

Reinvent The Toilet Challenge

data and design: mineralization of sanitation wastes from community ablution blocks -

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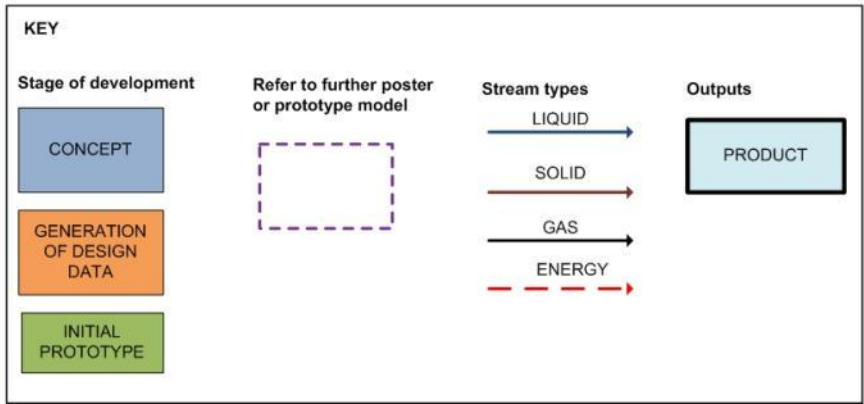
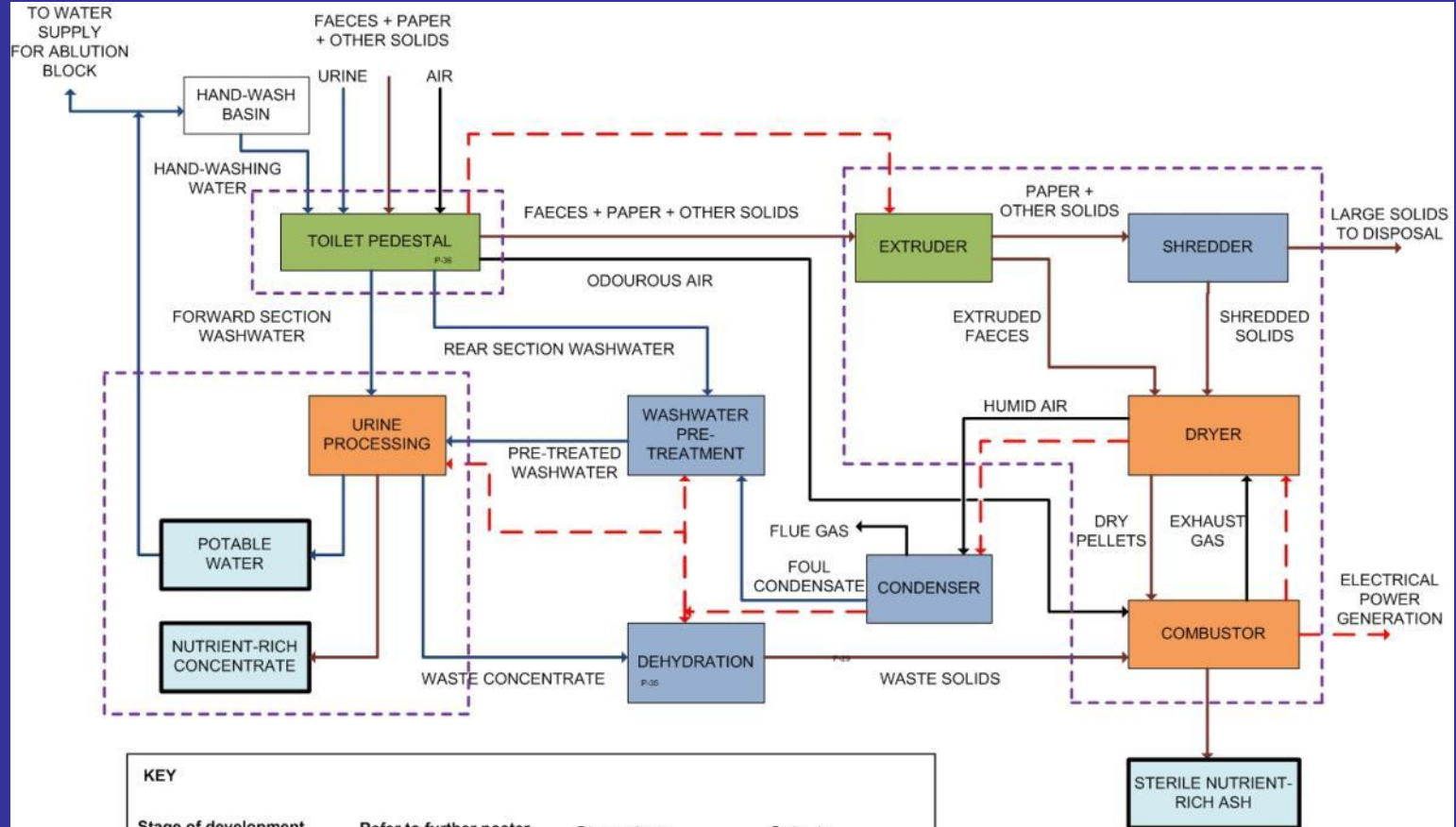
Key points from the Proposal

- process engineering approach
- grounded in a developing country context
- data centric
 - from real situations
- partner with
 - local municipality
 - pedestal manufacturer
 - toilet manufacturer

Deliverables

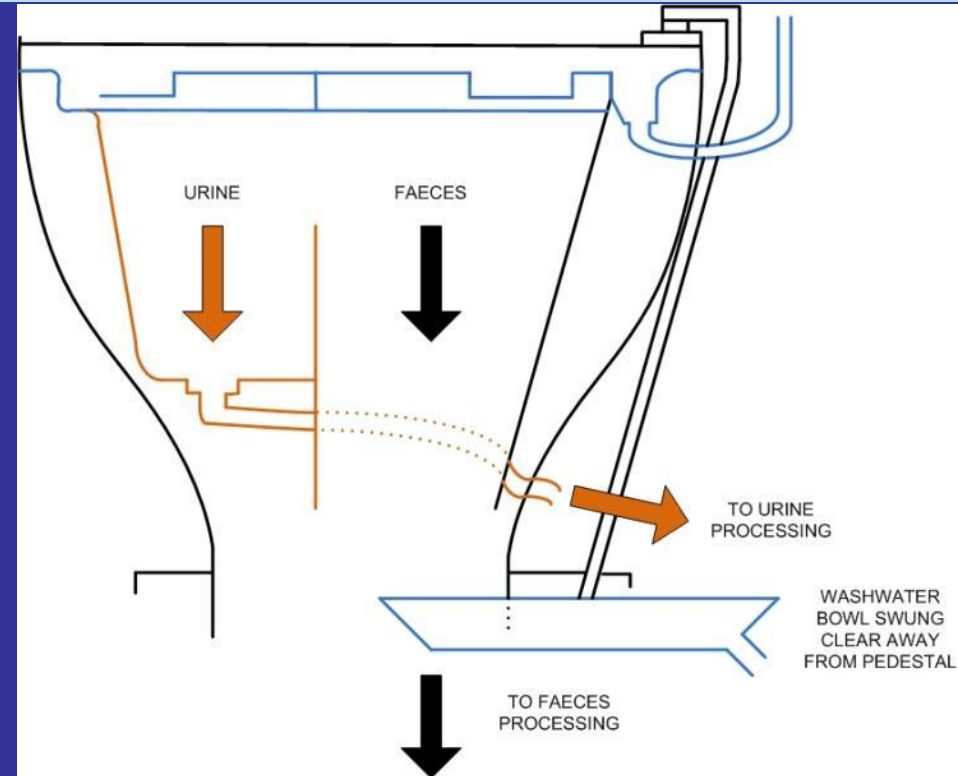
- flowsheet generation
- pedestal design
- experimental and literature data collection
- urine separation operation, lab proof-of-concept
- sludge extrusion, drying and combustion , lab proof-of-concept
- final PFD and process integration
- ergonomic and mechanical design of *Troilet*

Overview



Pedestal

- source separation
 - urine
 - faeces
 - wash water



The Reality

- cross contamination
 - faeces in urine
 - urine in faeces



which is which?



The Reality

- non faecal material



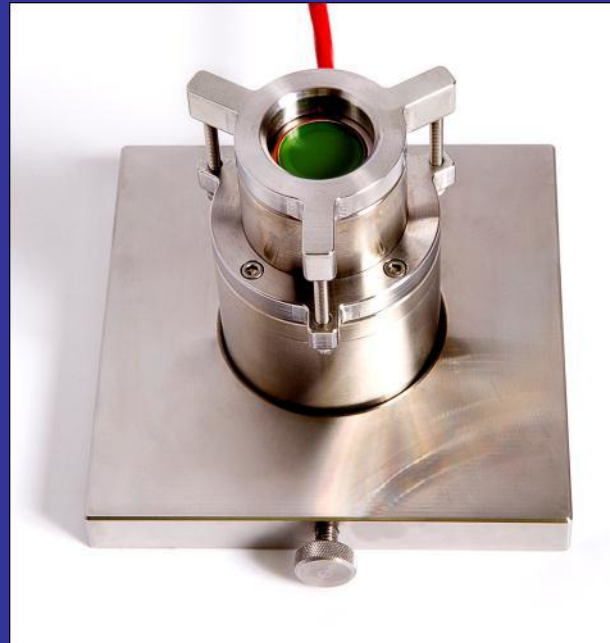
The Reality

- cross contamination
 - faeces in urine
 - urine in faeces
- non faecal material
- prevalence diarrhoea
- enemas and purging
- aging samples
 - changes due to biodegradation
 - urea to ammonium

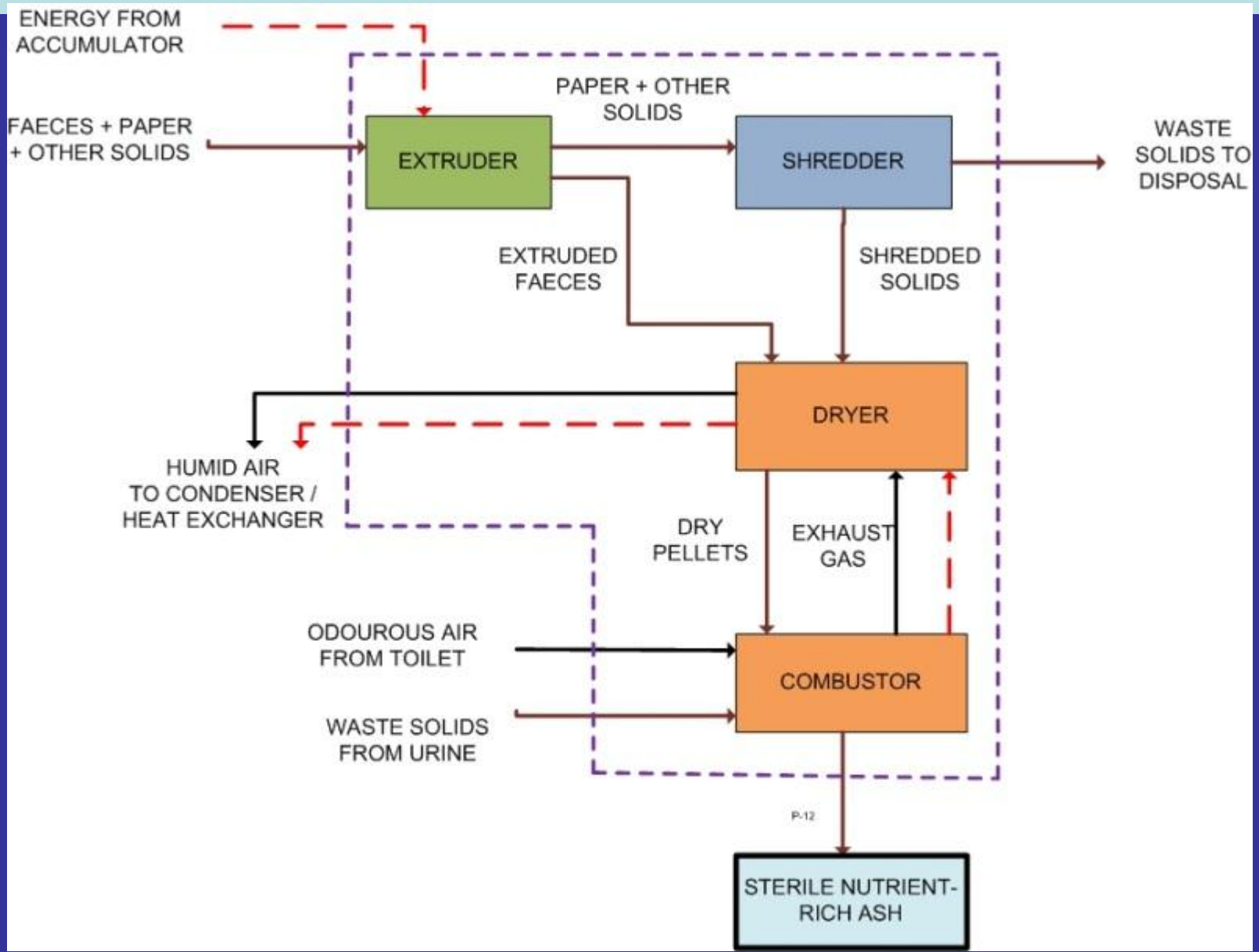
design to fail safe

Equipment / instruments

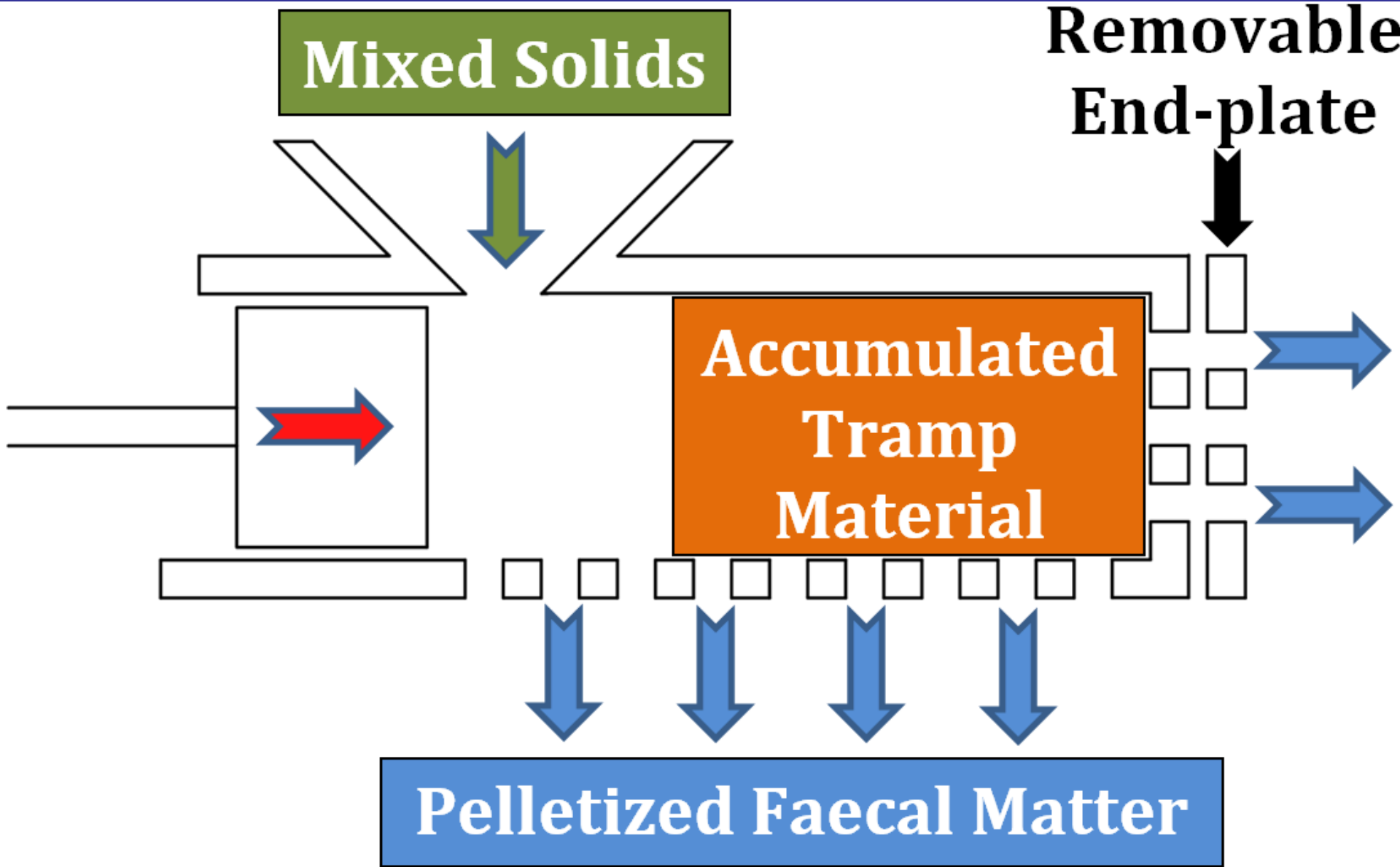
- rheometer
 - flow curves
- thermal conductivity
 - drying and combustion
- calorimeter
 - combustion
- drying rig
 - drying curves
 - pasteurisation
- chemical analysis
 - fertiliser
 - ash
 - property correlation



Faececes Processing



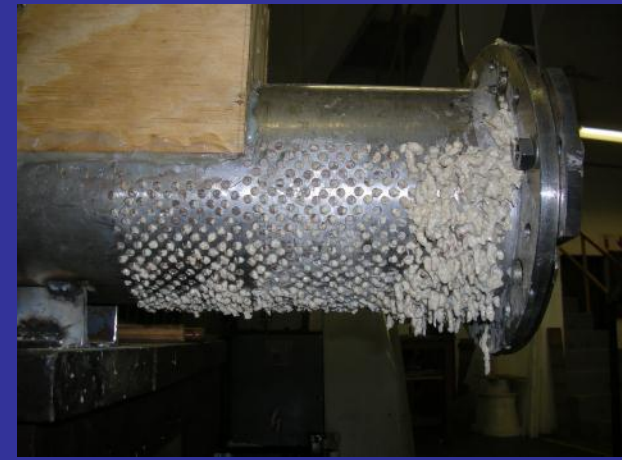
Extruder



LaDePa

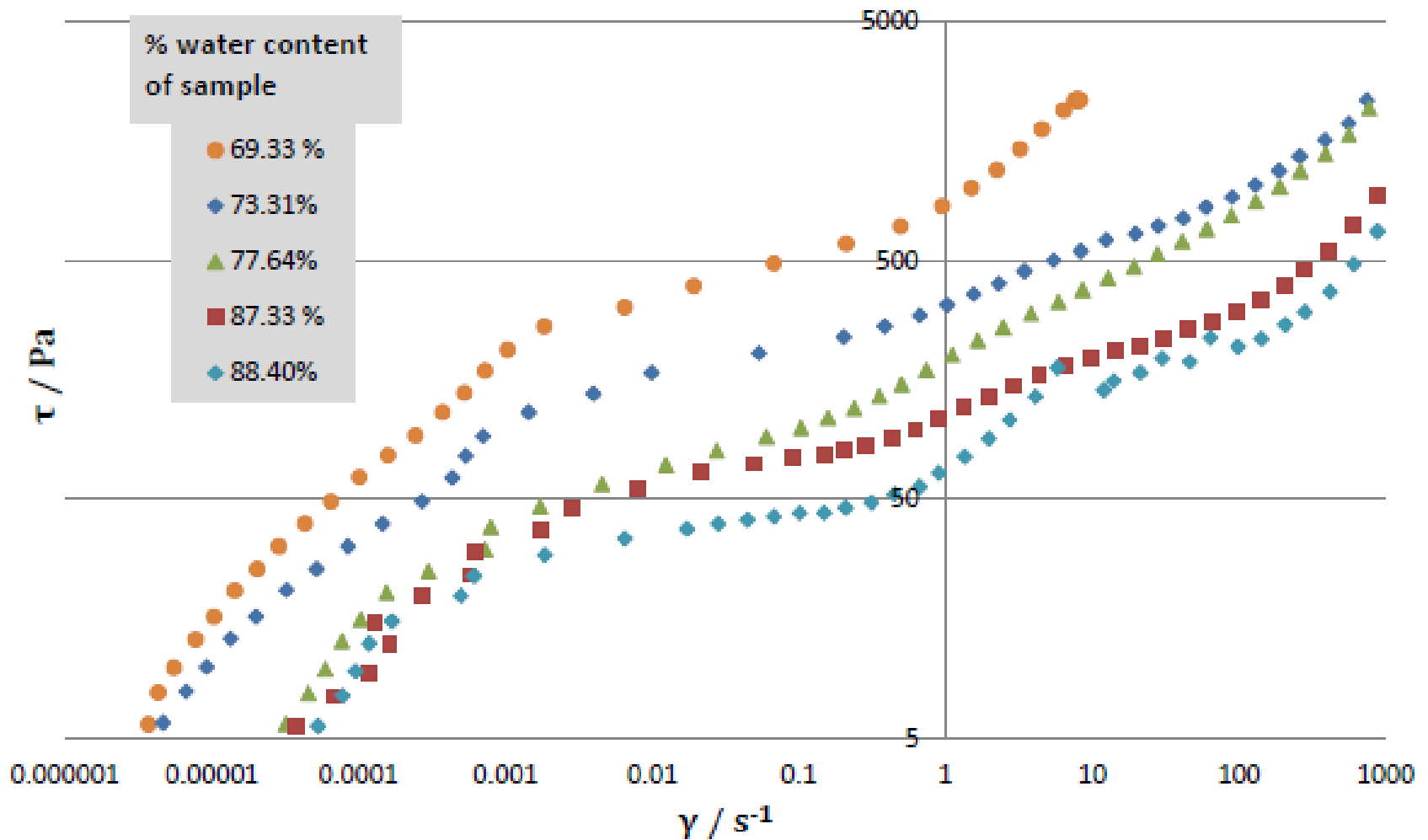


Extruder

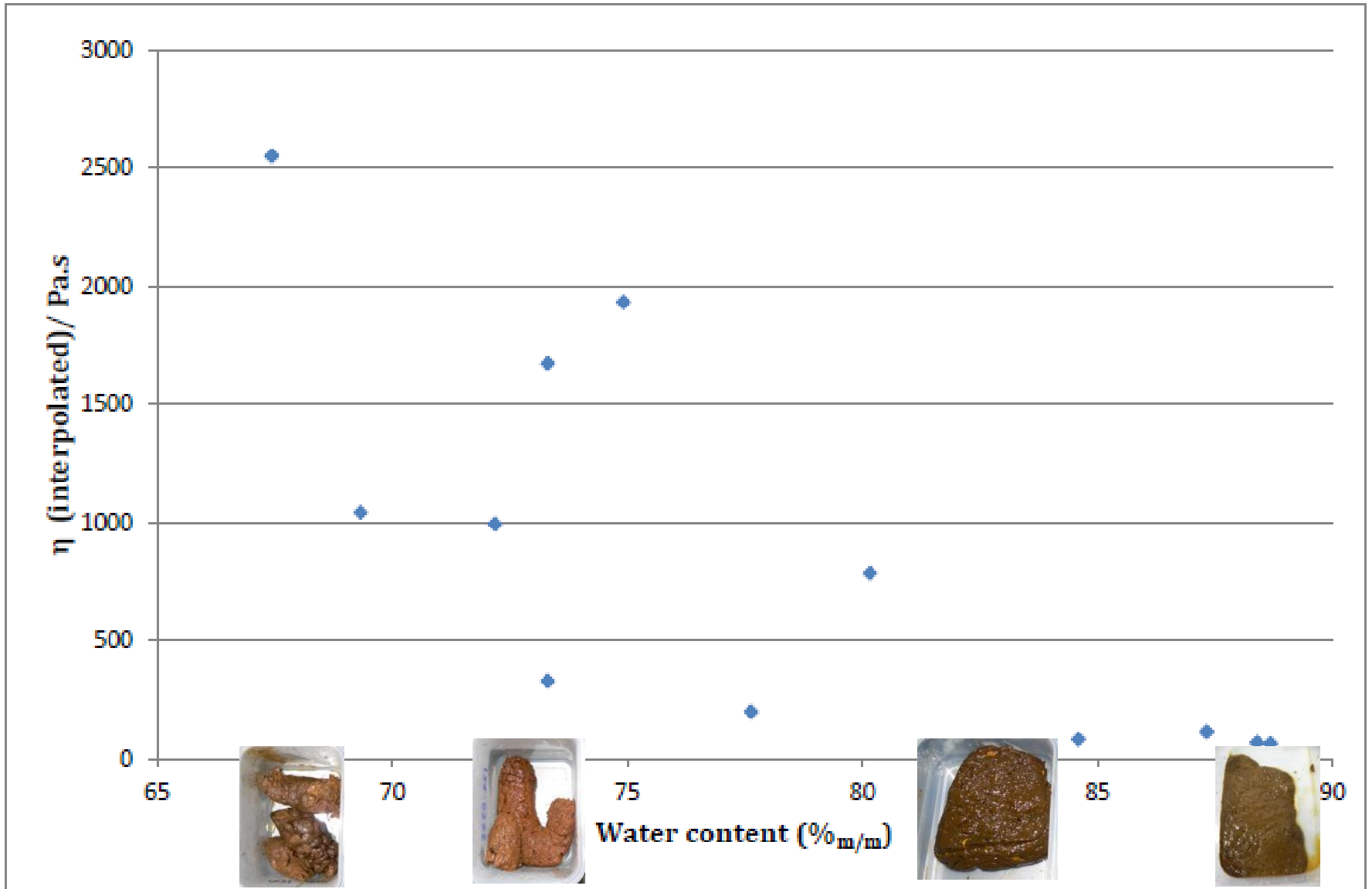


Fresh Faeces

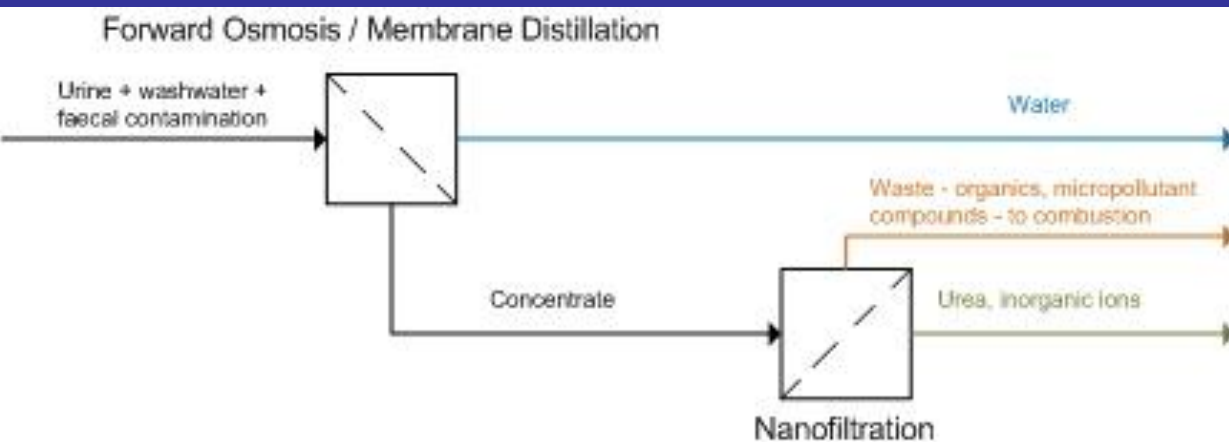
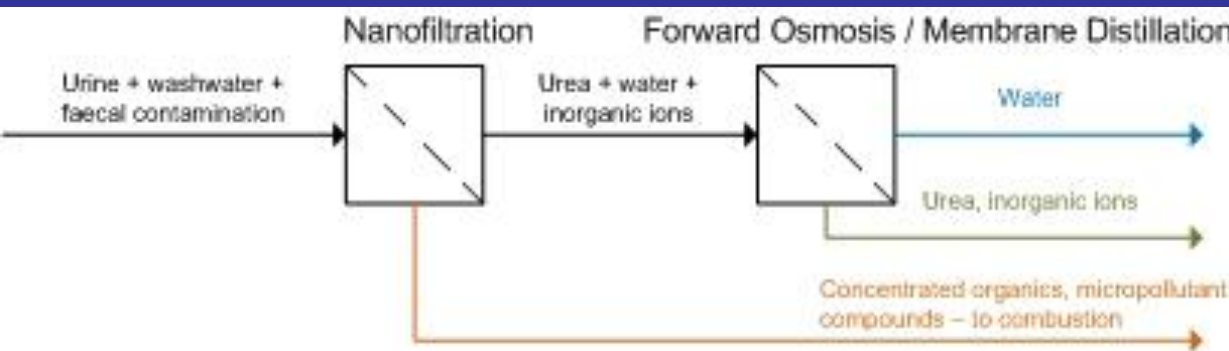
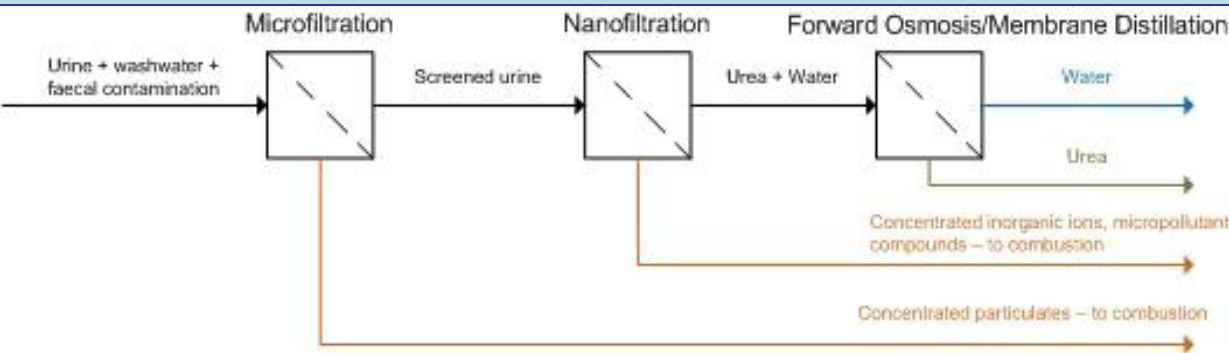
Flowcurves for fresh human faeces (at 25°C)



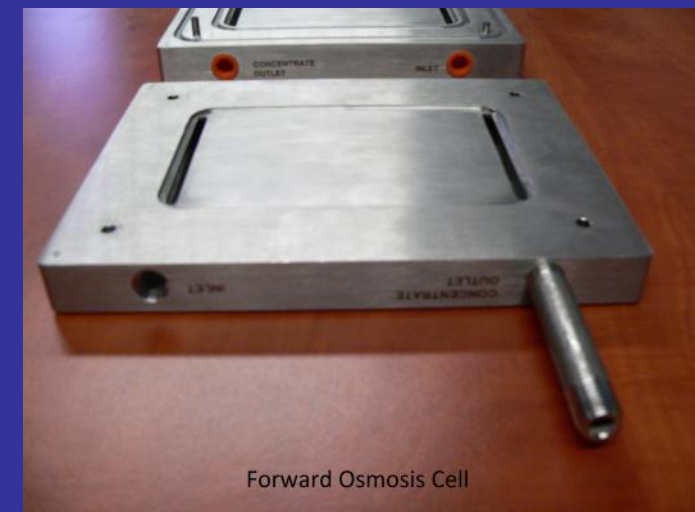
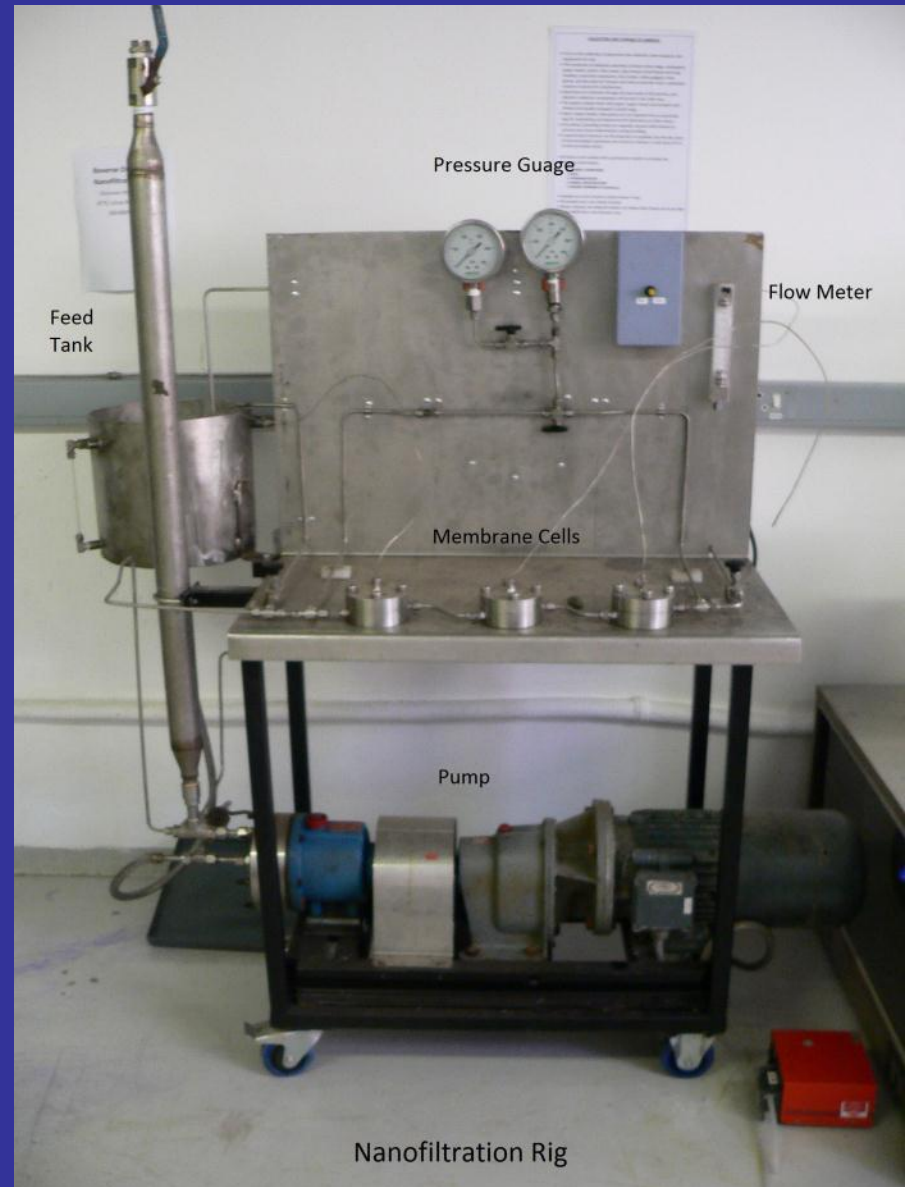
Fresh Faeces



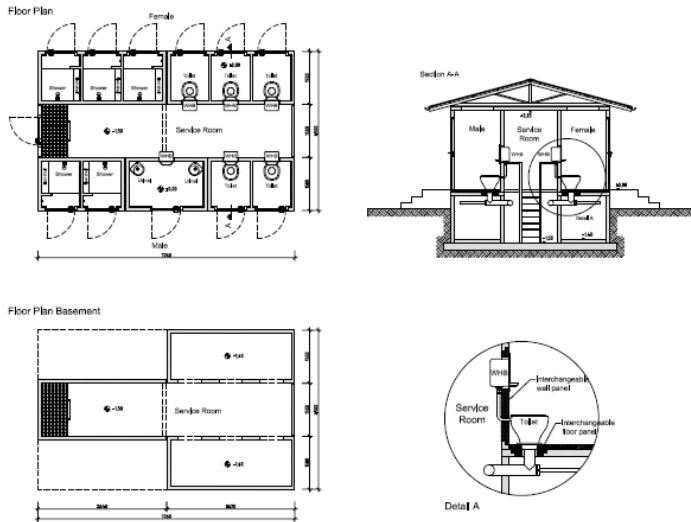
Urine Processing



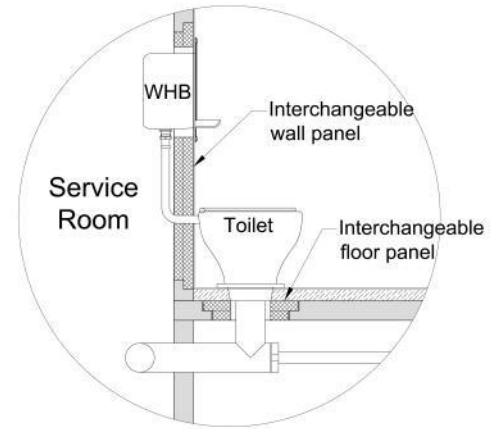
Urine Processing



Ablution Block



Project: Sanitary Facilities
Consult: 01/10/2010
Scale: 1:50
Drawing No: 10/10/10/01



Development of an RTTC Model

- Current focus on faeces handling
- Combined drying – combustion model
- Drying
 - Standard 3-phase drying model
 - Data: **moisture content**, equilibrium moisture content, kinetics of three phases from dynamic drying experiments, **thermal conductivity**
 - Correlation to standard properties (**COD, TS:VS ratio**)