

## 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<sup>2</sup> 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
<b>total [NRs]</b>	<b>7'000</b>	<b>43'000</b>

## 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](http://www.sandec.ch)

## Internet resources

- [www.novaquatis.ch](http://www.novaquatis.ch)
- [www.sandec.ch](http://www.sandec.ch)
- [www.ceep-phosphates.org](http://www.ceep-phosphates.org)

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# 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.

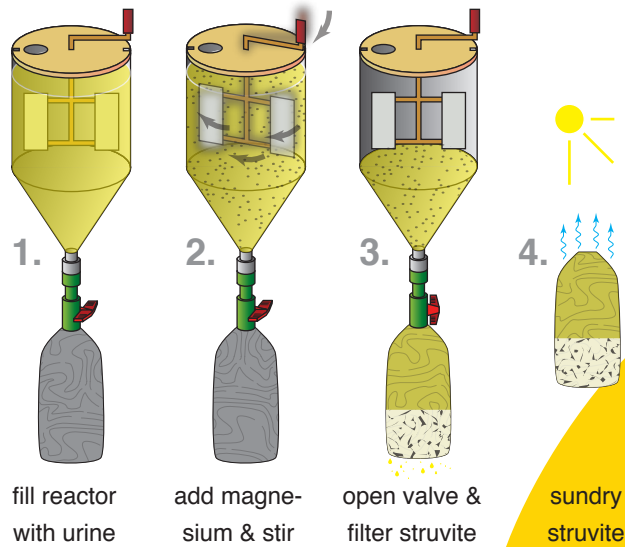
If **urine** cannot be applied directly because:

- 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

## How does the STUN reactor work?



## Process inputs

### urine

#### urine harvesting

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

### magnesium

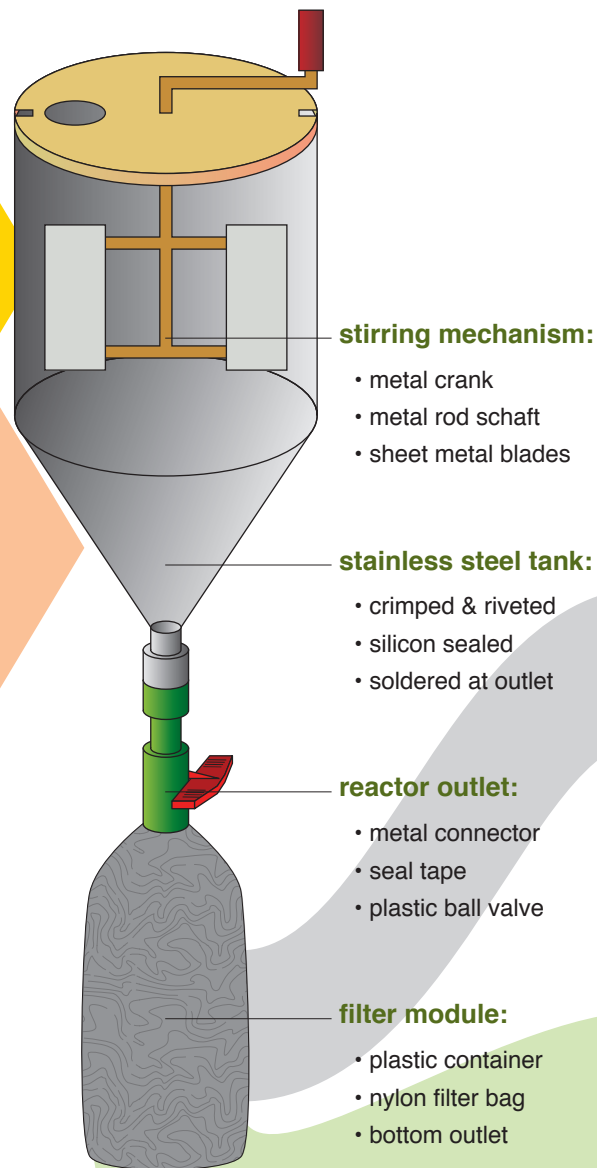
#### magnesium (Mg) sources

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

#### magnesium (Mg) dosage

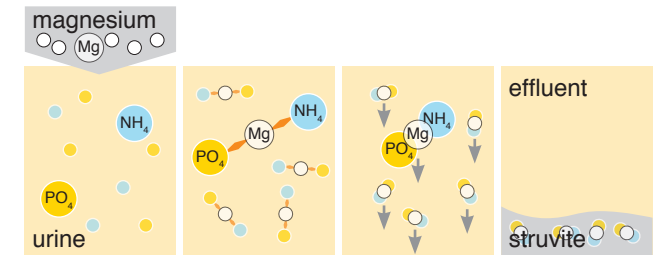
- determine phosphorus (P) content in urine
- Mg:P molar ratio 1:1.1

## STUN: Struvite recovery from urine in Nepal The Struvite Harvesting Reactor



## 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		
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 46:0:0

DAP 

N	P	
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 18:46:0

struvite 

N	P	Mg
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 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