

Integrating slow-release behaviour of encapsulated plant protection products into EU regulatory leaching assessment: Current knowledge and regulatory challenges



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Evidence from regulatory studies indicates that CS-specific slow-release behaviour can reduce groundwater leaching risk and should be considered in EU leaching assessment

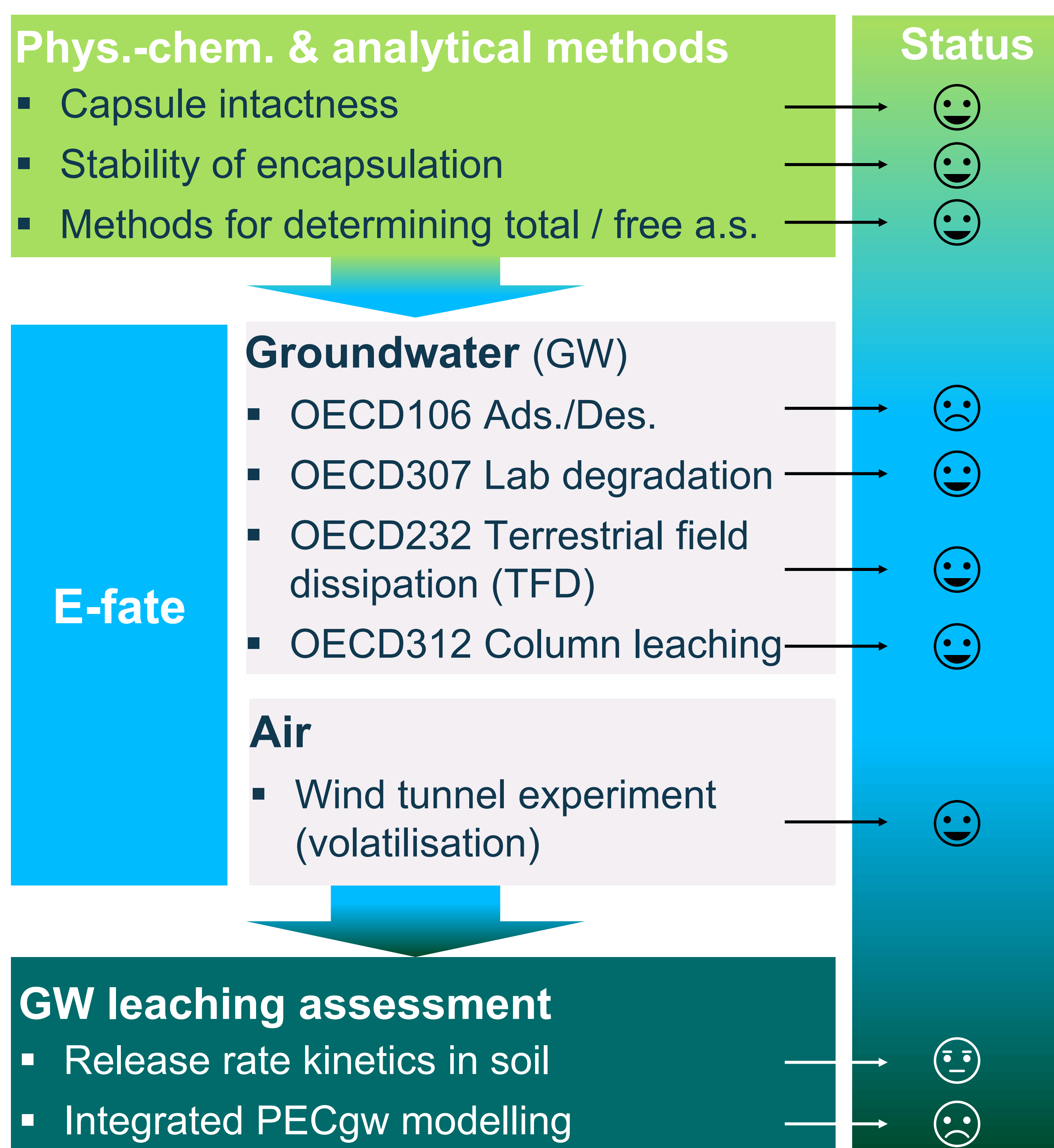
Introduction

Capsule suspension (CS) formulations embed active substance (a.s.) in a polymer matrix, improving efficacy and modifying risk profiles. Increasing evidence shows that CS formulations exhibit slow-release behaviour, which can influence environmental fate and reduce leaching potential. However, this controlled-release behaviour is not explicitly considered in current EU groundwater exposure assessments. Here, we reviewed EU regulatory dossiers to synthesize knowledge on the impact of slow-release behaviour of CS formulations on groundwater exposure and to raise regulatory awareness that current leaching assessments may overestimate groundwater risk of CS-formulated plant protection products (PPPs).

State of Regulatory Knowledge

Limited a.s. with CS as representative PPPs

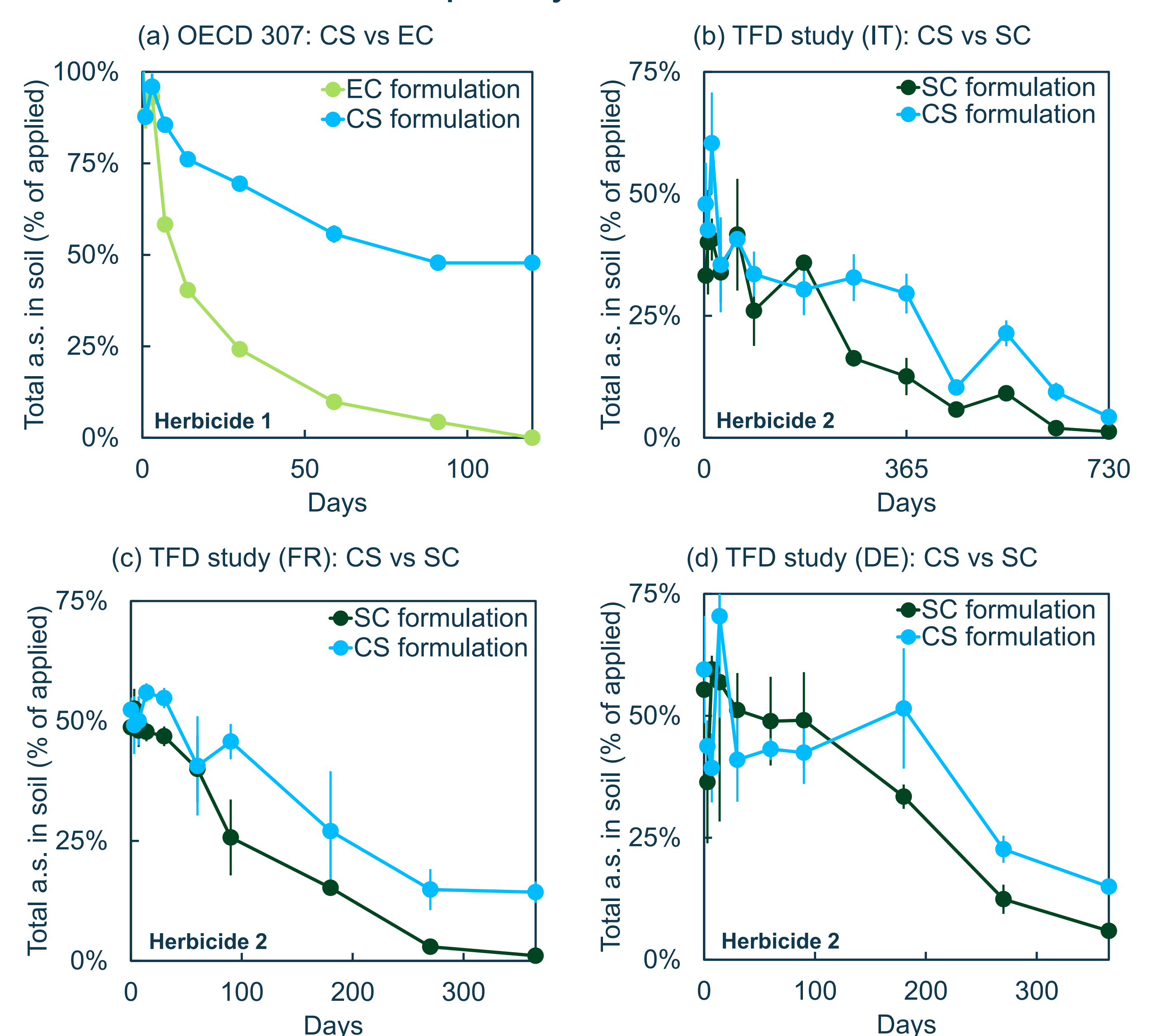
None individually covered all CS-specific studies relevant in the current EU framework. Collectively, most key studies were covered (😊), with missing types either covered by scientific literature (😐) or not covered at all (😞). An overview is presented in the figure below:



Evidence on Slow-Release Behaviour

Consistent with slow release, higher percentages of applied a.s. in soil over time were observed for CS compared with SC/EC in regulatory lab and field studies:

- In an OECD 307 study comparing EC and CS (Fig.a), apparent half-lives of CS were 10-times higher than EC
- In EU TFD studies, CS showed release-limited dissipation in long-term (Fig. b-d). Metabolites were at trace levels, less frequently detected in CS than in SC



Outlook and Challenges

Experimental:

- Quantification of encapsulated and free a.s. in soil
- Degradation and mobility of capsules in soil
- Bioavailability of encapsulated and free a.s. to soil (micro) organisms

CS formulation:
▪ Slow release → Higher persistence in soil
▪ Lower leaching to GW

? How to bridge

SC/EC formulation:
▪ Normal release in soil
▪ Higher leaching to GW

Current EU leaching assessment

Modelling:

- Integration of release kinetics into EU FOCUS GW models

Overall:

Leaching assessment should allow the consideration of (CS) slow release in a tiered approach