



# Fate of faecal pathogens and indicator bacteria in urea treatment

---

**Björn Vinnerås<sup>\*,\*\*</sup>, Håkan Jönsson<sup>\*</sup>**

<sup>\*</sup>Swedish University of Agricultural Sciences

<sup>\*\*</sup>National Veterinary Institute



# Objective



- Evaluate urea treatment of faecal matter for removal of pathogenic bacteria.



# Treatment alternatives



## ■ Storage

- Simple method
- More efficient at higher temperatures
- Needs long time to produce safe fertiliser
- Risk for re-growth of bacteria



# Treatment alternatives



- Composting
  - DM 30-40%
  - High organic content
  - Sensitive for inert additives (ash/lime)
  - Cold zones
  - Insulation needed (Poster)
  - Risk for regrowth



# Treatment alternatives



- Urea treatment
  - Most common N fertiliser
  - $\text{NH}_3$  (g)
    - Better effect than  $\text{OH}^-$
  - Regulated by
    - Temperature
    - pH
    - $\text{NH}_{3/4(\text{tot})}$



# Treatment alternatives



## ■ Urea treatment

- TS < 25%
- pH > 8.5
- Enzymatic degradation



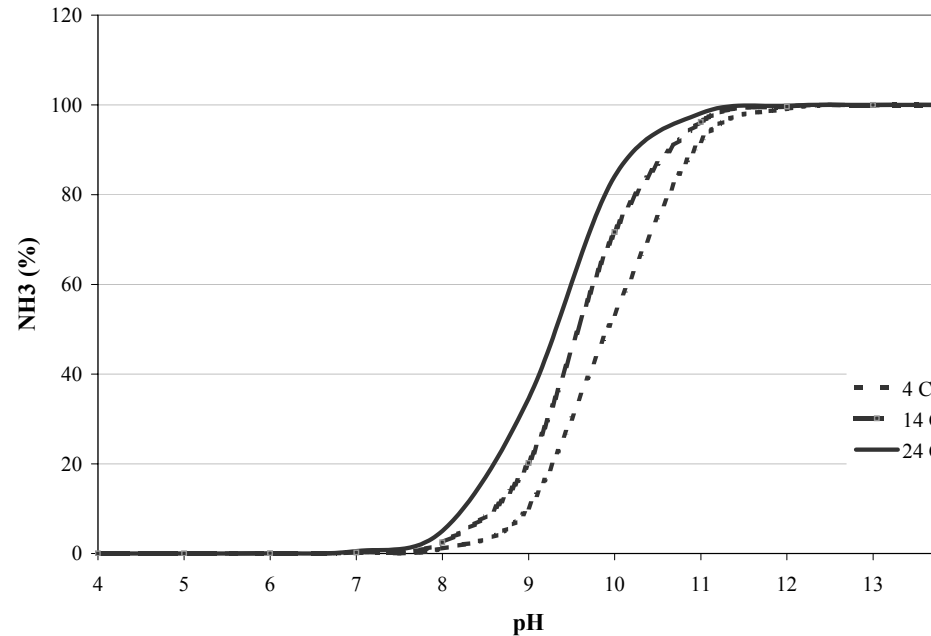
- Increase fertilising value



# Amount of free ammonia



- Free ammonia (%) are regulated by
  - Temperature
  - pH
- Available ammonia in solution also regulated by
  - $\text{NH}_3$  concentration
  - Dry matter content



# Material to treat



## ■ Faecal matter / Toilet water

- TS=0.1-25%
- Ashcontent 5-10%
- pH neutral

## ■ Additives

- Paper
- Water
- Ash/lime
- Stones, corncobs etc.



# Urea treatment



- Lower dosage=longer time for treatment
- Temperature
  - Main effect on enzymatic activity
    - The colder temperature the slower degradation of urea



# Treatment alternatives



## ■ Storage

- Faecal matter
  - 20°C TS = 10%
  - 14°C TS = 20%
- Toilet water
  - ~15°C TS 0.1%

## ■ Chemical treatment

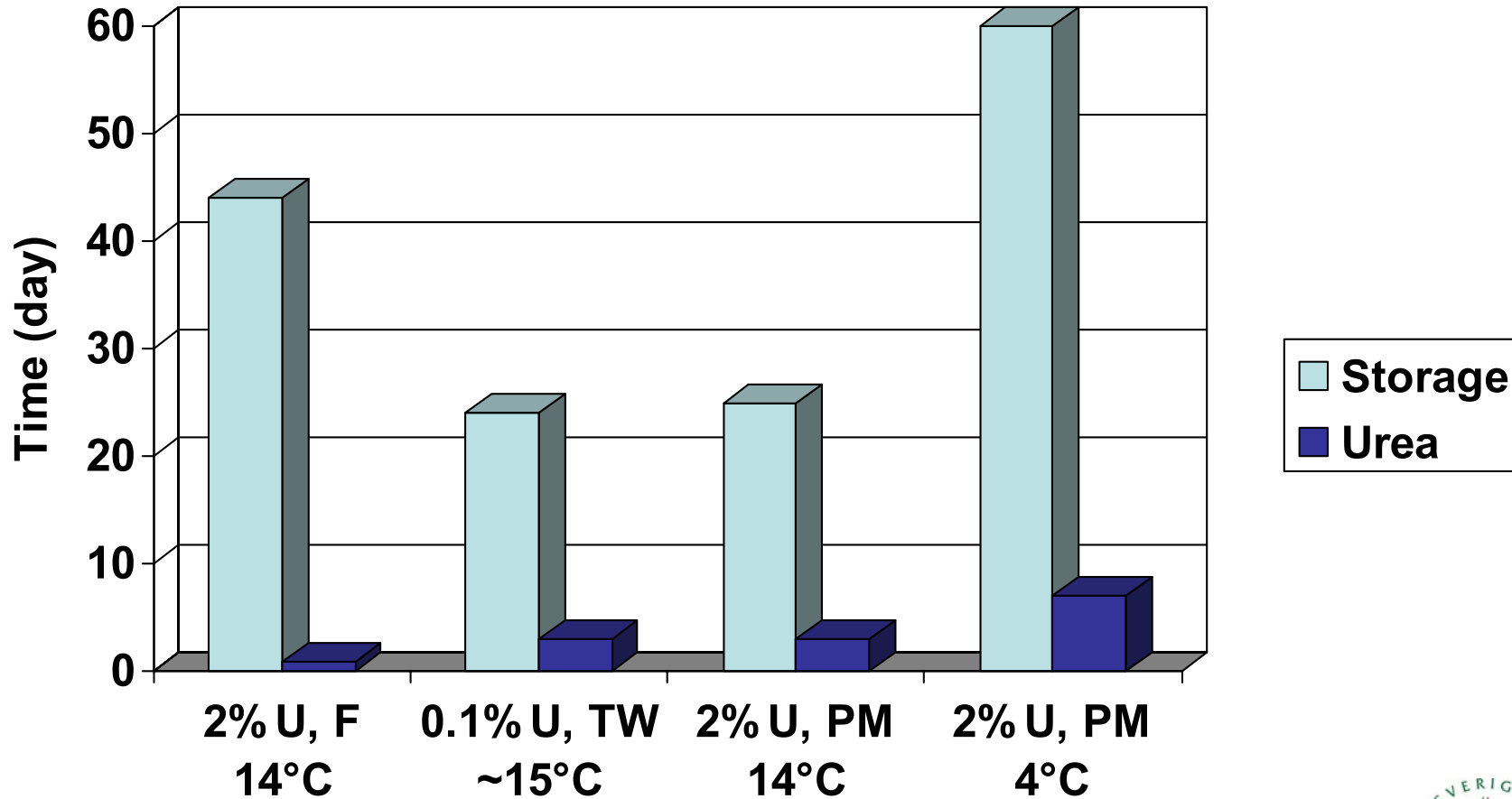
- Faecal matter
  - Urea 6%, 20°C TS=10%
  - Urea 2%, 14°C TS=20%
- Toilet water
  - Urea 0.1% ~15°C TS=0.1%
- Pig manure
  - Urea 2% 4°C TS=4%
  - Urea 2% 14°C TS=4%



# Salmonella spp



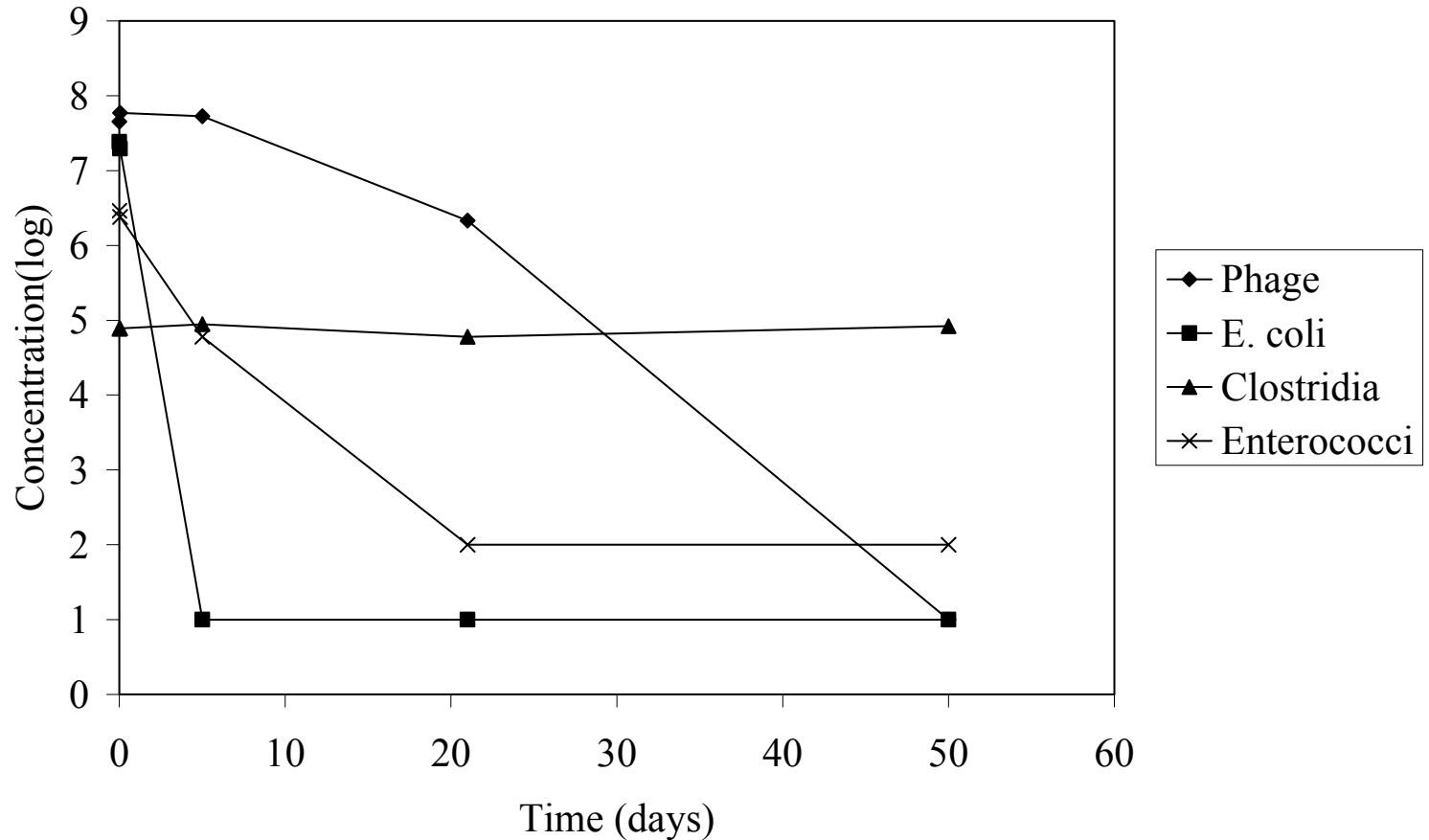
Time for decimal reduction (90%=1 log<sub>10</sub>)



# Urea treatment



6% urea 20°C



# Urea treatment



- Is efficient for treatment of
  - Bacteria
  - Viruses
  - Paracites
  
- Have no effect on
  - Spore forming bacteria



# Urea treatment



- Corrosive
- Smelly
- Closed container is needed
- Increased fertilising value
- No mixing after initial mix necessary
- No degradation of organic matter
  - I.e. the material will not be homogenised as in compost
  - Higher amount of available carbon
- Main alternative for pumpable material



# Comparison between alternatives



| Treatment  | Time | Cost | Re-growth | Infrastructure | Tech. S.P. | Efficiency |
|------------|------|------|-----------|----------------|------------|------------|
| Storage    | R    | R    | R         | R              | R          | R          |
| Urea       | +    | 0    | +         | 0              | 0          | +          |
| Heat       | ++   | -    | -         | -              | -          | +          |
| Composting | +    | -    | 0         | -              | -          | +          |



# Conclusion



- Urea treatment is an
  - Efficient
  - Safe
  - Economical
  - Simpel

treatment method for sanitising faecal matter

