IWRM-Indonesia Fact Sheet

Appropriate Water Treatment Concept for Water Quality Assurance: A Field Laboratory for Semi-Central Hygienization Processes

General Data

Plant type:	Container based semi-central water hygienization as field laboratory
Location:	Wonosari Public Hospital (RSUD Wonosari), Gunung Kidul Regency, Province of Yogyakarta Special Region, Indonesia (110.603086° E / -7.962156° S)
Operated since:	August 2013
Commissioning:	April 2014
Operator:	RSUD Wonosari

Technical Data

Technology:	Four water hygienization methods • Sand filtration (1,100 L/h) • UV disinfection (400 J/m^2) • Chlorination (calcium hypochlorite) • Filtration with ceramic membranes (200 nm, 50 nm)
Manufacturer:	Veolia Berkefeld, ZIMMERMANN GmbH Öhringen in accordance with CIP Chemisches Institut Pforzheim GmbH

1 Objective

In the frame of the IWRM-Indonesia project, water quantity was successfully enhanced using an innovative approach in terms of an underground hydropower driven water supply to deliver water from the 100 m deep karst aquifer without use of external energy. Thus, it was possible to secure the water supply for some 75.000 people. After the foremost problem was solved and water

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quantity had been enhanced, further questions had to be addressed such as water distribution, waste water treatment and water quality assurance.

Karst aquifers are known to be especially vulnerable to pollutions due to fast and direct infiltration. In Gunung Kidul, sinkholes allow a direct entering of cow dung and solid waste into the underground river system. Furthermore, waste water treatment in the project region is either insufficient or nonexistent. Waste water is also partly discharged directly into the ground or collected in unsealed septic tanks. Considering the low retention capacity for pollutants of the karst setting, this leads to a high contamination of the karst aquifer particularly with fecal bacteria. Moreover, water quality assessment showed that the contamination increased within the water distribution network. Currently, people boil the water, which is barely sustainable. Apart from high consumption of fuel, in-house boiling on traditional fires may promote respiratory diseases. Moreover, boiling is often not done properly. Thus, a more sustainable treatment was needed.

Based on all above investigations and results, a kind of multi-barrier water treatment concept was developed, consisting of a central protecting treatment step prior to the distribution system, a semi-central hygienization where high water volumes need to be treated and a final treatment step at household level. This water treatment concept was implemented exemplarily in form of pilot plants. In the context of semi-cental hygienization, four selected technologies were installed in an oversea container which functions as a field laboratory to test the treatment options under local conditions.

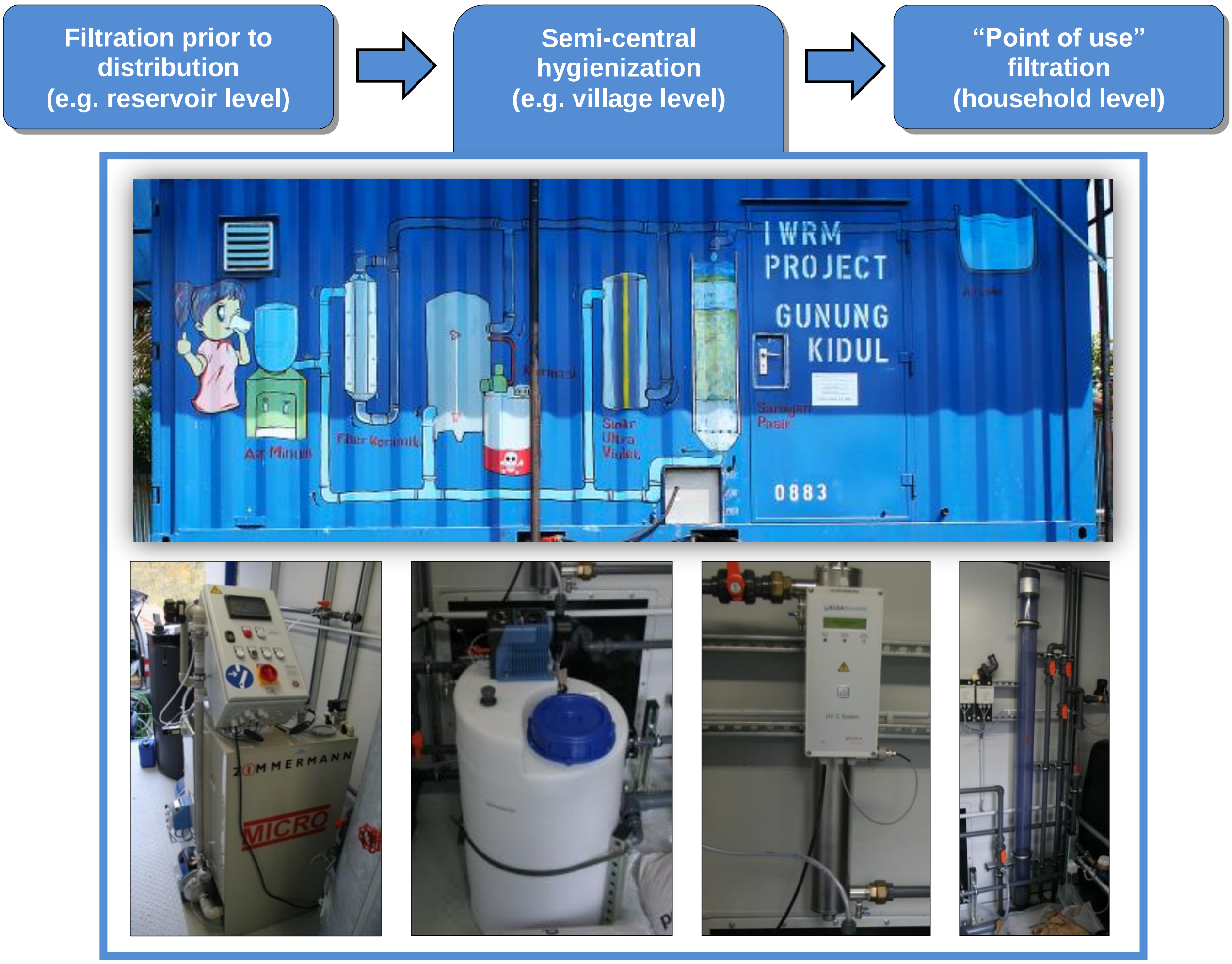

Fig.1. Possible semi-central hygienization technologies as part of three-phase water treatment concept

2 Implementation and Results

To find the most appropriate technology for a semi-central water treatment step, four selected technologies were tested under local conditions. Sand filtration was chosen as a pretreatment to remove turbidity and adhering bacteria. Chlorination and UV disinfection were tested as two standard technologies that are widely spread in industrialized countries. For chlorination the Indonesian calcium hypochlorite “Kaporit” (tjiwi kimia, Indonesia) was used as it is best available in the project region. These technologies were installed in a shipping container by Berkefeld (ELGA Berkefeld, Veolia Water Solutions and Technologies, Celle, Germany). Finally, an ultra-filtration system (ZIMMERMANN GmbH, Oehringen, Germany) was installed using 50 nm and 200 nm ceramic membranes (atech innovations gmbh, Gladbeck, Germany) which belong to the less expensive ultra-filtration technologies and are relatively stable and comparatively easy to handle.

The four technologies were chosen based on local circumstances, such as availability of basic material, adaptation to the poor infrastructure and power supply, to the lack of adequately trained people and to the lack of means for costly water treatment systems.

The results showed that ceramic filtration consistently removed coliform bacteria and turbidity. UV disinfection seemed to be quite vulnerable in the local climate and to fluctuations in electrical power supply. Chlorination proved to be more complex than expected, as the settings under local conditions needed to be adjusted continuously because of fluctuations in raw water quality and the quality of the chlorine solution. Results of the experiments under local conditions suggest that a combination of sand filtration as a pre-treatment and ultra-filtration with ceramic membranes might be the best solution for the water hygienization step.

Furthermore, various capacity development measures were carried out during the development and implementation of the field laboratory. The aims of the measures were to increase public awareness regarding hygiene and safe water and to develop the human resources capacity regarding operation and maintenance of the technologies in the field laboratory and water treatment in general.

Fig. 2 (a) Water quality assessment

(b) Capacity development measures

(c) Commissioning of the plant

3 Project Partners

Karlsruhe Institute of Technology	Chemisches Institut Pforzheim GmbH	Ministry of Public Works and Public Housing	Province of Yogyakarta Special Region	National Nuclear Energy Agency	Local Government of Gunung Kidul Regency	Wonosari Public Hospital

4 Contact

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