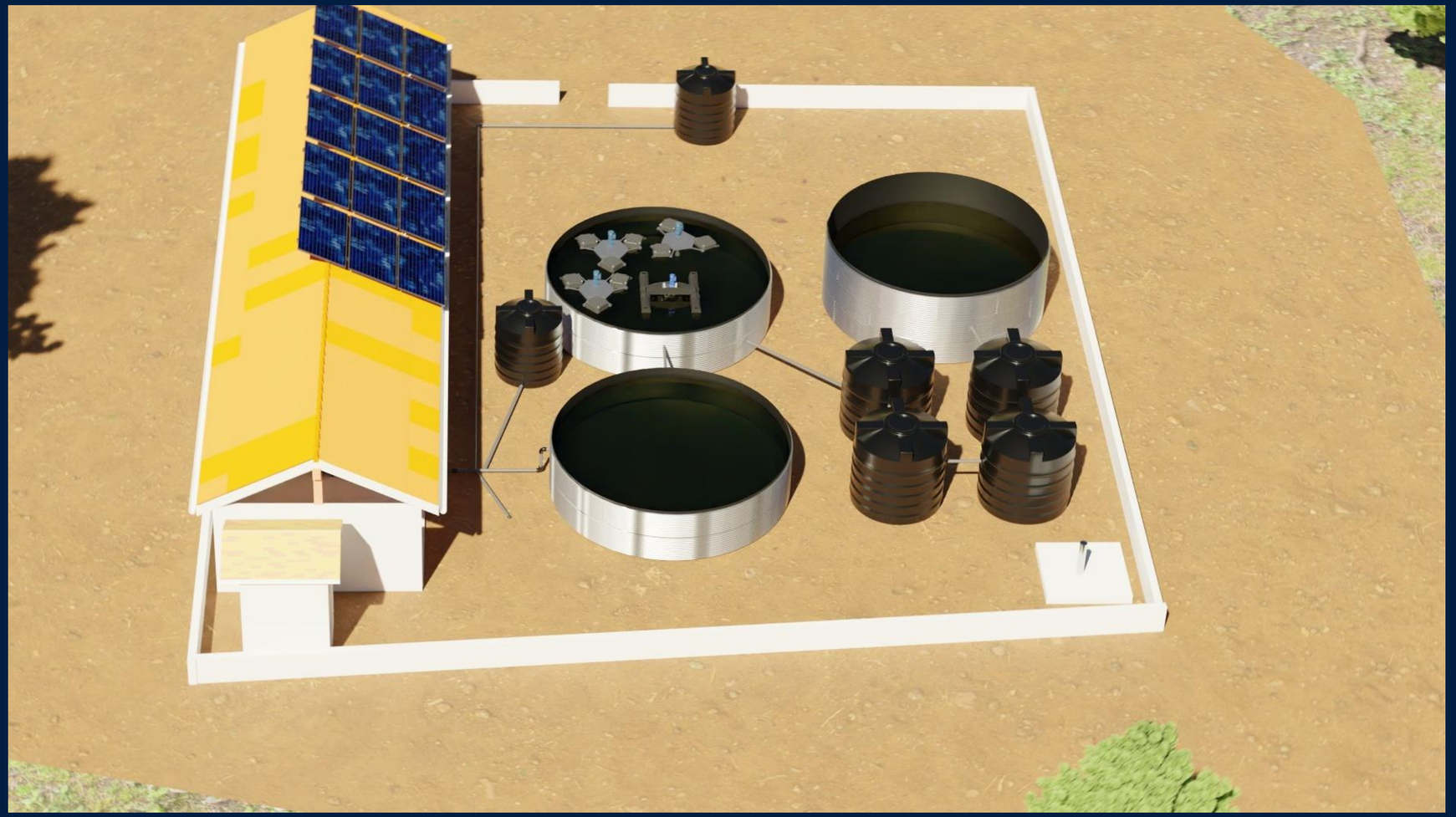
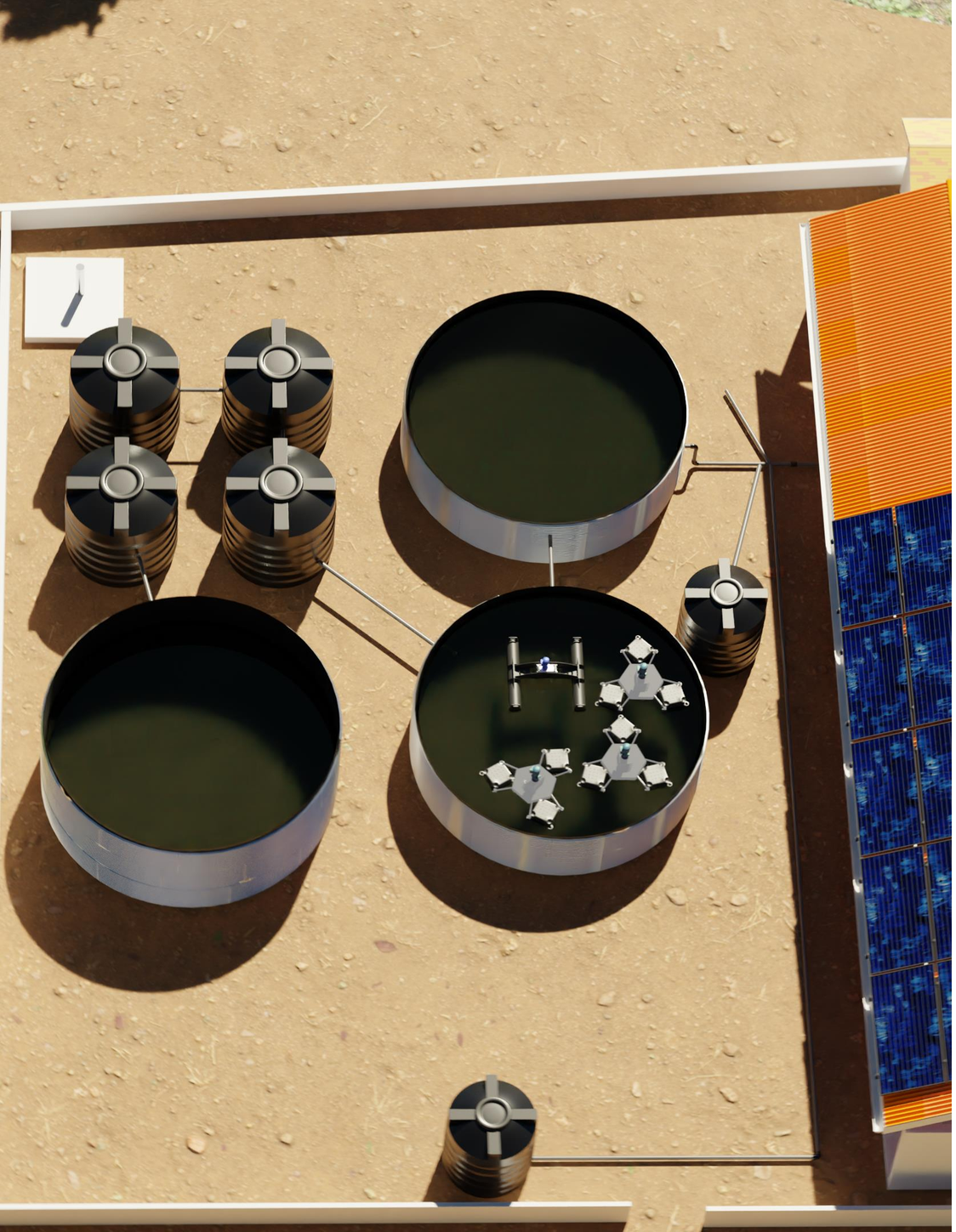


AFWTU type FSTP – Camp 19

20 September 2023



Agenda

- **Background**
  - *History and background of the AFWTU system*
  - *Treatment steps*
  - *Advantages*
  - *Disadvantages*
- **Treatment type**
  - *Activated sludge treatment*
  - *Basic flow chart*
  - *System components*
- **Treatment objective and design assumptions**
  - *Objectives*
  - *Design*
- **Technical specifications System Bravo Camp 19**
  - *Technical data*
  - *Area calculation*
- **Modularity**
  - *Modules*
  - *Functions*
  - *Scalability*
- **Applications elsewhere**
  - *Floodings in Germany*
  - *Results*
- **Contact data**

Background

First implementation

The AFWTU type fecal sludge treatment plant was designed by a German engineering company and first implemented during the Rohingya Refugee Crisis in 2018 in Cox's Bazaar Bangladesh as a pilot plant (Alpha System).

The treatment type is the activated sludge treatment.

The complete system contains

- Pretreatment: Screen, primary clarifier, ABR
- Main treatment: Aeration step, parasite filter
- Post treatment: Disinfection (UV and/or chlorination)
- Excess sludge treatment: Anaerobic excess sludge tretment

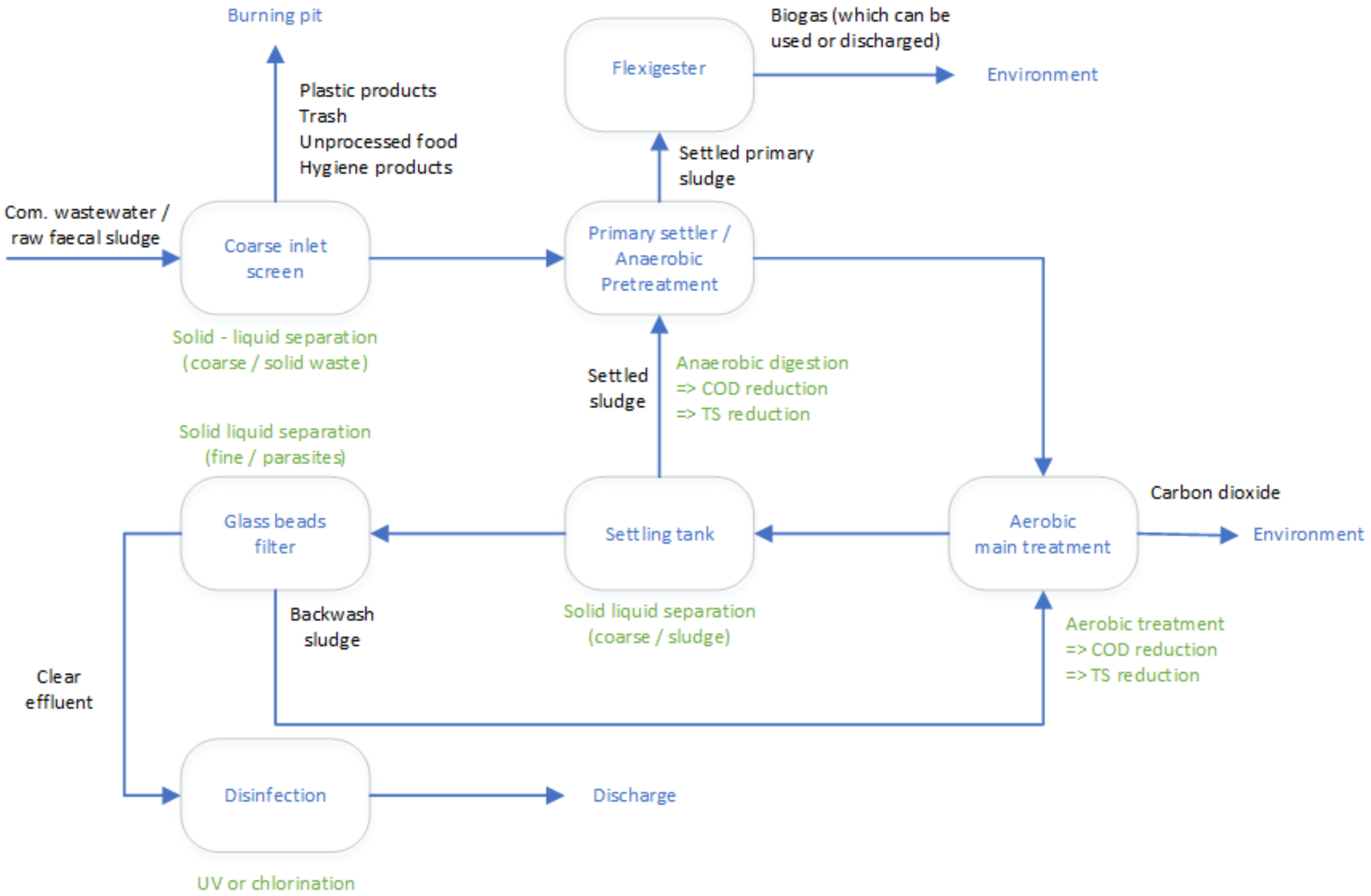
Advantages

- Extremely low footprint
- Outstanding effluent values
- No chemicals needed for operation
- Short setup time

Disadvantages

- Skilled labour for operation required
- Setup to be carried out under an engineer's supervision
- High energy requirement (solar power possible)

Treatment type: Activated sludge



Activated sludge treatment

This system combines several treatment methods, while the „activated sludge treatment“ is the main and most important treatment step.

Coarse inlet screen:	removal of large objects
Primary settler:	settling and removal of heavy sludge
ABR:	anaerobic digestion
Aerobic treatment:	aerobic combustion
Settling tank:	solid liquid separation
Parasite filter:	removal of parasites
Chlorination:	elimination of pathogens
Flexigester:	anaerobic digestion of heavy sludge

Black:	Solid, liquid or gaseous matter that is being transported or processed
Blue:	Locations of process or final destinations (reactor, environment)
Green:	Explanations and options

Treatment objective, design assumptions

Treatment objective

The main treatment objective is to prevent downstream contaminations and disease outbreak, typical for large settlements with poor human waste management in emergency contexts.

The secondary goal is to minimize environmental pollution.

Therefore the main goals is a constant and safe COD (chemical oxygen demand) reduction by at least 85 – 90% as well as a reduction of pathogens and parasites by 99,99%.

Design assumptions

The assumed incoming volume of wastewater per day and person is 2,5 L which differs from the commonly used assumed volume of 500 ml per person per day.

Max. number people served:	12.000
Max. inflow per day:	30.000 L
Number of filters:	3
Max. filtration capacity (total):	9.000 L/h
Reaction time (chlorination):	1h
Incoming wastewater:	- extremely high COD (over 10.000 ppm) - high concentration of microorganisms - high count of parasites - content of large solid objects (plastic bags, female hygiene products etc.)

Technical specifications

Treatment capacity

Max. influx:	30.000 L/d
Max. number people served:	12.000
HRT Primary settler:	60 h
HRT ABR:	32 h
HRT Aeration:	36 h
Max. dissolved Oxygen:	360 kg/d
Required power (min.):	1,75 kW
Required power (const.):	4,75 kW
Required power (peak):	7 kW

Power breaks up to 6 hours allowed
HRT = Hydraulic Retention Time
Minimum operation: 1 x Oloid 400 (homogenization)
1 x HydrO2 (minimum oxygen for bacteria)

Area calculation

In order to give a realistic approach, all components including the circular shaped objects were calculated as squares plus 0,5 meter periphery for each component, rounded up when summed. The spaces in between are used for piping and freedom of movement.

Butyl T70 tanks (3x):	60 square meters (each)
Total area Butyl tanks:	180 square meters
ABR tanks (4x):	9 square meters
Total area ABR:	40 square meters
Flexigester:	40 square meters
Filters and generators:	50 square meters
Office and warehouse:	80 square meters
Total:	370 square meters (treatment only)

Modularity

Modular approach

Due to the general modular approach, the AFWTU is flexible in setup and upscaling.

Primary settler:	The primary settler can be enlarged or even doubled and the capacity increased. Several sizes of tanks are available.
ABR:	The ABR can be extended in a modular way in order to increase to a higher capacity.
Aeration tanks:	The standard setup is one Oloid 400 and three HydrO2 inside a T45 / T75 / T95 – tank. Different tank sizes result in different HRTs. This setup can be varied in volume and easily multiplied.
Secondary settler:	Different tank sizes are available. Treatment lines can be multiplied.
Parasite filter:	Industrial pressure filter housings are worldwide availale in a variety of shapes and sizes.

Applications elsewhere

July 2021 – Flooding in Germany

During the devastating floodings in Western Germany in July 2021 several infrastructural wastewater treatment plants along the Ahr River Valley have been completely destroyed. Untreated raw wastewater was running into the Ahr River.

At that time the German Red Cross installed 3 systems.

The first system has been erected in 11 days, processes 160 cubic meters a day for 800 people which meets German discharge standards at Mayschoss village.

The second system was set up in December 2021 at Hönningen village which processes 250 cubic meters per day.

Third deployment, finished May 2022, processes 200 cubic meters a day at Altenahr.

Each system serves between 1.000 and 1.250 people (including laundry, greywater, kitchen water, toilet flush) plus rainwater plus local industry.

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