry. A flow chart of the greywater treatment plant is presented in Figure 1. Within this work the international transferability of this technology was investigated.

Aims of research

- Investigation of membrane bioreactor technology.
- Identification of limitation of the research project.
- Evaluation of economic feasibility of the technology.
- Assessment of the international transferability of MBR technology by utility analysis.

Methods

- Literature study of greywater characteristics and legal foundations.
- Comparison of treatment technologies.
- Investigation of existing MBR projects.
- Assessment of international transferability of MBR technology by utility analysis based on the fundamentals of sustainable sanitation (Hellström et al., 2000).

Plant technology

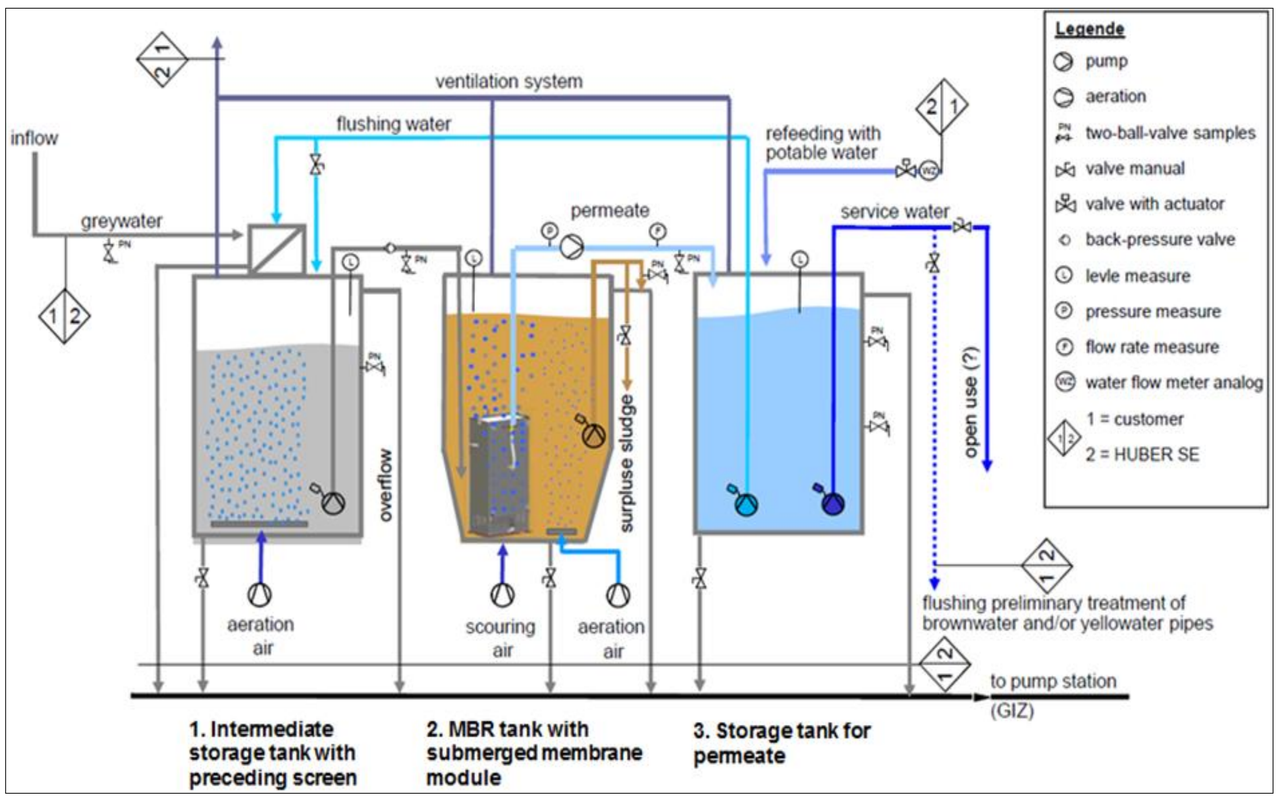

Figure 1: Flow chart of greywater treatment plant (HUBER SE, 2011)

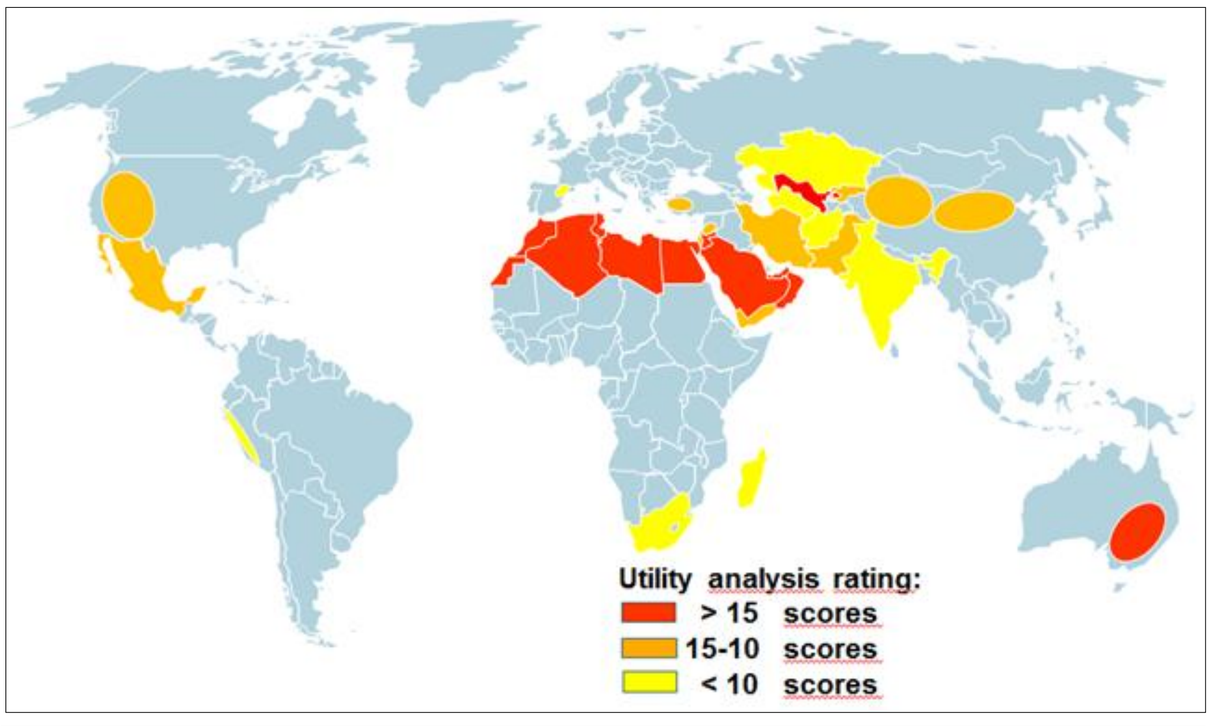

Figure 2: Presentation of countries identified by utility analysis, ideal for greywater treatment via MBR technology; (by K. Löw)

Results

- MBR technology for greywater treatment provides an excellent cleaning performance with minimal space requirement, but relatively high energy demand.
- For office buildings, an economic benefit is rarely achieved, caused by an unfavourable water balance. While residential buildings show beneficial water balance and reimbursement is attainable.
- Concerning worldwide transferability, 32 countries were assessed according environmental aspects based on water scarcity as an indicator criterion. In reference to the four rating criteria: water shortage, water quality, population density and high urbanisation rate; an estimation was conducted.
- Jordan was identified as a predestined country for the implementation of greywater recycling via membrane bioreactor plant technology, due to a correlation of all assessed criteria with a maximum rating of 21 scores. Further ideal applications for international greywater recycling projects are in the Middle East and North Africa (MENA) region, especially Oman, Egypt, Libya, Saudi Arabia, Morocco, Tunisia, United Arab Emirates, Western Sahara Territory and Algeria sorted into descending order can be pointed out. These countries are all characterised by water shortage and high urbanisation rate in combination with high population density, which makes MBR technology reasonable. In Figure 2 the identified countries are presented, displayed in colours according to their rating within the utility analysis.

Conclusions

In general, the identified regions represent appropriate conditions based on environmental criteria to implement greywater treatment via MBR technology; further aspects like installation of such a system in large buildings with high water consumption contribute to making a MBR project even more suitable. The same applies for economic, legal and socio-cultural conditions, if the circumstances meet the sustainable criteria according to the utility analysis, the project becomes more viable. Hence, a consideration of all aspects is always necessary to identify the practicability of membrane bioreactor technology in a certain application. Worldwide, there are a variety of application ranges where a viable reuse application is possible, but it needs to be well-planned, by taking all background information into account including economic and sustainable aspects, shown in Figure 3.

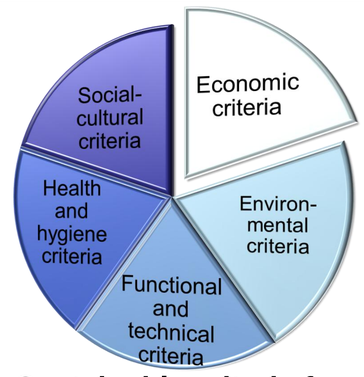

Figure 3: Sustainable criteria for sanitary concepts; (Hellström et al., 2000)

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