Installation procedure

- assembly of reactor container (sheet metal tank with conical bottom) according to treatment volume (1 L reactor per 10 L of urine per day)
- construction of stirring mechanism & stand (welded metal bars and sheet); assure flow from storage to reactor to disposal.
- installation of fittings & filter (polypropylene fittings and nylon filter bag). Filter fabric: nylon fabric as used for shirts sewn to bag of 0.4 m^2 surface for 100 L reactor.
- set-up of reactor and storage tanks (plastic storage tanks with connections to reactor)

Dimensioning

- daily treatment capacity: 10 L urine / 1 L reactor
- 500 L urine yield approximately 1 kg struvite

Installation costs

- labour costs: 1 operator for a 500 L reactor

Reactor set-up [NRs]	**50 L**	**500 L**
steel tank for reactor	3‘500	15’000
stirring system & stand	2‘000	10’000
urine storage tank	500	8’000
pipes & fittings	500	2’000
effluent storage tank	500	8’000
total [NRs]	**7’000**	**43’000**

Further considerations

- small scale business approach
- commercialization of struvite as a fertilizer
- phosphorous prices are likely to increase further
- transportation of bittern from India to Nepal

Further readings

• Etter, B. (2009): Struvite recovery from urine at community scale in Nepal – Project intermediate report. EPFL: Swiss Federal Institute of Technology, Lausanne, Switzerland

• Etter, B. (2009): Process optimization of low-cost struvite recovery – MSc thesis. EPFL: Swiss Federal Institute of Technology, Lausanne, Switzerland

• Gantenbein, B., Khadka, R. (2009): Struvite recovery from urine at community scale in Nepal – Final project report phase I. Eawag: Swiss Federal Institute of Aquatic Science and Technology. Zurich, Switzerland

• Tilley, E., Gantenbein, B., Khadka, R., Zurbrügg, C., Udert, K.M. (2009): Social and economic feasibility of struvite recovery from urine at the community level in Nepal. In: International Conference on Nutrient Recovery from Wastewater Streams. K. Ashley, D. Mavinic and F. Koch (eds). IWA Publishing, London, pp 169-178.

> Download the publications from www.sandec.ch

Internet resources

• www.novaquatis.ch
• www.sandec.ch
• www.ceep-phosphates.org

Contact information

struvite.nepal@eawag.ch

Eawag
Swiss Federal Institute of Aquatic Science and Technology
Department for Water and Sanitation in Developing Countries
Überlandstrasse 133
8600 Dübendorf
Switzerland
Phone +41 44 823 55 11
Fax +41 44 823 50 28
www.eawag.ch
www.sandec.ch

UN-Habitat Nepal
The United Nations Human Settlement Programme
Water for Asian Cities Programme Nepal
Pulchowk
Kathmandu
Nepal
Phone +977 1 55 42 816
Fax +977 1 55 39 877
www.unhabitat.org
www.unwac.org
wac.nepal@unhabitat.org.np

UN-HABITAT FOR A BETTER URBAN FUTURE

eawag aquatic research

How to produce fertilizer from urine: Struvite

Urine contains valuable nutrients; it is an excellent fertilizer if applied to crops.

Struvite is a powder fertilizer produced from urine.

If **urine** cannot be applied directly because:
- storage space is not available
- transport is difficult
- its odour is unpleasant

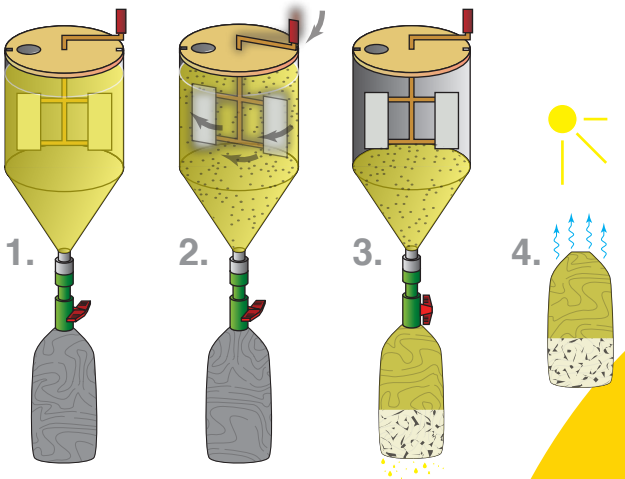
You can produce **struvite** to benefit from the fertilizing properties of urine, because:
- volume and weight are reduced
- nutrients can be stored over time
- handling is more user-friendly in powder form

Eawag: Swiss Federal Institute of Aquatic Science and Technology
UN-HABITAT: The United Nations Human Settlement Programme

STUN: Struvite recovery from urine in Nepal

The Struvite Harvesting Reactor

How does the STUN reactor work?



1. fill reactor with urine
2. add magnesium & stir
3. open valve & filter struvite
4. sundry struvite

Process inputs

urine

urine harvesting

- from urine diverting toilets
- from urinals
- on markets
- in public buildings etc.

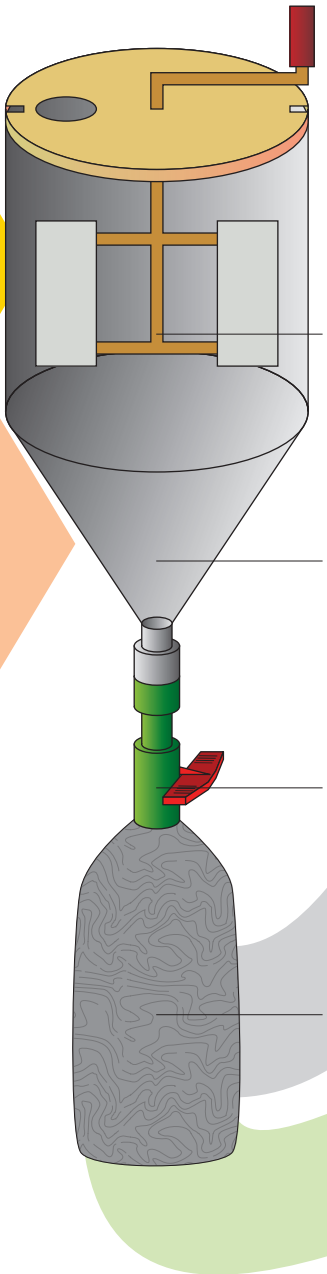
magnesium

magnesium (Mg) sources

- magnesium sulphate ($MgSO_4$): fertilizer powder
  magnesium content: 5 - 10%
- bittern: waste product of salt production
  magnesium content: 3 - 10%

magnesium (Mg) dosage

- determine phosphorus (P) content in urine
- Mg:P molar ratio 1:1.1



stirring mechanism:

- metal crank
- metal rod schaft
- sheet metal blades

stainless steel tank:

- crimped & riveted
- silicon sealed
- soldered at outlet

reactor outlet:

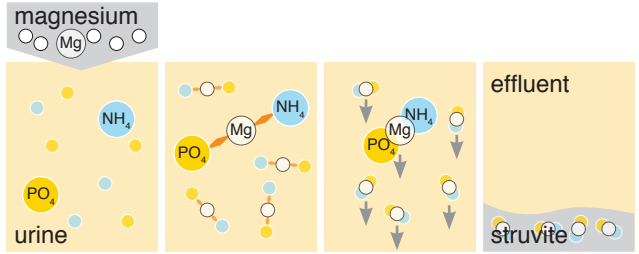
- metal connector
- seal tape
- plastic ball valve

filter module:

- plastic container
- nylon filter bag
- bottom outlet

How is struvite formed?

Urine contains phosphate (PO_4) and ammonium (NH_4); both are important nutrients. If magnesium (Mg) is added to urine, these substances will bind and form struvite ($MgNH_4PO_4 \cdot 6H_2O$) powder, which can be filtered out.



Process outputs

struvite as fertilizer

fertilizer comparison (N:P:K)

urea	N	46:0:0
DAP	N P	18:46:0
struvite	N P Mg	6:29:0+10Mg

struvite in practice – a valuable fertilizer

- slow-release – continuous nutrient flow
- bio-available – easy uptake by plants
- free of heavy metals and pharmaceuticals

effluent reuse potential

effluent characteristics – additional nutrients

- high nitrogen (N) content
- high potassium (K) content

reuse potential – fertigation

- fertigation: fertilization by irrigation
- no clogging in drip irrigation