



Active packaging: controlled release of microbial agents from packaging materials

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ACTIVE PACKAGING: CONTROLLED RELEASE OF MICROBIAL AGENTS FROM PACKAGING MATERIALS

Mia Kurek, Valerie Guillard, Nathalie Gontard



NextGenPack

Next generation of advanced active and intelligent bio-based packaging for food



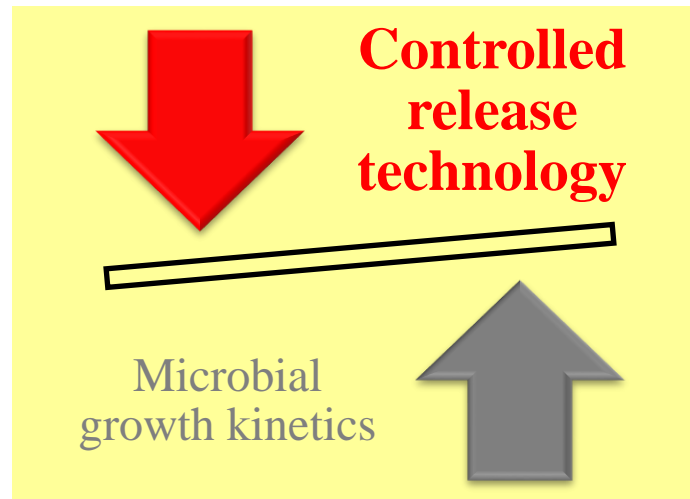
ACTIVE ANTIMICROBIAL PACKAGING

How to create an optimised AP?

AC mass transfer rate \ll MO growth rate

$$C_{AC} < C_{critical}$$

MO will grow instantly, before AC is released



AC mass transfer rate \gg MO growth rate

$$C_{AC} > C_{critical}$$

→ activity

Active NGP film design



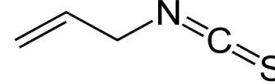
BioPE or PLA film



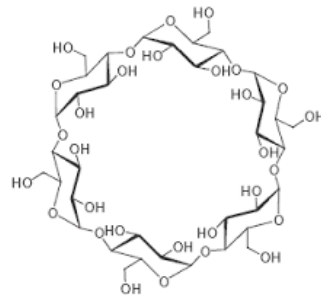
Active volatile compound

encapsulation

Allyl isothiocyanate



Why AITC?
strong AM activity
in vapour state



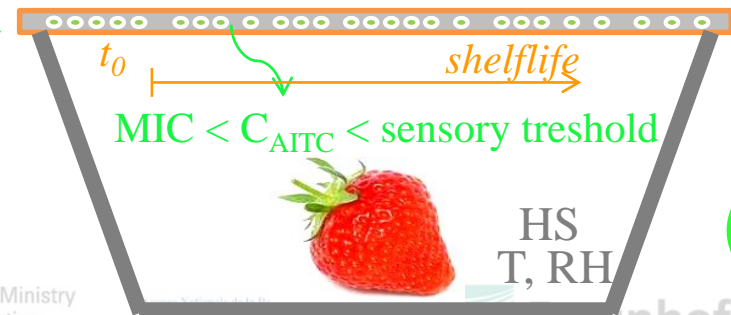
Why β cyclodextrine?

- Protection against thermal degradation
- To avoid premature release
- AC release $\rightarrow f(\text{headspace RH})$



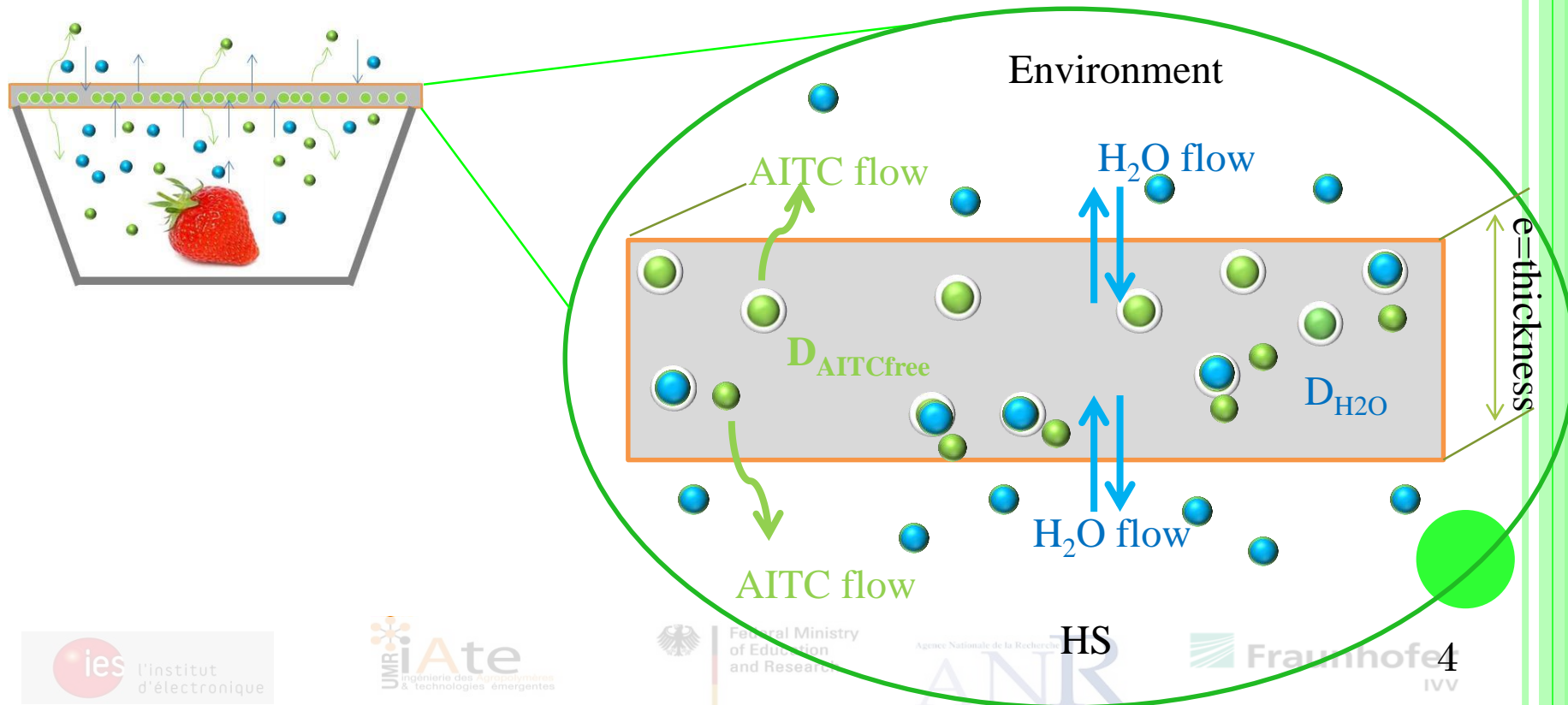
Active BioPE or PLA film

Environment T, RH



STEPS

- To model H_2O transfer into active film
- To model the release of AITC from β -CD as function of RH
- To model AITC transfer through active film
- To couple mass transfers & AITC release kinetic to predict AITC release into HS



OUTPUTS:

→ allows calculation of active complex needed for the optimisation of packaging design

✓ evolution of AITC in the HS allows to determine the activity profile → $C_{aitc} > MIC$

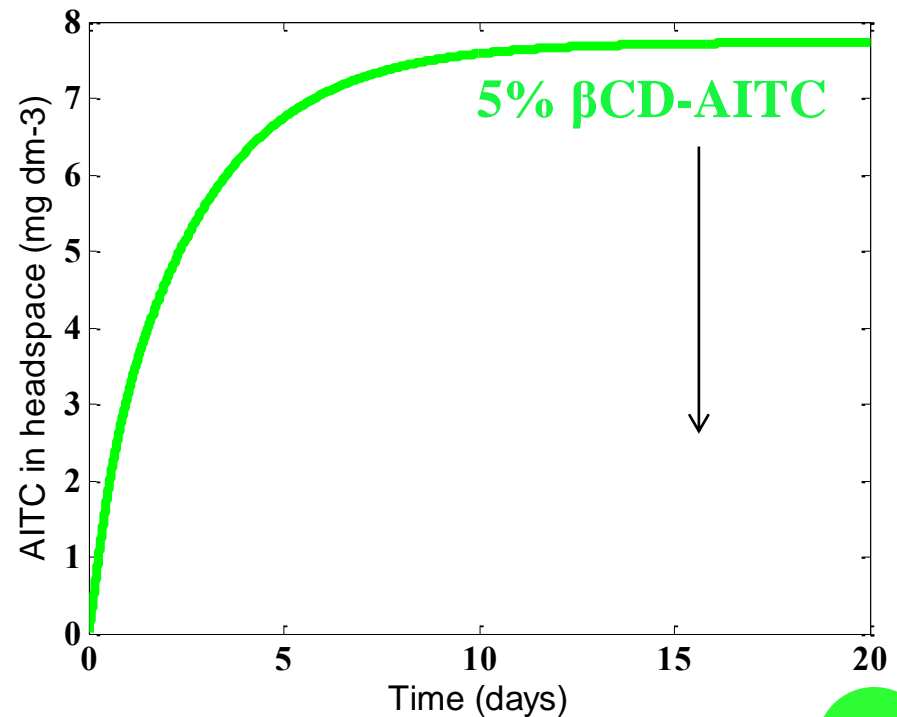
Example:

BioPE



By changing:

Film composition



OUTPUTS:

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✓ evolution of AITC in the HS allows to determine the activity profile → $C_{aitc} > MIC$

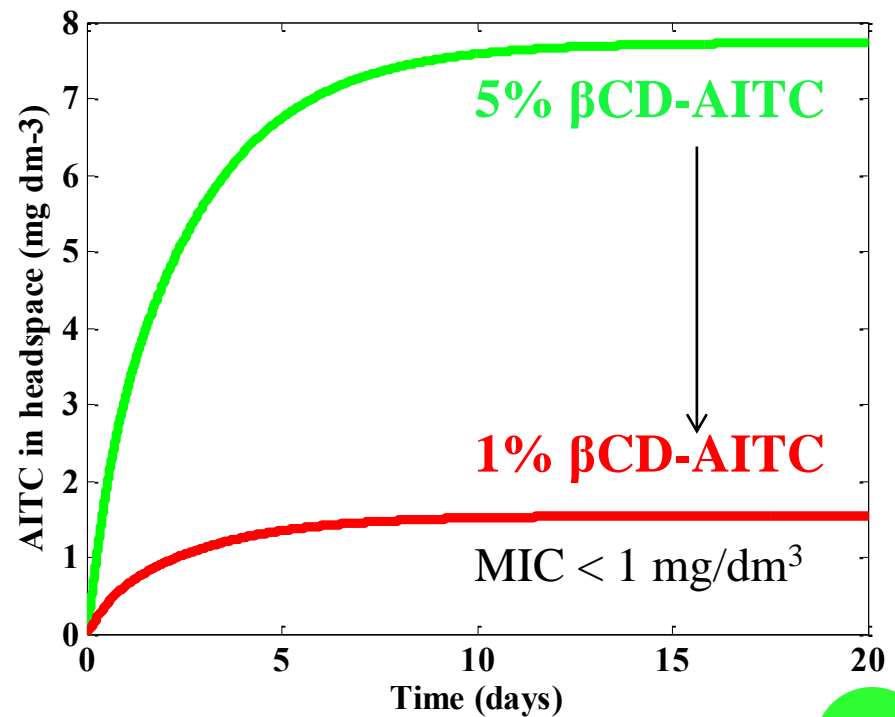
Example:

BioPE



By changing:

Film composition



OUTPUTS:

→ allows calculation of active complex needed for the optimisation of packaging design

✓ evolution of AITC in the HS allows to determine the activity profile → $C_{aitc} > MIC$

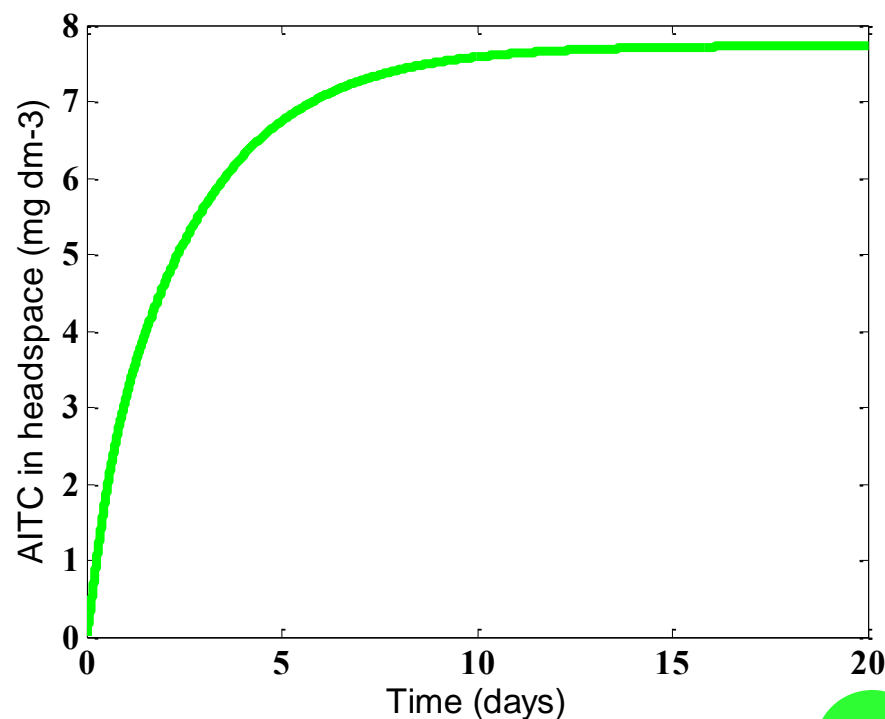
Example:

BioPE



By changing:

Film composition
Headspace volume



OUTPUTS:

→ allows calculation of active complex needed for the optimisation of packaging design

✓ evolution of AITC in the HS allows to determine the activity profile → $C_{aitc} > MIC$

Example:

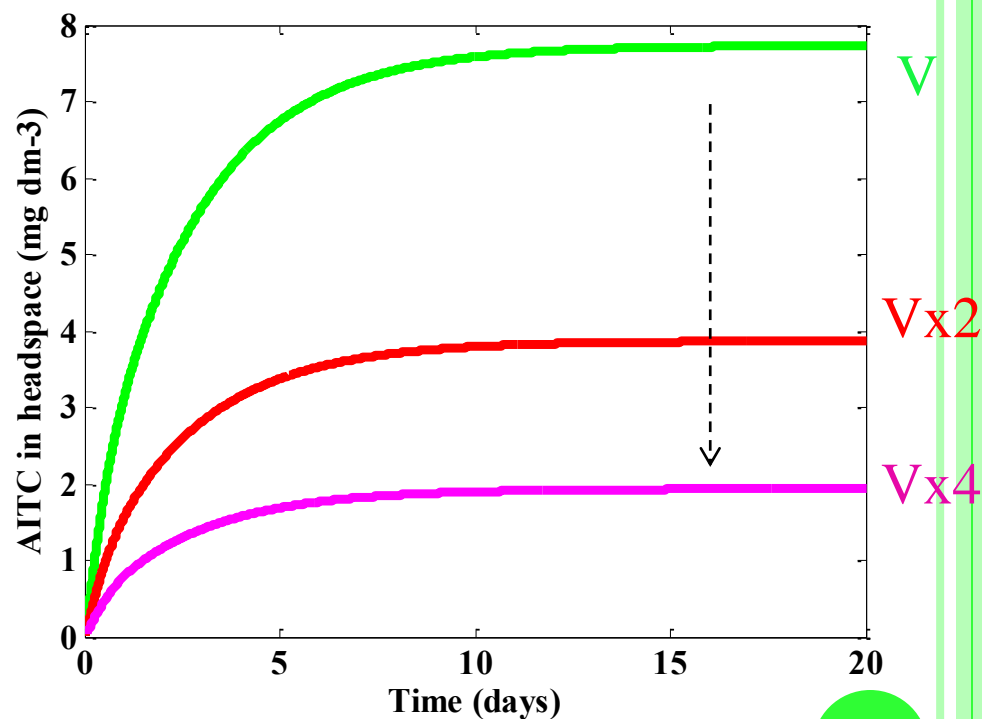
BioPE



By changing:

Film composition

Headspace volume



OUTPUTS:

→ allows calculation of active complex needed for the optimisation of packaging design

✓ evolution of AITC in the HS allows to determine the activity profile → $C_{aitc} > MIC$

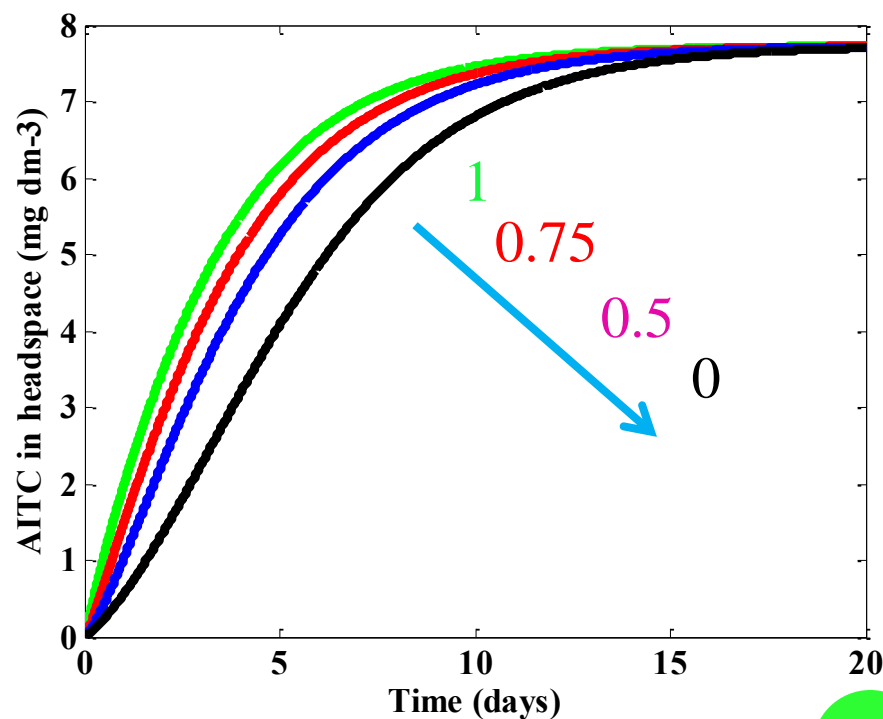
Example:

BioPE



By changing:

Film composition
Headspace volume
 a_w of the HS



CONCLUSIONS

- 1) **Developed mathematical model successfully describes controlled release of AC in the HS in order to reach MIC**
- 2) **The rate of release depends on the moisture content of the system**
- 3) **H₂O and AC distribution profiles can help in understanding the release kinetics**
- 4) **The model can be used to optimise design of active packaging**



Thank you for your attention
