Active packaging: controlled release of microbial agents from packaging materials

Mia Kurek, Nathalie N. Gontard, Valérie Guillard

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

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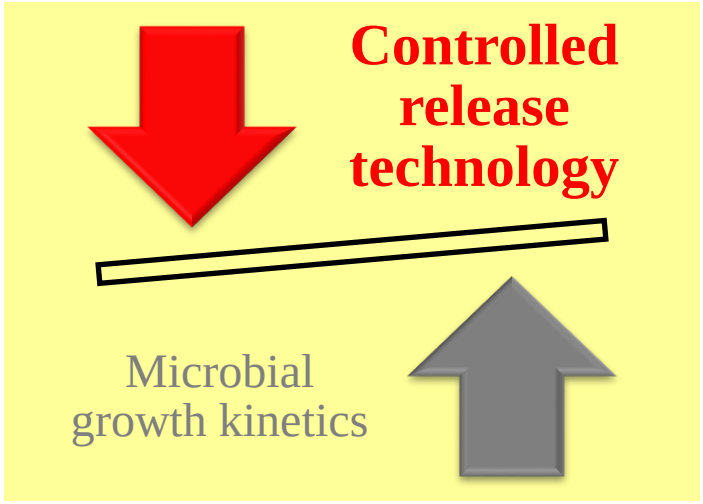
ACTIVE ANTIMICROBIAL PACKAGING → How to create an optimised AP?

AC **mass transfer rate** « MO growth rate

$C_{AC} < C_{critical}$

MO will grow instantly, before AC is released



AC **mass transfer rate** » MO growth rate

$C_{AC} > C_{critical}$

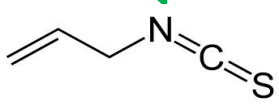
→ activity

Active NGP film design

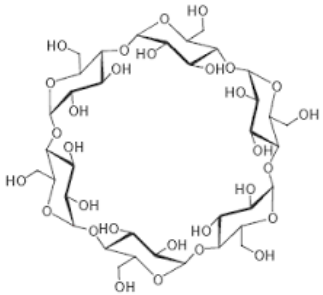
BioPE or PLA film Active volatile compound

encapsulation

Allyl isothiocyanate



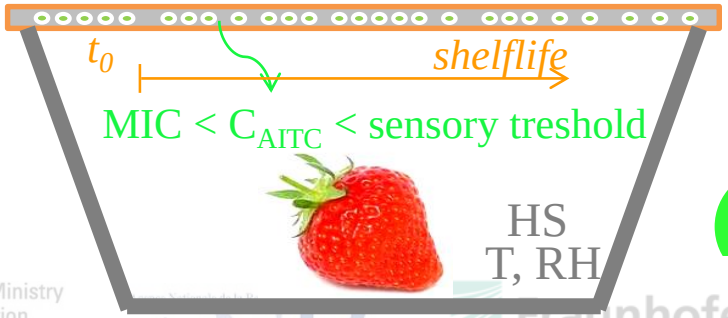
Why AITC?
strong AM activity in vapour state



Why β cyclodextrine?
- Protection against thermal degradation
- To avoid premature release
- AC release → *f* (headspace RH)

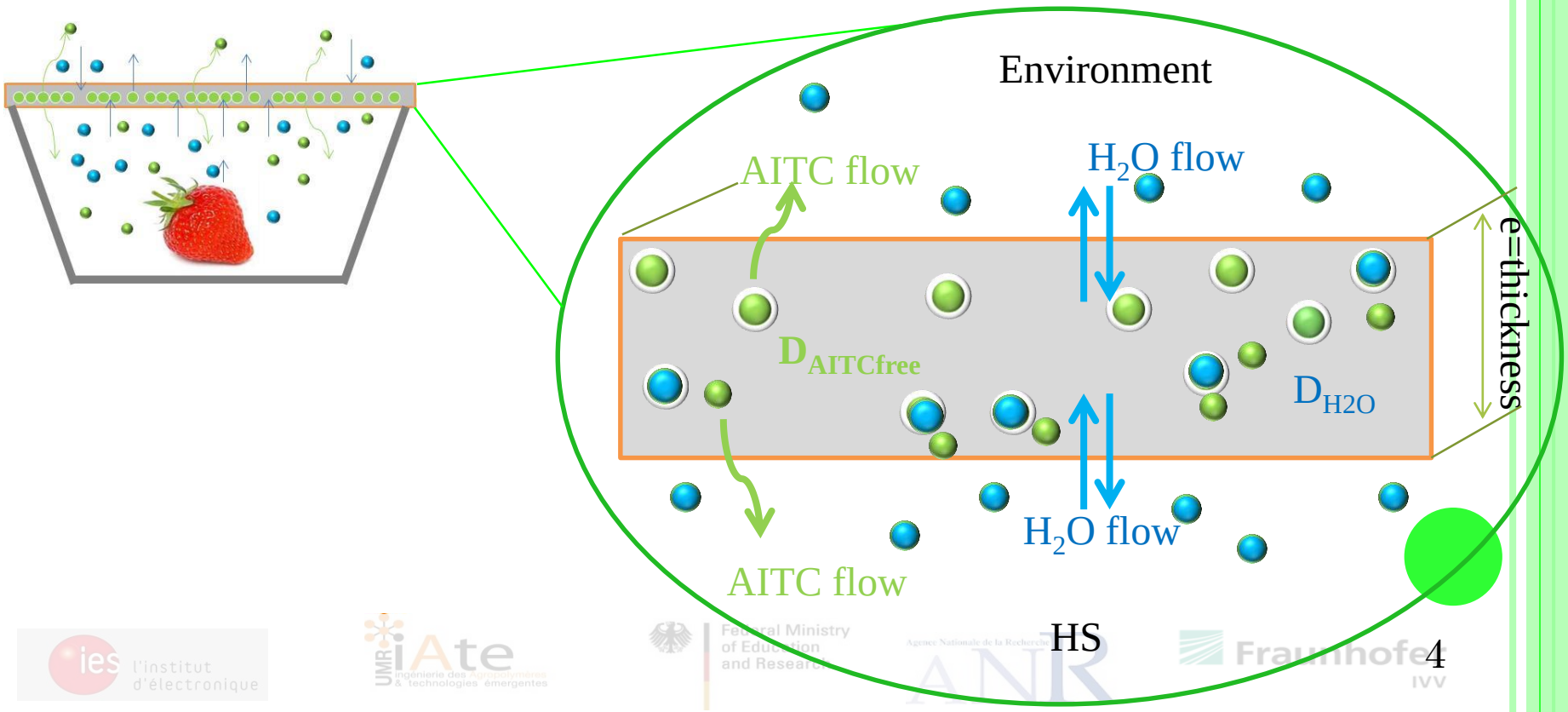
Environment T, RH

Active BioPE or PLA film



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

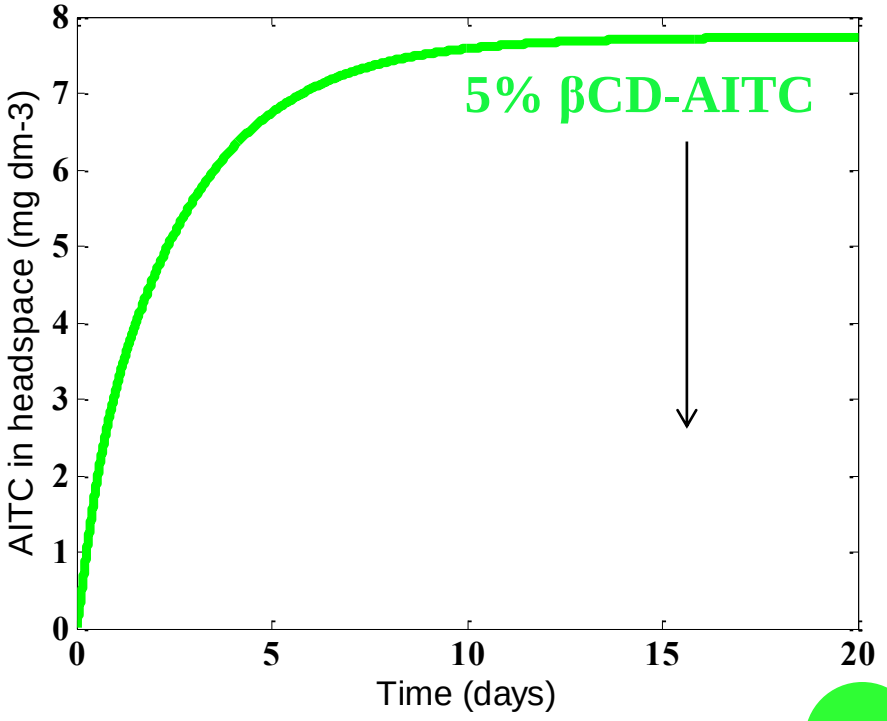
✓ evolution of AITC in the HS allows to determine the activity profile → C_{aitc} > MIC

Example:

BioPE

By changing:

Film composition



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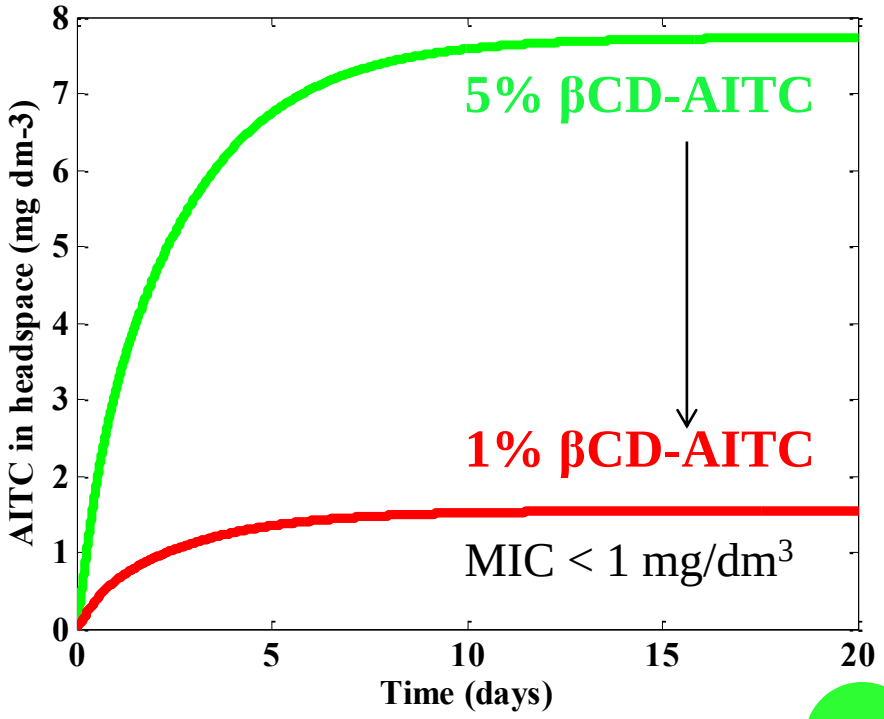


OUTPUTS:

→ 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

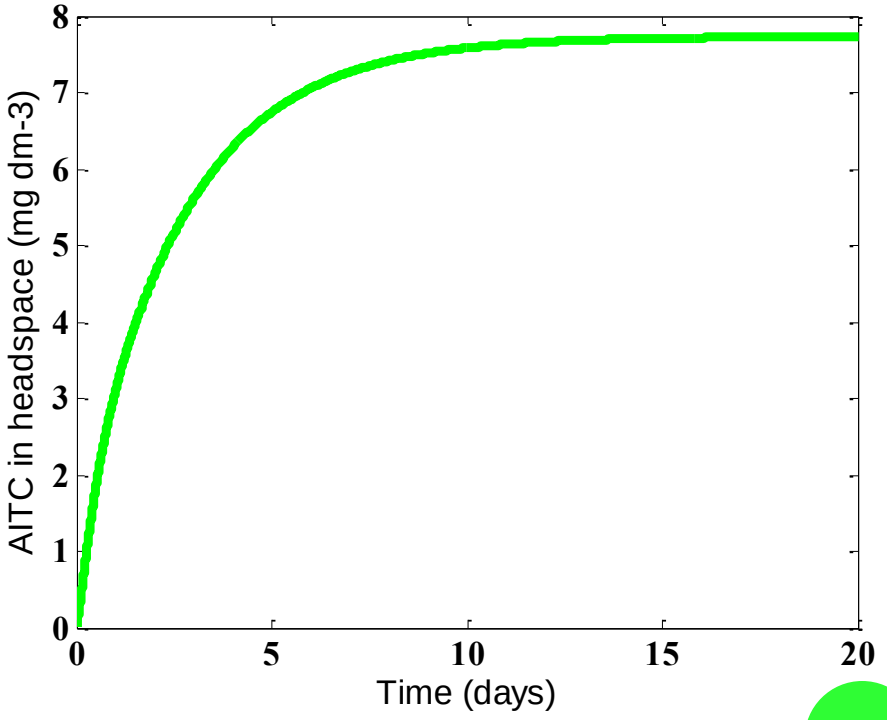
Example:

BioPE

By changing:

Film composition

Headspace volume



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By changing:

Film composition

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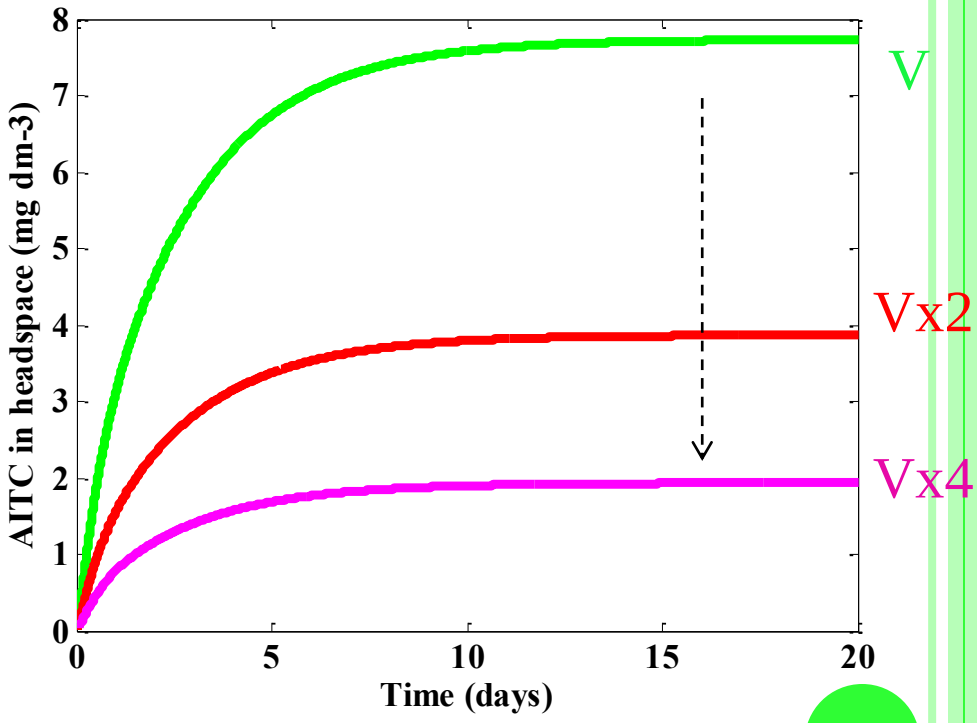

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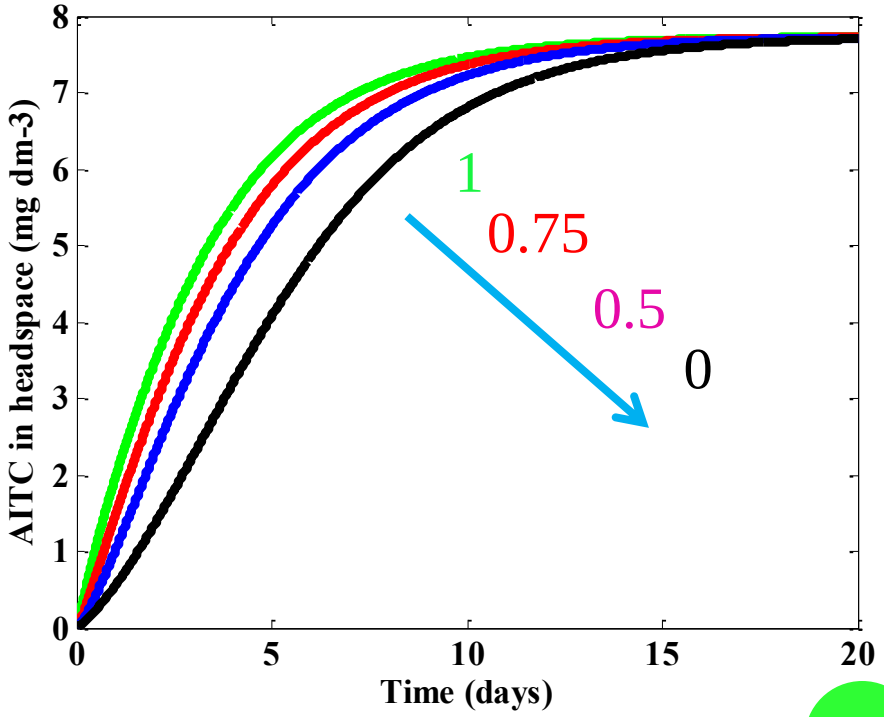
Example:

BioPE

By changing:

- Film composition
- Headspace volume
- a_w of the HS



CONCLUSIONS

1) Developed mathematical model succesfully 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) H_2O 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