SewageLCI 1.0 - A first generation inventory model for quantification of chemical emissions via sewage systems. Application on chemicals of concern

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SewageLCI 1.0 – A first generation inventory model for quantification of chemical emissions via sewage systems. Application on chemicals of concern.

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Introduction / Model setup

The **inventory model SewageLCI** help life cycle assessors to handle lack of inventory data for chemicals emissions trough WWTP. The basic setup of the model framework, assumes that all **waste water emissions can be split in three main flows** (Figure 1.)

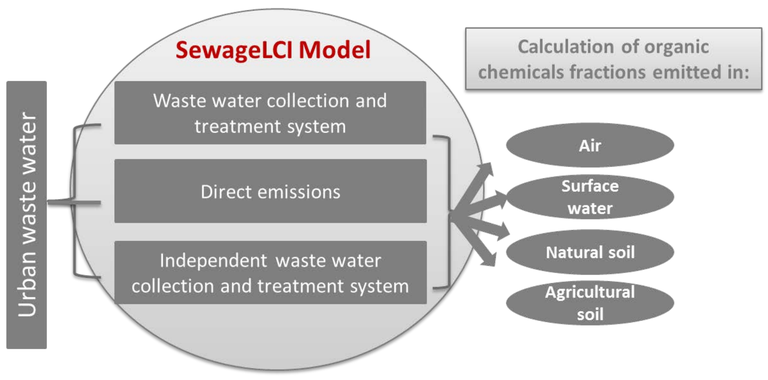


Figure 1. Model setup of Sewage LCI.

- The modelling of the fate processes taking places during primary and secondary treatment is modeled by the STP model [1].
- Percentage of the population connected to the three waste water handling typology is national specific [2] [3].
- The urban waste water systems are assumed to consist of the urban waste water collecting system (UWWCS) and the urban waste water treatment system.

Case study specifications

Emissions patterns of 6 chemicals of concern (Table 1) were evaluated using the Sewage LCI 1.0 model. **Human toxicity and aquatic ecotoxicity was calculated using USEtox characterization factors** [4].

CAS number	Compound name
103-90-2	Paracetamol
57-63-6	Ethinyl estradiol
56-53-1	Diethylstilbestrol
81-81-2	Warfarin
110-00-9	Furan
639-58-7	Triphenyltin chloride

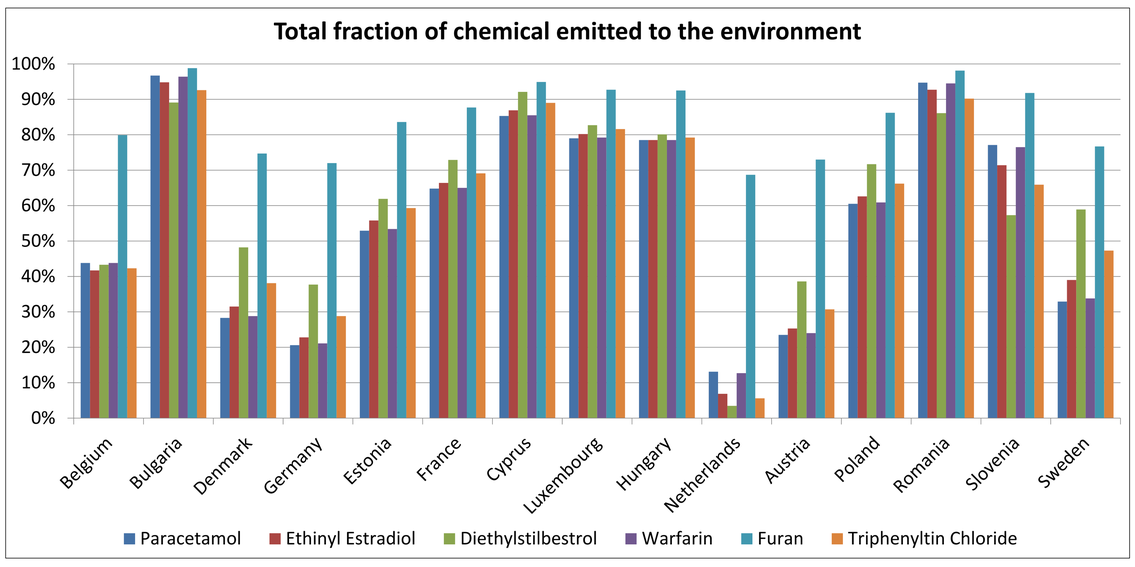
Table 1. Chemicals selected for the case study

- Chemicals parameters are mostly provided by the EPI Suite™ tool [5].
- Two scenarios have been compared regarding reuse of effluent from primary treatment for irrigation of arable land.

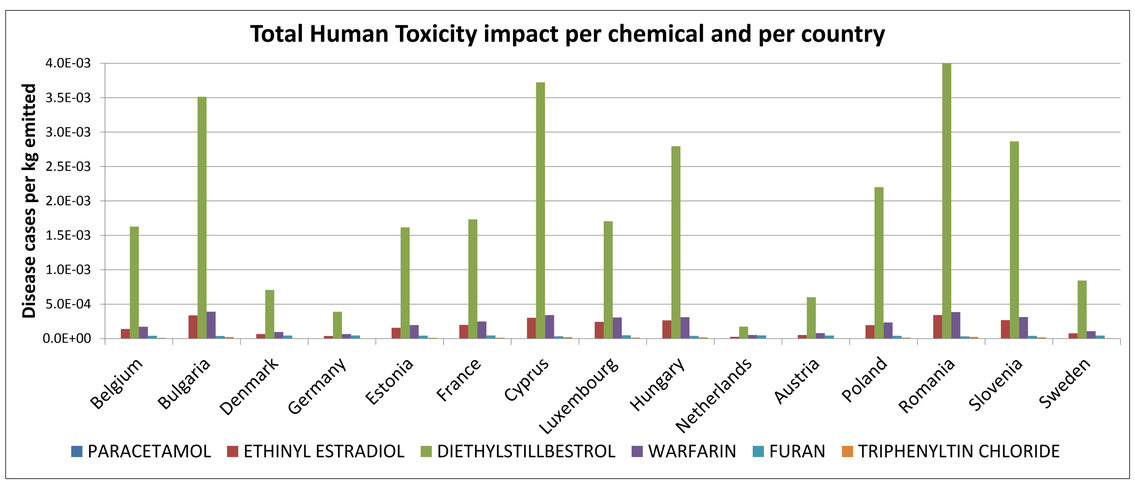
Results

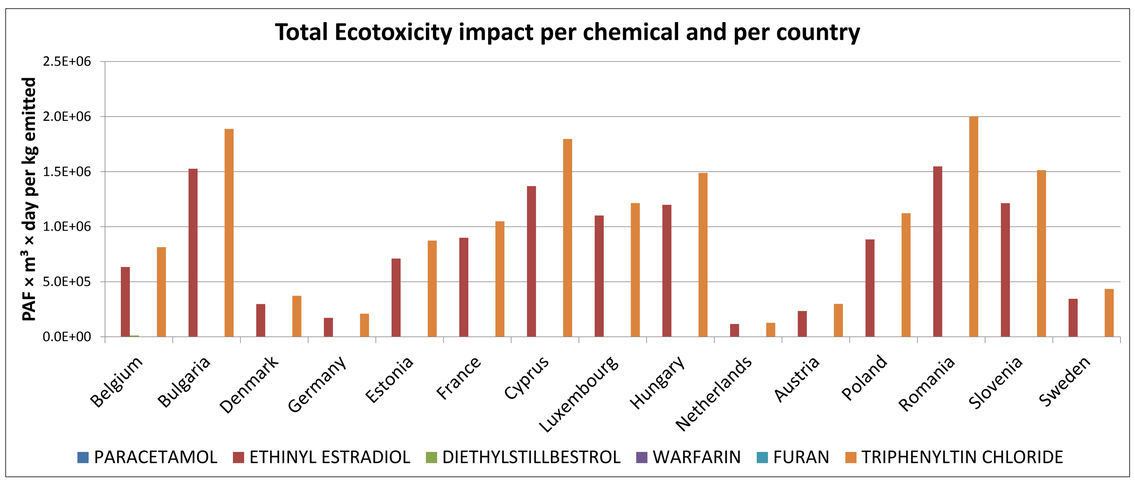
- The results indicate that the total emission fraction of a chemical may vary as much as up to one order of magnitude across the 15 countries included in the case study.
- The reuse of treated waste water for irrigation does not change the global emitted fraction to the environment. A different distribution between fraction emitted to agricultural soil and to surface water is then observed.

- The major emission route is by emission to surface water for all chemicals except for Furan which is urban air. Few chemicals have emissions to urban air due to they low volatibility.



- The impact potential trend reveal that diesthylsbestrol is the chemical causing the largest human toxicological impact and that ethinyl estradiol and triphenyltin chrloride are causing the largest ecotoxicological impact. However, paracetamol which is strongly emitted to the environment after WWTP (up to 96,7% for Bulgaria) show low impact compared to the others chemicals.





Conclusion

Despite SewageLCI 1.0 simulates national and hence theoretical average European waste water treatment grids, it is concluded that **the model provides the best possible general mean for including emissions of chemicals with wide and dispersive use in LCAs.**

References

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