
Reuse of urine in agriculture

Can pharmaceuticals cause a problem?

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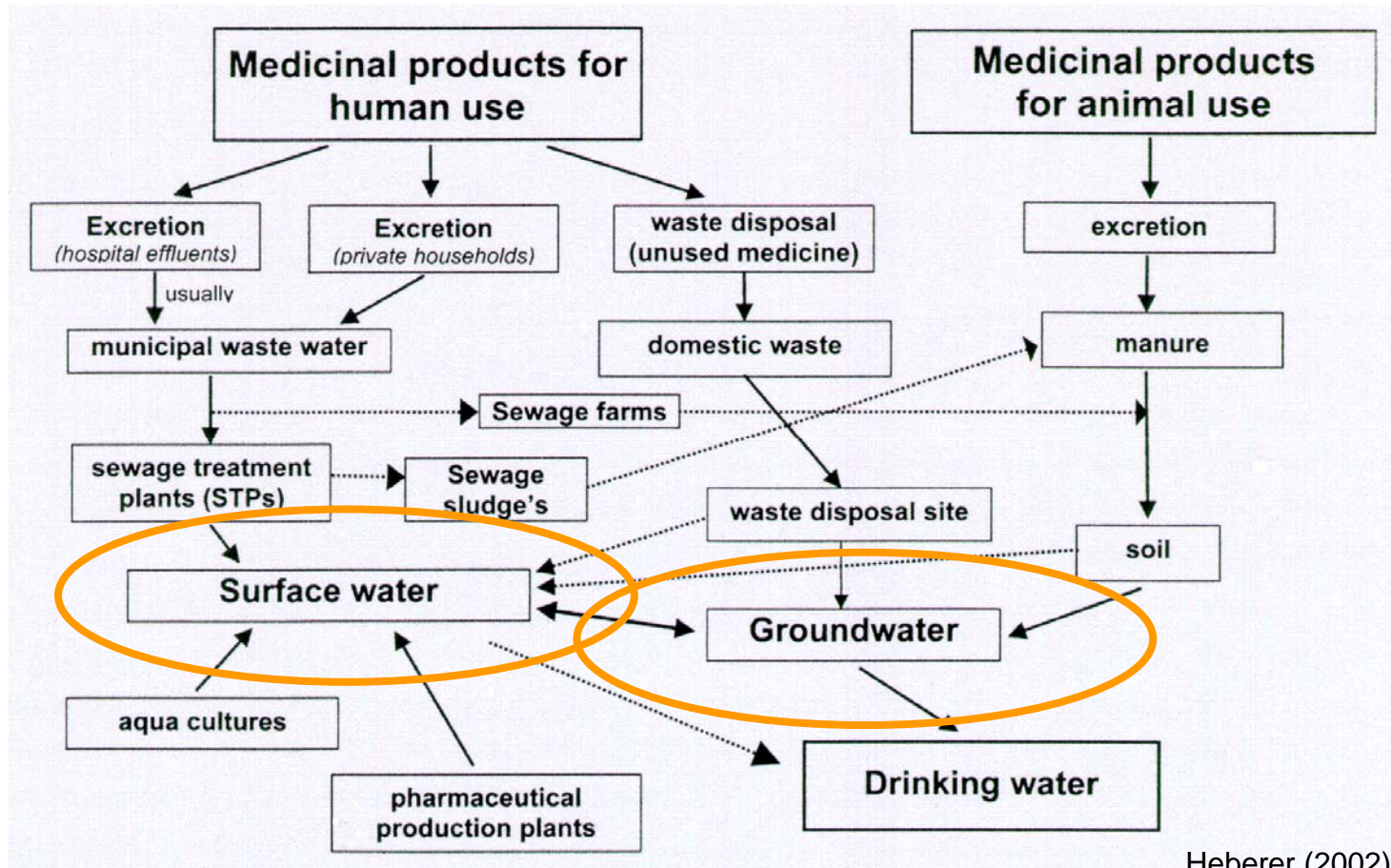
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Introduction

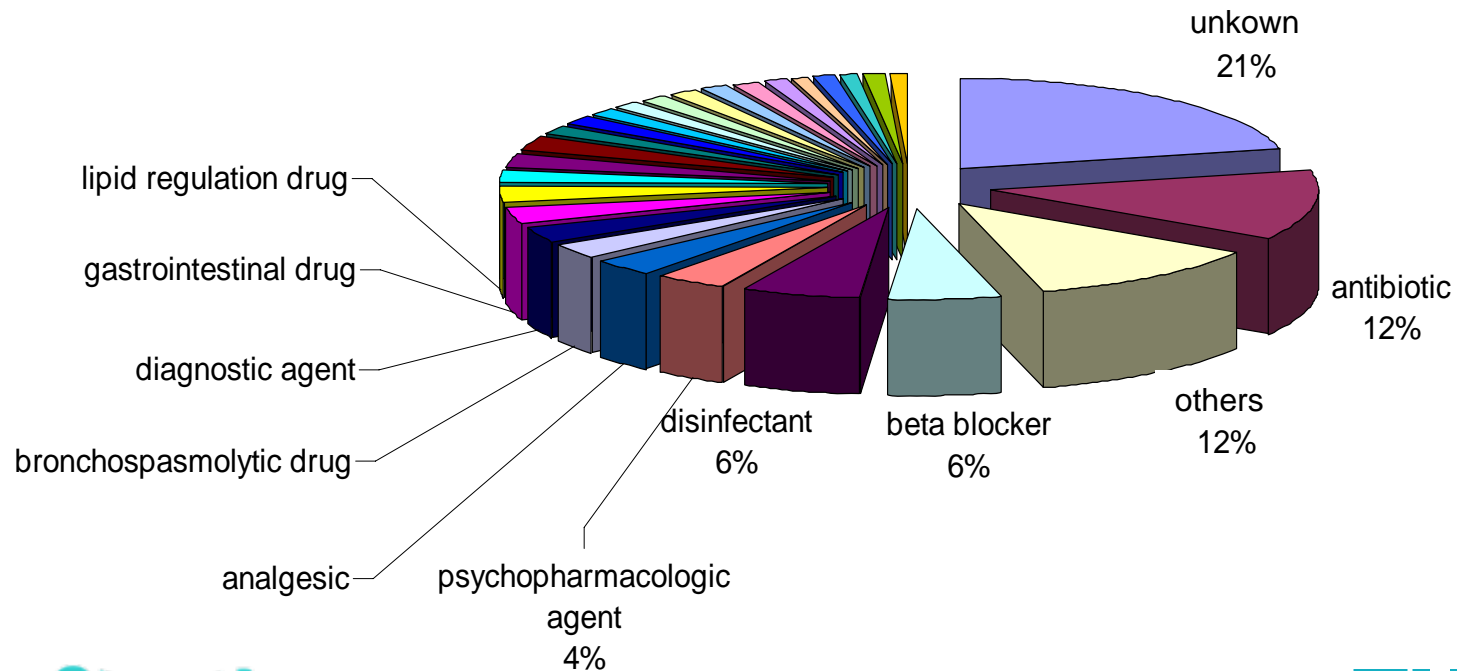
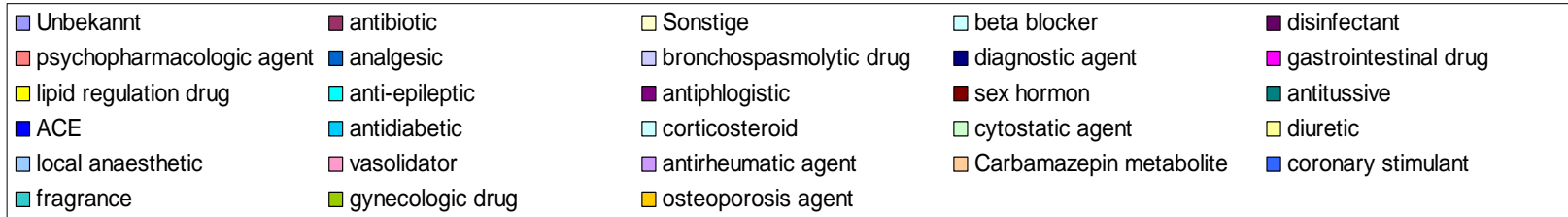
- Pharmaceutical residues (PhaR) are found in the environment since decades: 1970, 1973, 1976...
- Large investigations started in 1990s when analyzing tools improved
- Took time until problem was realized
 - » First - major polluter expected: hospitals
 - » Now - major polluter detected: households
- Today's wastewater treatment plants (WWTP) are not able to hold back PhaR

Pathways of PhaR

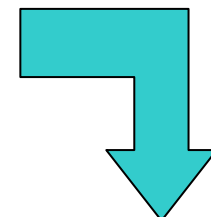
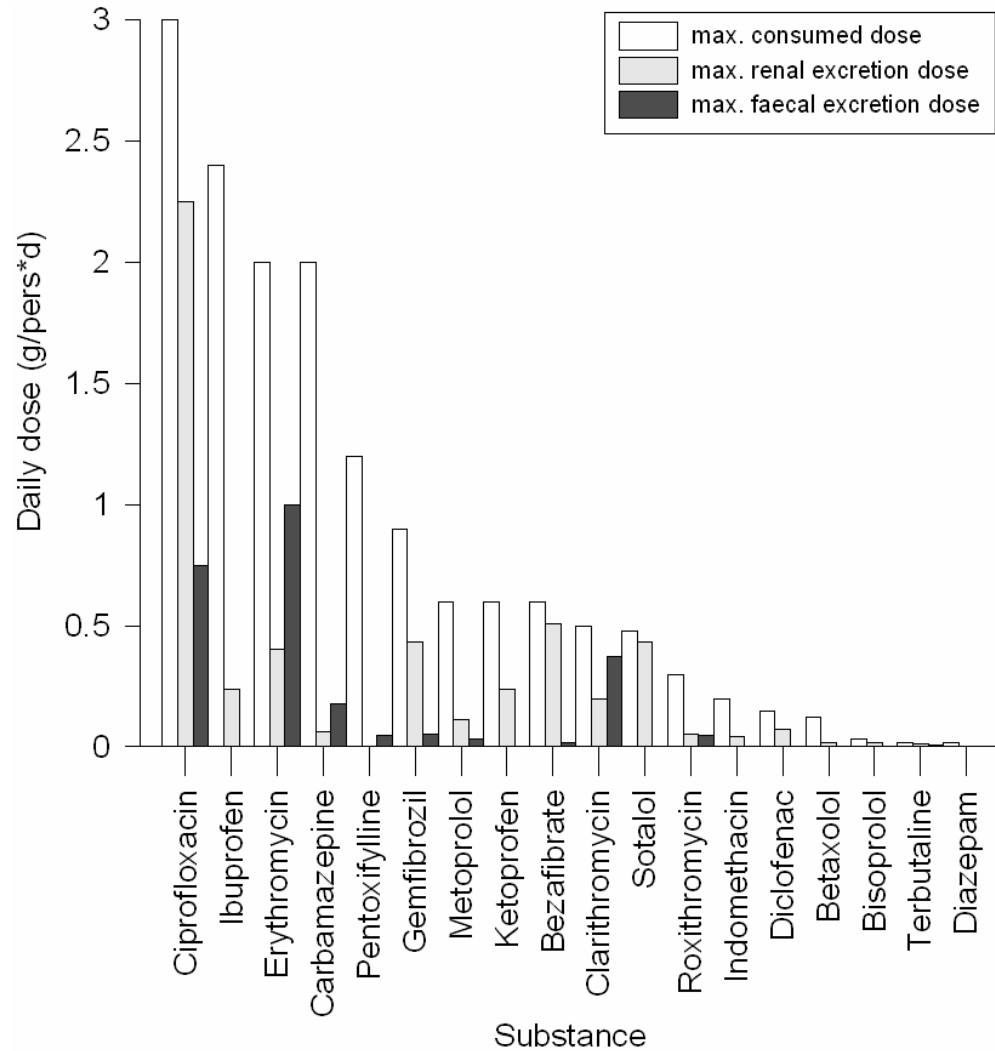


Heberer (2002)

Overview about pharmaceutical groups

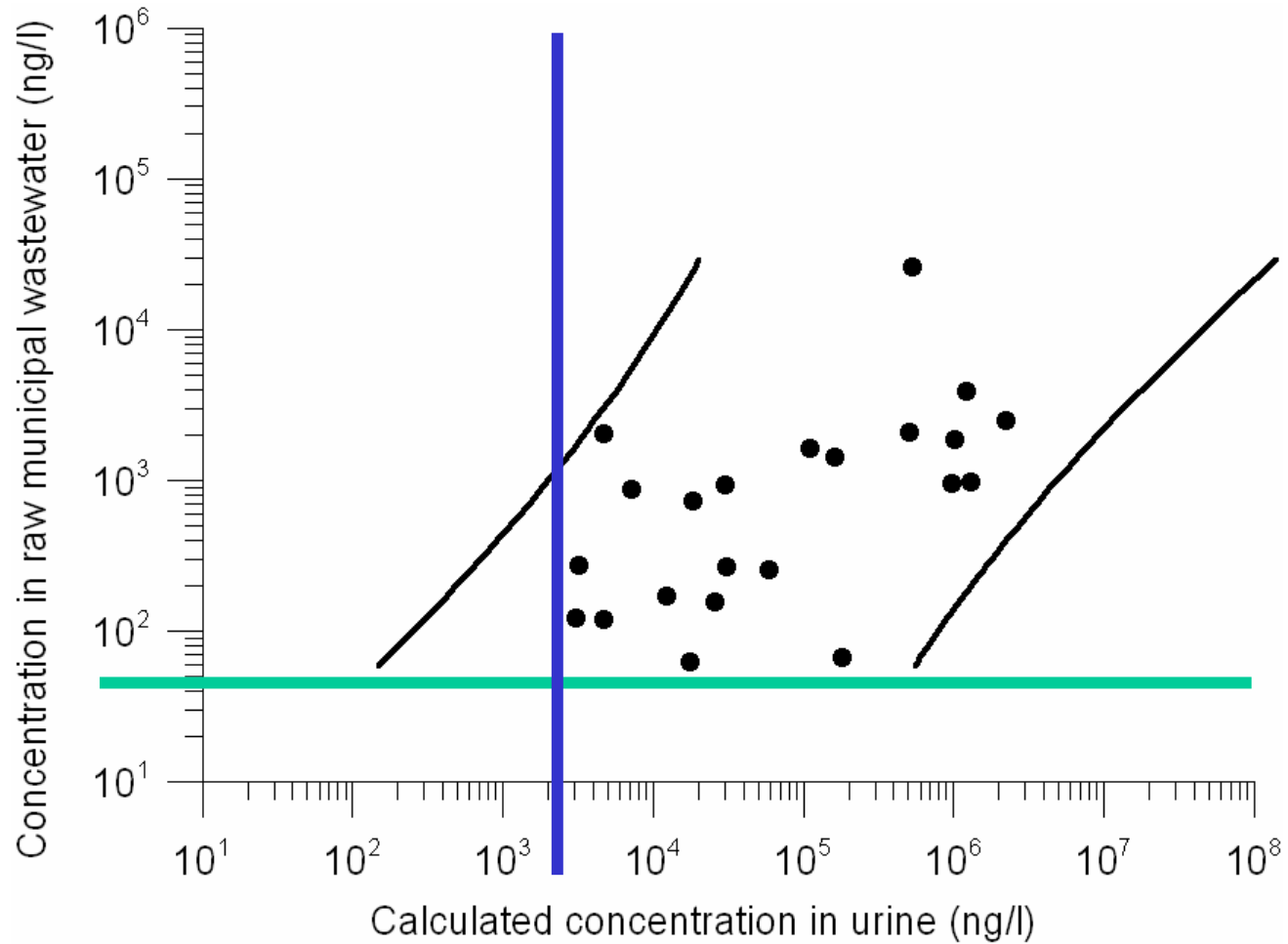


Discharge of PhaR

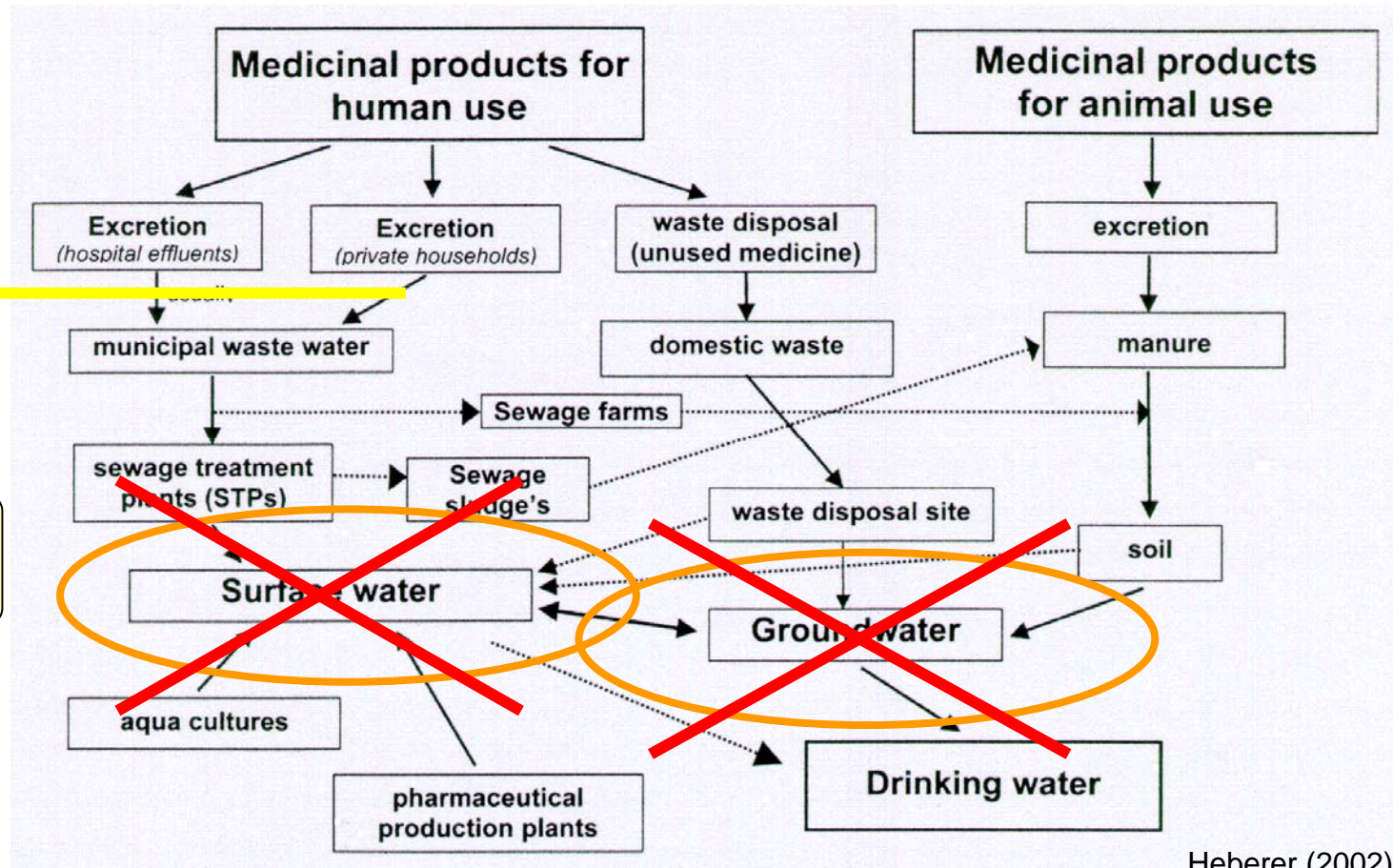


Mainly
via urine

Concentrations of PhaR

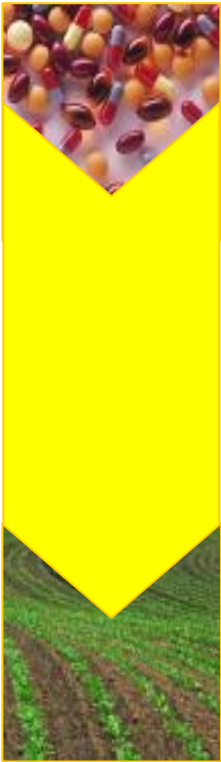


Pathways of PhaR



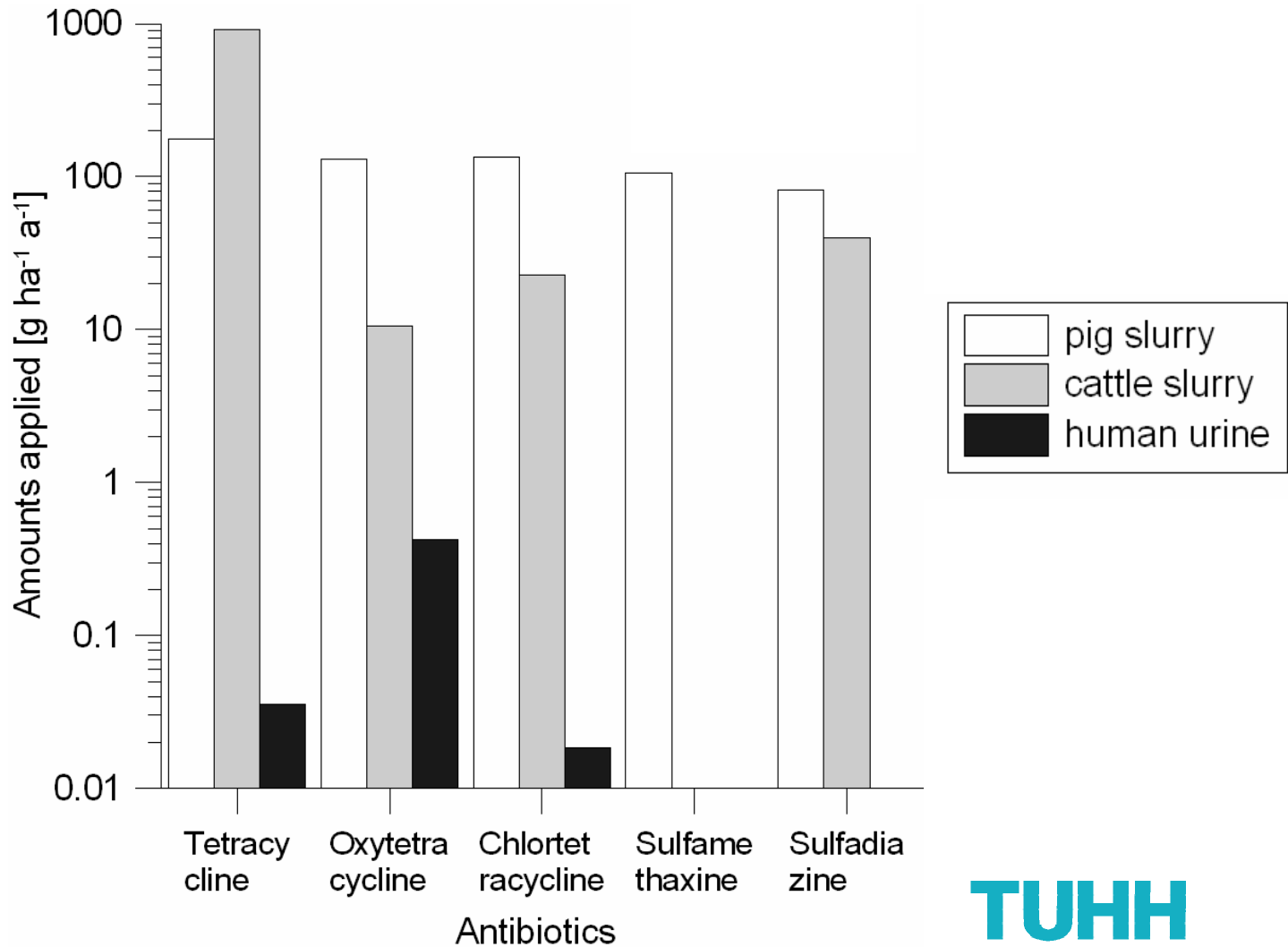
Heberer (2002)

Pharmaceuticals in agricultural soils

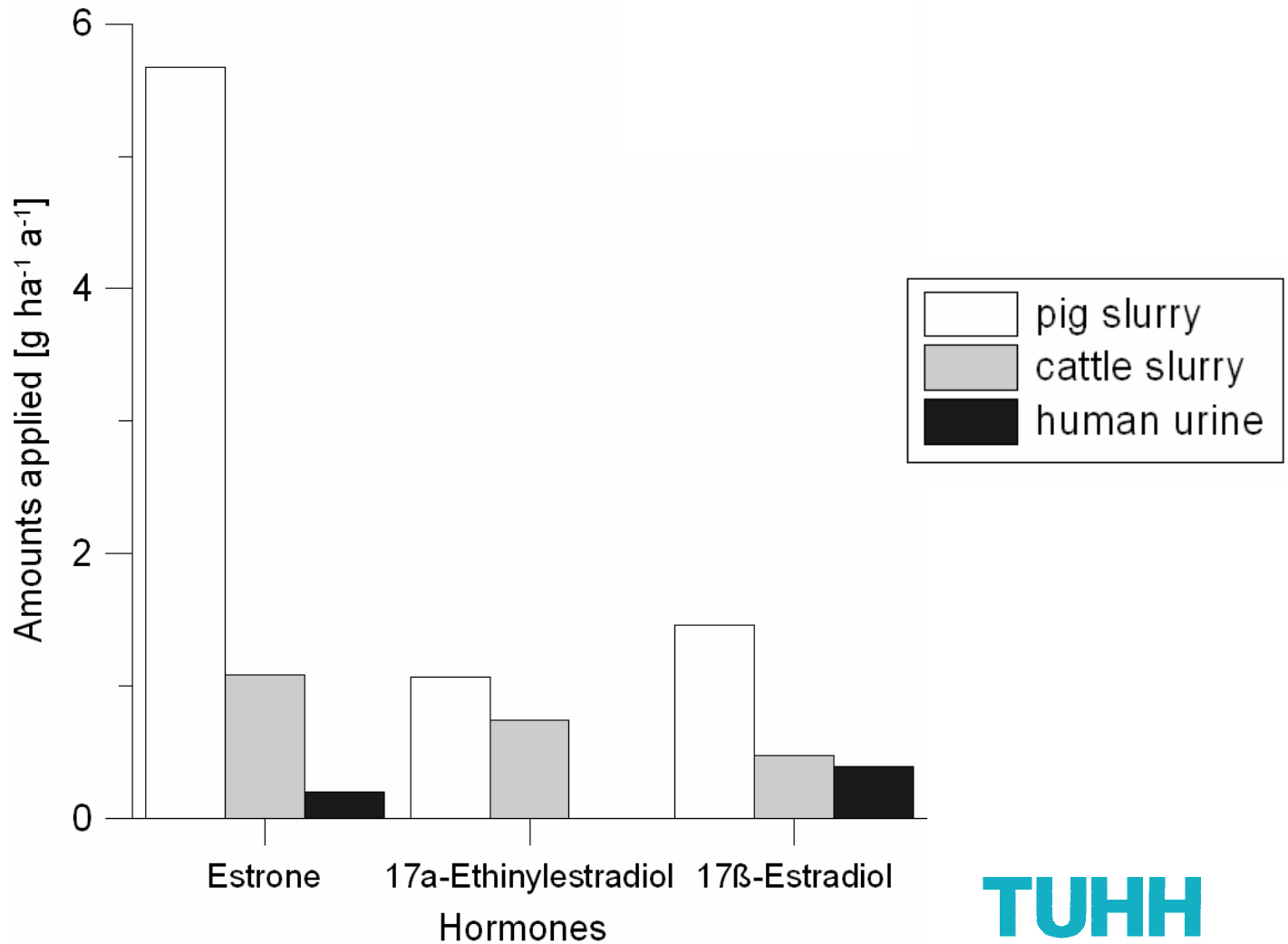


- 20 substances found in soil
 - » Applied through sewage sludge and manure
 - » Below 40cms depths: nothing detected
 - » Degrade after application
- Plants
 - » Found in each part, highest amounts in side roots, then roots.
 - » Also in grain of wheat (when 0.5 mg/kg DM by manure application)

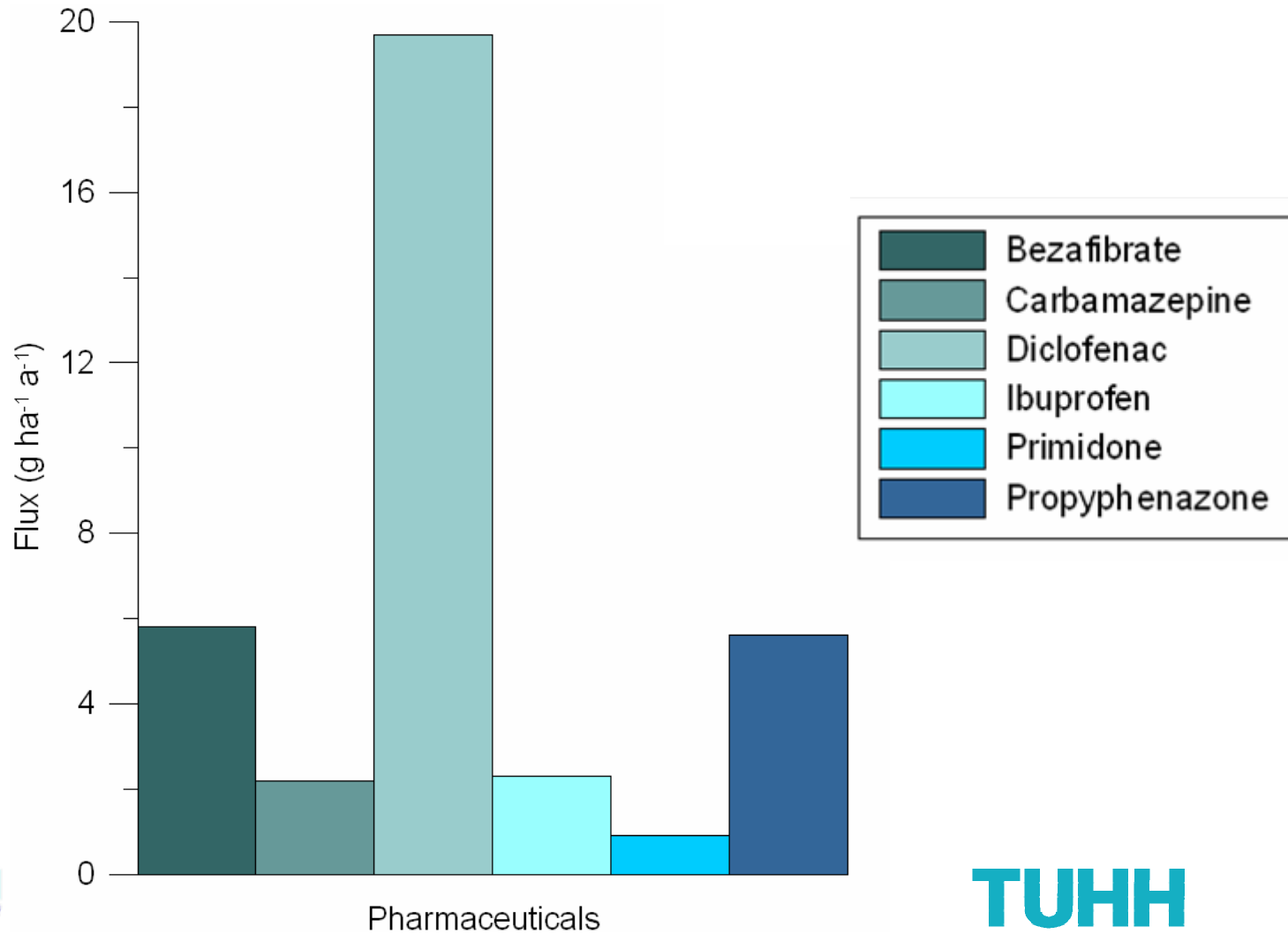
Antibiotics



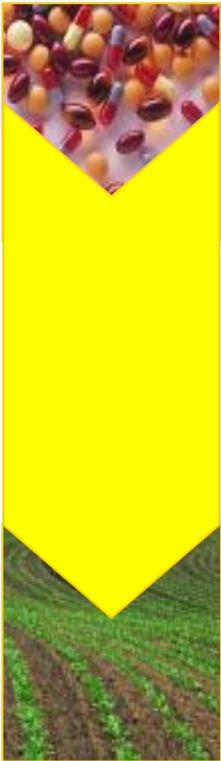
Hormones



Other pharmaceuticals



Fertilization on urine base depends on...



- Source of urine
- Amount / Nutrient composition: max. $20 \text{ m}^3 \text{ ha}^{-1} \text{ a}^{-1}$
- Storage over some time – change of pH
- Technique of application
- Timing of fertilization
- Type of crop / crop rotation

Conclusion

- Urine can be field applied in a dosage of about $20 \text{ m}^3 \text{ ha}^{-1} \text{ a}^{-1}$.
- Hormones' and antibiotics' fluxes show higher values in animal manure than in urine.
- Certain aspects not finally discussed.
- Source separation is a promising option to save water bodies and groundwater from pollution.

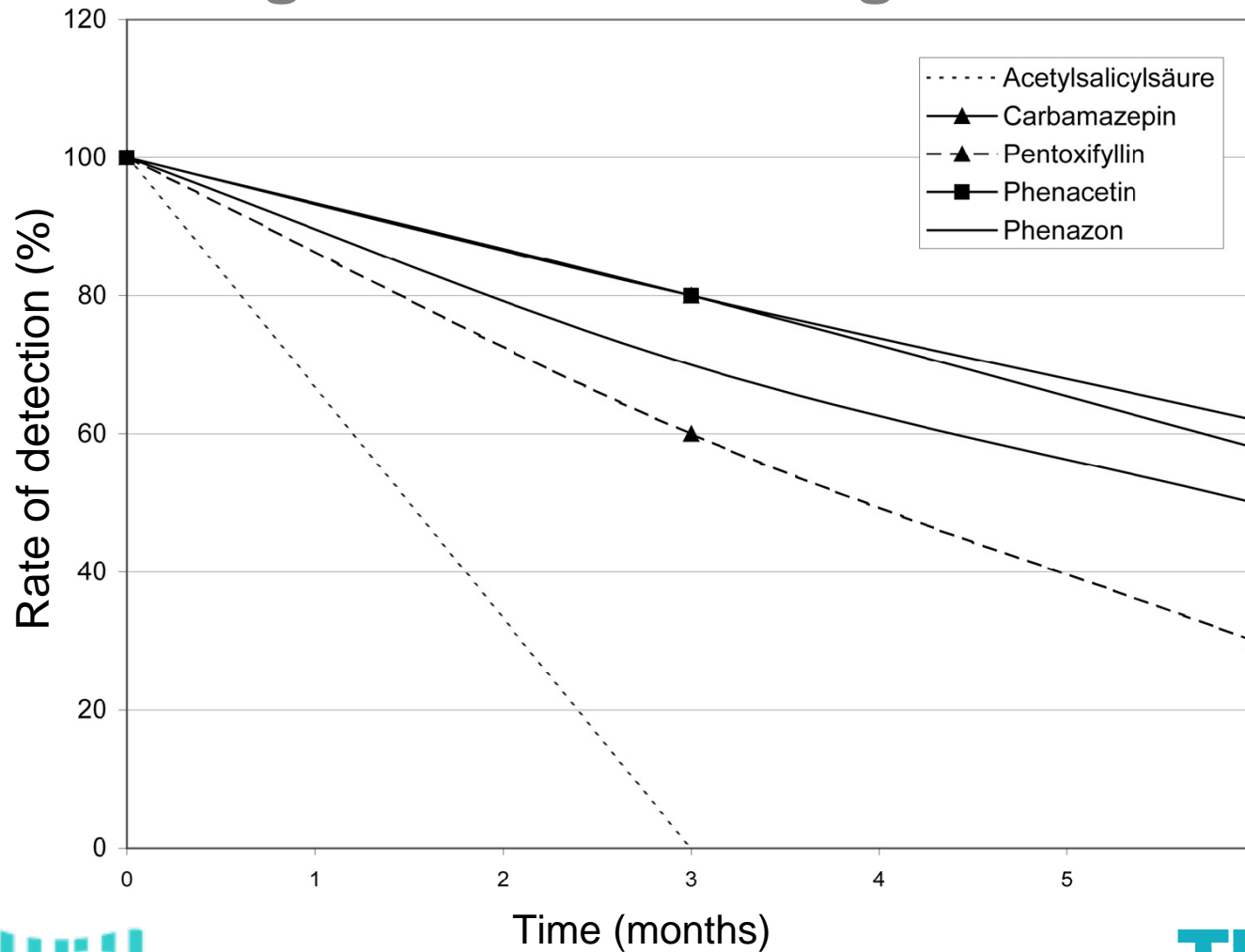
Thank you!

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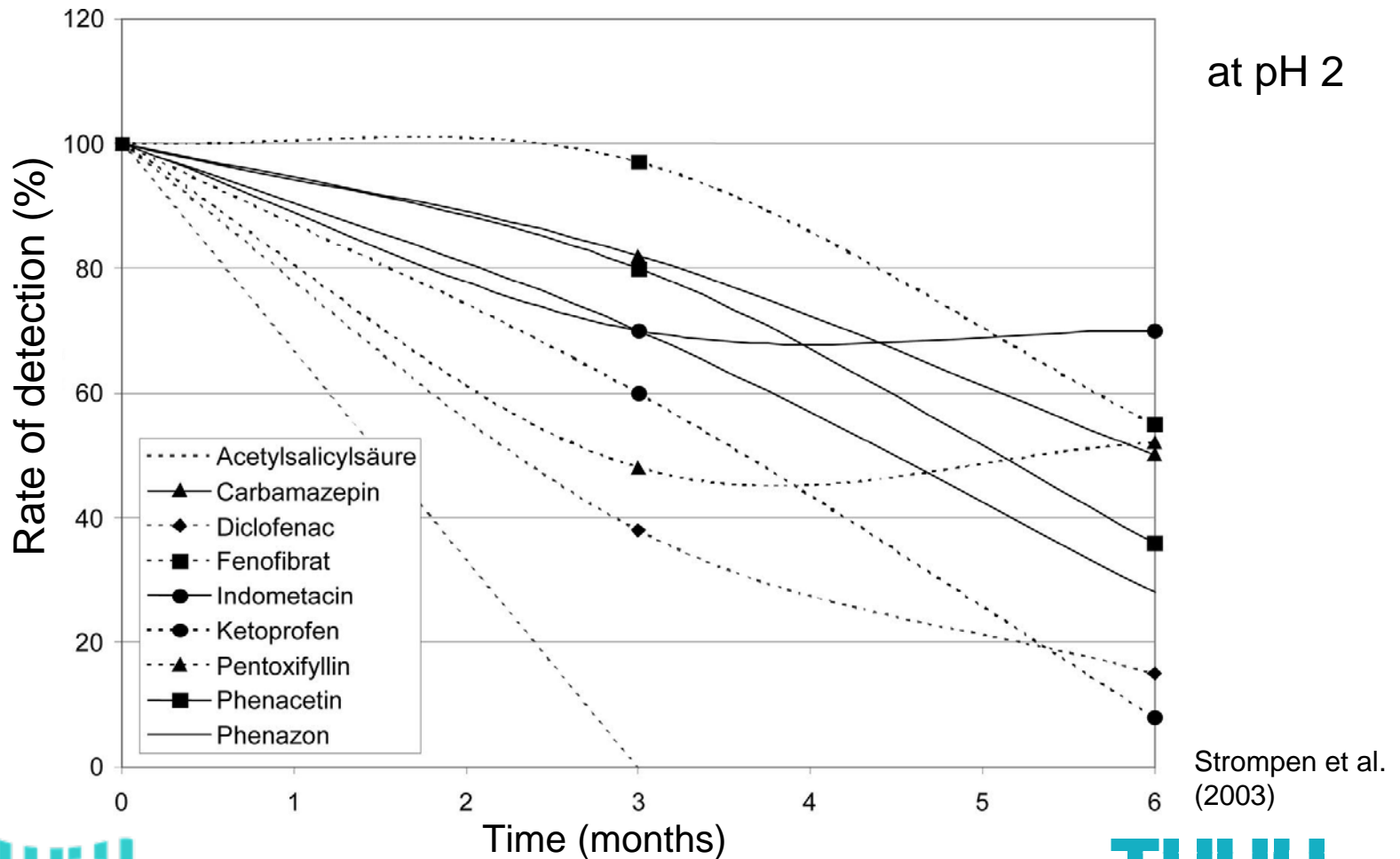
Degradation in storage tank

at pH 9

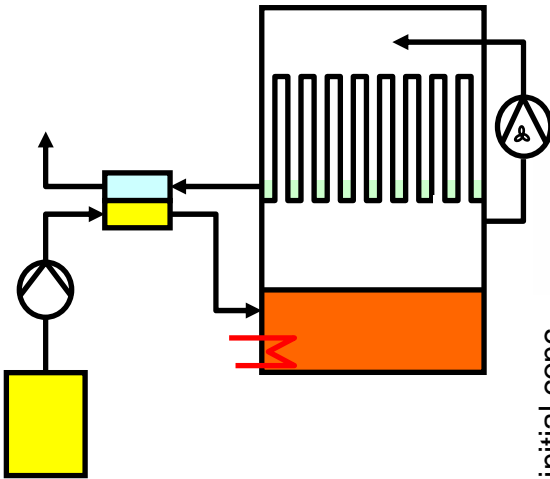


Strompen et al.
6 (2003)

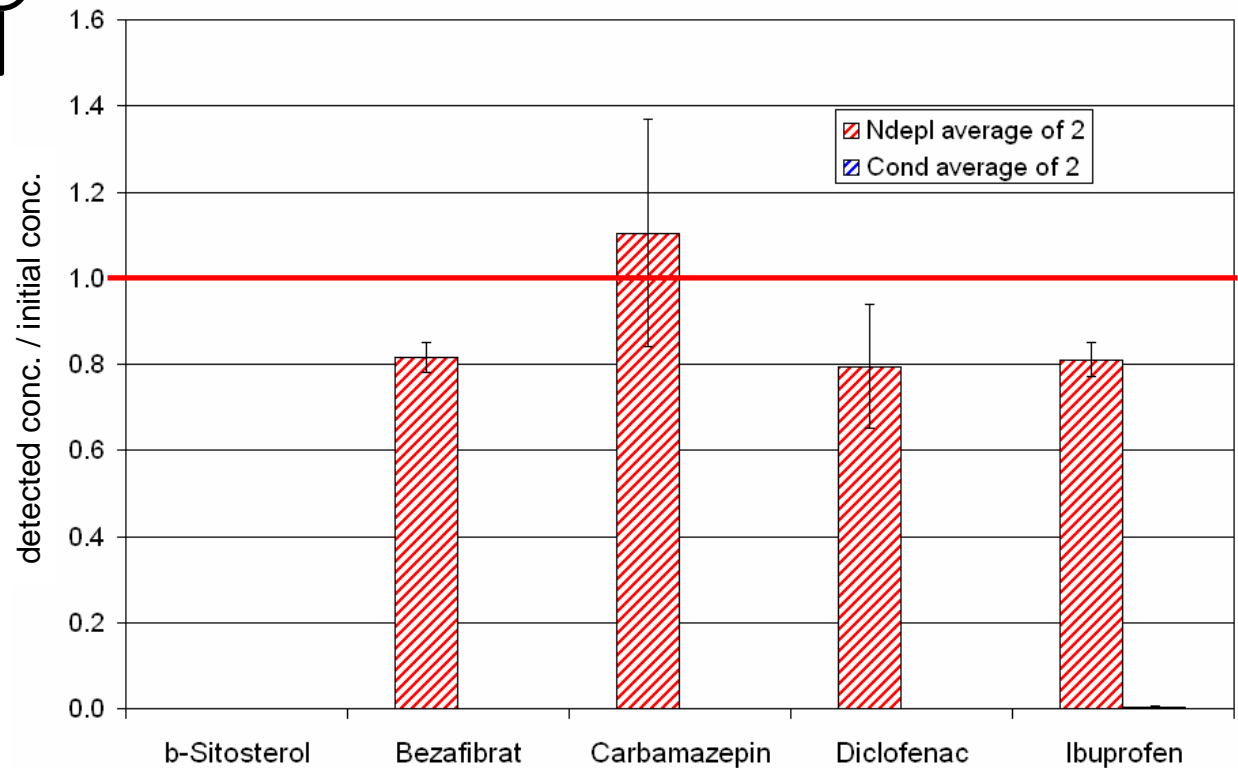
Degradation in storage tank



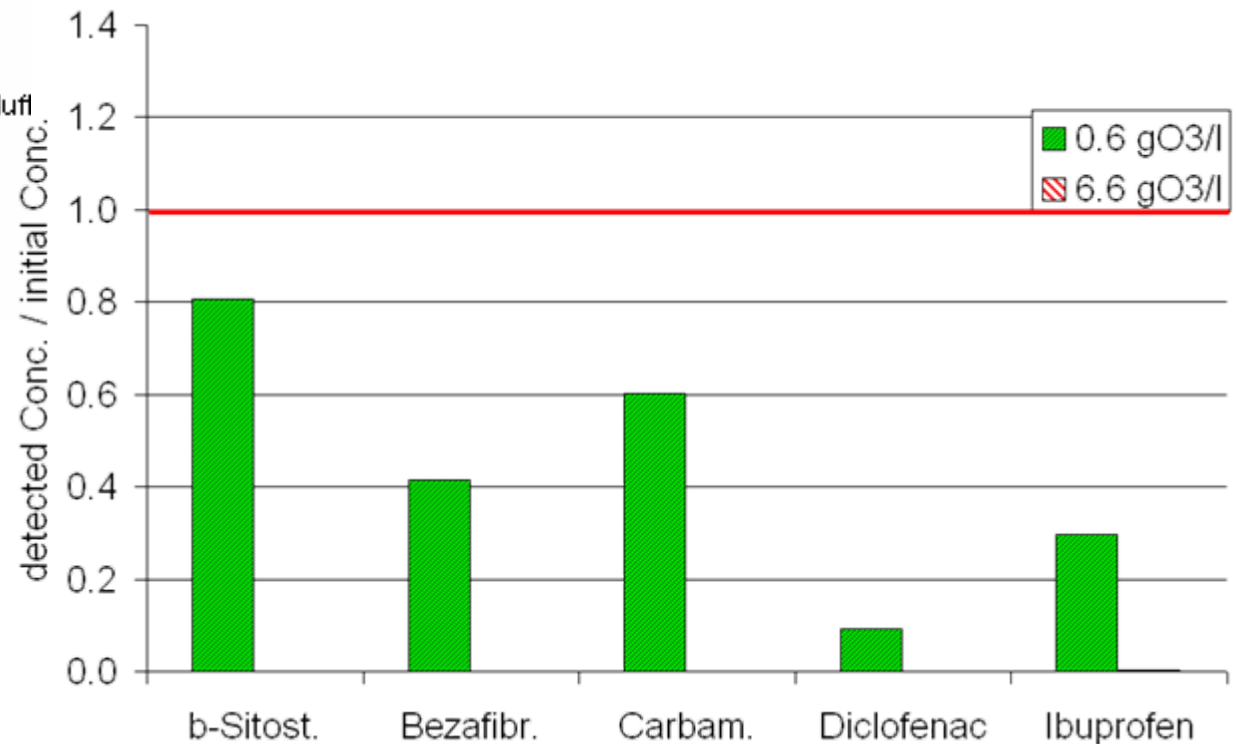
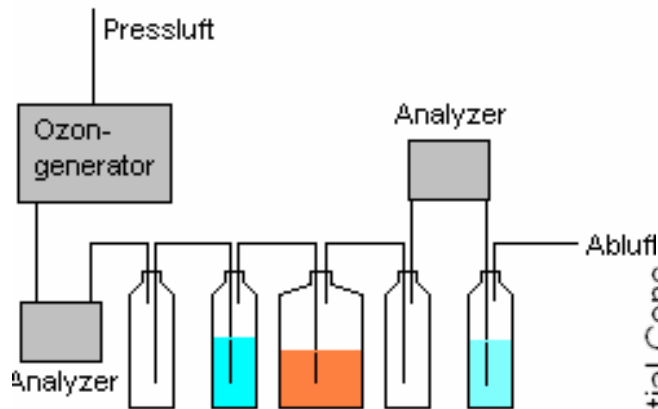
Treatment of urine – steam stripping



Results of:
Tettenborn, F. (2006)



Treatment of urine - ozonisation



Results of:
Tettenborn, F. (2006)