In rural areas, household wastewater is produced by various activities but this water is dumped either in the courtyard or outside. The quantities produced during a day can be important if collected together. Our study aimed to propose a system for collecting all types of greywater generated from various activities for its treatment for reuse in market gardening.

Design and set-up of the complex shower room-greywater treatment system

The greywater management facility is composed of three main components: a shower room, a receiving basin and a greywater treatment system developed using locally available materials (plastic tanks, local plants, concrete and, granitic gravel and sand as filter media). The design of the shower room was based on the system reported previously by Maiga et al. [36] with slight modifications to allow for the collection of shower greywater that then flows to the treatment system by gravity. Issues related to laundry and dishwashing greywater collection are solved by integrating a receiving basin (internal L × W × H: 0.7 m × 0.5 m × 0.3 m) for laundry and dishwashing greywater, embedded to the shower room and located inside the courtyard. After laundry and dishwashing activities, the collected greywater is discharged into this basin, from where it can flow to the treatment system located outside the courtyard, through the same pipe as the shower greywater. The system was operated in batch mode and receives greywater as soon as it is produced by a user within the household.

The treatment system is a subsurface horizontal flow wetland with an upstream pre-treatment step. Each filter media was washed with tap water and dried before packing it into the filter. Pre-treatment consists of two superimposed compartments. The first level is a plastic tank (internal L × W × H: 1.00 m × 0.60 m × 0.35 m) containing 0.15 m of crushed granite of 2-6 mm grain size.

The second level is a basin made of concrete (internal L × W × H: 2.00 m × 0.40 m × 0.30 m) and filled with the same granitic gravel at a height of 0.15 m.

A previous study conducted in two rural settlements in Burkina Faso estimated the per capita greywater productions of *Q1* (8 l/day) and *Q2* (13 l/day) respectively [1]. The household was composed of 8 persons from which 2 were under 5 years old. Their greywater production was considered negligible. We therefore estimated the greywater production of 6 persons.

For a horizontal filter design, an area of 2 m² per 100 liter a day is needed [37]. The needed area *A* is calculated by multiplication of *Q* to the number of persons, *P* and the factor for the type of filter, *F* and subsequent division by 100:

$$A = \frac{Q \times P \times F}{100}$$

Based on these assumptions, the resultant surface area appeared to be between *A1* (0.96 m²) and *A2* (1.56 m²): $A1 = \frac{8 \times 6 \times 2}{100} = 0.96$ and $A2 = \frac{13 \times 6 \times 2}{100} = 1.56$

Length-to-width ratios for secondary horizontal flow wetlands generally fall between 2:1 and 4:1 [4]. We chose to work with a ratio of 4:1. As the length of the filter should be 4 times the width, using this assumption and the values of *A*, the dimensions should be: $W = \sqrt{\frac{A}{4}}$ and $L = 4W$.

W is between *W1* (0.49 m) and *W2* (0.62 m) with $W1 = \sqrt{\frac{0.96}{4}} = 0.49$ m and $W2 = \sqrt{\frac{1.56}{4}} = 0.62$ m

and *L* between 1.96 and 2.48 m

Dotro et al. [38]) explained the necessity to use practical dimensions for easy application on the field: "*Engineering designs must take into consideration the constructability of the system. Small treatment wetland* *systems, especially those built for individual homes, are often constructed by homeowners themselves or small contractors. Choosing wetland dimensions that are easy to measure and implement in the field is an important aspect of the design process*."

Therefore, we chose a width of 0.5 m and a Length of 2 m.

The planted section is semi-underground and made of concrete with internal dimension of L × W × H: 2.00 m × 0.50 m × 0.75 m. It is filled with sand at a height of 0.45 m and planted with *Chrysopogon zizanioides* (5 plants/m^2). This plant (a perennial grass of the *Poaceae)* was selected based on its vigorous and deep root system that makes it ideal for use in planted filters, in soil remediation and erosion control [17]. This planted basin is crossed by a wall of 0.2 m allowing two compartments in series (internal L × W × H: 1.00 m × 0.50 m × 0.75 m and 0.80 m × 0.50 m × 0.75 m) communicating through an orifice in order to increase the residence time of the greywater for more pathogen removal.

Finally, the treated greywater is collected in an underground storage reservoir of 200-L capacity.

After the end of the construction in the household, the system was immediately operated. A period of acclimatation was considered and the data of the four first weeks were not considered in the evaluation of the performance of the system. The data collected and used are mainly from the rainy season (June-July). The frequency of rain during the period considered is weak and due to the low section of the filters, the contribution of the rain is considered negligible.