

# Chemical food safety related to using supermarket returns for rearing *Hermetica illucens* for feed and food uses

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# 1. Introduction

- Black soldier fly larvae (BSFL, *Hermetia illucens*) capable of converting organic waste materials
- Potential substrate: former food products (FFP)
  - “Food produced for human consumption, but which is no longer intended for human consumption due to reasons such as expired use-by date or due to problems of manufacturing or packaging defects”.<sup>1</sup>
- Legal EU: allowed, but without meat/fish<sup>2</sup>
- Packaging materials in FFP: prohibited<sup>3</sup> but zero tolerance ‘practical nor proportionate to the risk’.<sup>4</sup>
- Risk of packaging: leaching chemical contaminants

1: Regulation (EU) No 68/2013, Annex, Part A, point 3

2: Regulations (EC) No 999/2001, Article 7(2); No 142/2011, Annex X, Chapter II, Section 10; No 1069/2009, Article 10(f)

3: Regulation (EC) No 767/2009, Annex III, Chapter 1: Prohibited materials, point 7.

4: ACAF (2013). Information paper: Traces of packaging material in feed derived from former foodstuffs. <https://www.aictradeassurance.org.uk/latest-documents/acaf-13-05-paper-packaging-in-surplus-foods/acaf-13-05-paper-packaging-in-surplus-foods.pdf>

## 2. Methodology

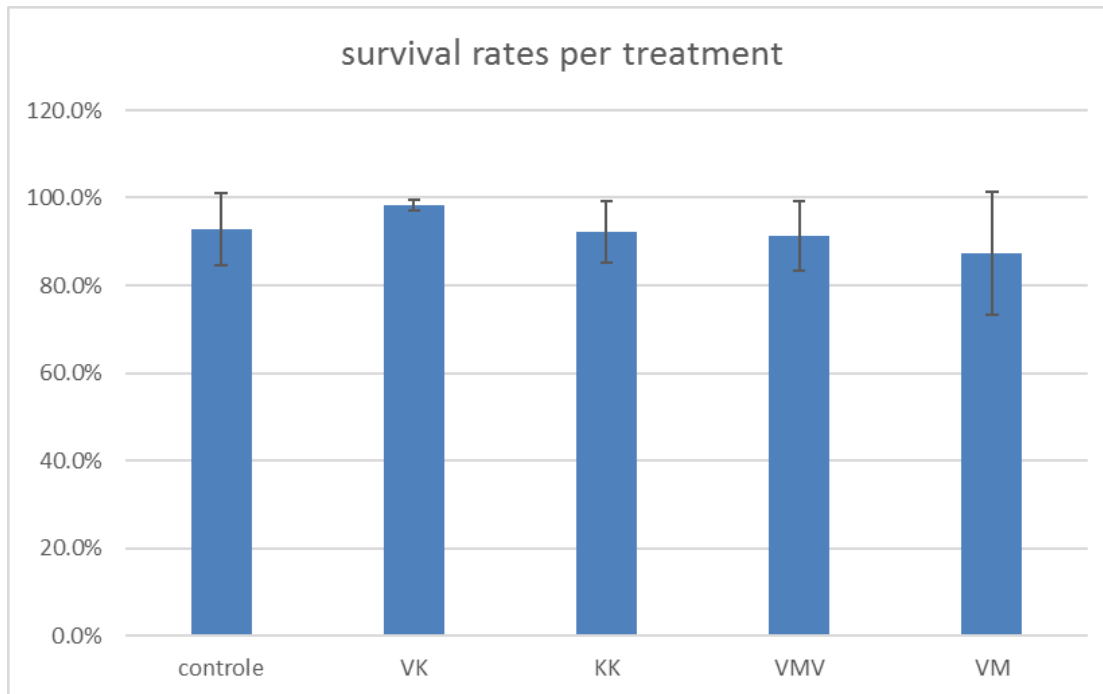
- 4 treatments + control
- Each in triplicate

<b>Packaging material</b>		
<b>Matrix</b>	<i>Plastic</i>	<i>Carton</i>
<b>Meals with meat</b>	MP	MC
<b>Vegetarian meals</b>	VP	VC

- BSF: day 4 – 10 (1<sup>st</sup> prepupae)
- Chemical analyses: feed, larvae, residual material
  - Heavy metals (Cd, Pb, As, Hg)
  - Mineral oil hydrocarbons
  - Dioxins (WHO-PCDD/F-TEQ) and PCBs
  - Polycyclic aromatic hydrocarbons (PAH)
- Bioaccumulation factor (BAF) = [larvae] / [substrate]

# 3: Results: larval growth + survival

- No differences in growth and survival between the different treatments groups



# 3. Results: heavy metals

- Concentrations all samples: <MRL for heavy metals
- As + Hg: <LOQ for all samples
- Pb:
  - Larvae: 0.06 – 0.19 mg/kg (treatments)
  - Feed: <LOQ
  - BAF >1
- Cd:
  - Larvae: 0.27-0.55 mg/kg (treatments)
  - BAF:

Treatment	BAF (Cd)
MC	15.4 ± 1.12
VC	20.0 ± 1.27
MP	7.73 ± 0.91
VP	7.06 ± 1.86

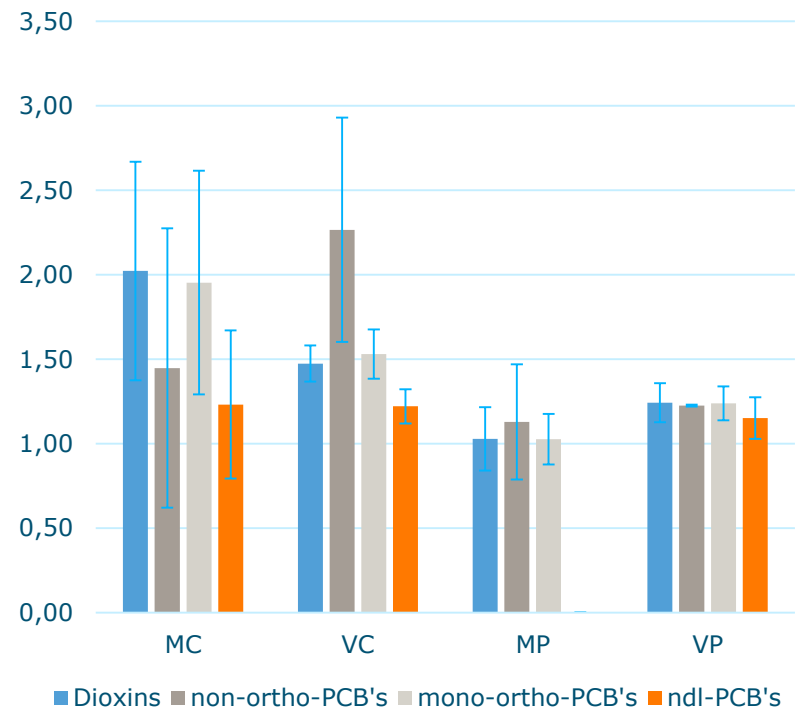
# 3: Results: dioxins + PCBs

Larval concentration

Treatment	Dioxins	Non-ortho PCBs	Mono-ortho PCBs	Ndl-PCBs
C	0.26 ± 0.03	0.09 ± 0.04	0.36 ± 0.03	0.40 ± 0.22
MC	0.35 ± 0.09	0.03 ± 0.02	0.38 ± 0.11	0.32 ± 0.11
VC	0.29 ± 0.04	0.04 ± 0.01	0.33 ± 0.06	0.28 ± 0.03
MP	0.23 ± 0.02	0.02 ± 0.00	0.25 ± 0.02	0.28 ± 0.01
VP	0.25 ± 0.02	0.03 ± 0.00	0.28 ± 0.02	0.29 ± 0.04

**All concentrations <MRL**

Bioaccumulation factor dioxins + PCBs



BAFs for dioxins and mono-ortho PCBs differ between treatment groups

# 3. Results: mineral oil + PAH

## Mineral oil hydrocarbons:

- Larvae:  $503.33 \pm 101.3$  mg/kg
- BAF:  $5.05 \pm 1.24$
- No differences between results M/V nor P/C

## Polycyclic aromatic hydrocarbons (PAH16)

- Larvae:  $2.03 \pm 0.17$   $\mu\text{g}/\text{kg}$
- BAF:  $0.93 \pm 0.30$
- No differences between results M/V nor P/C

## No feed MRL for mineral oil / PAH

# 4. Discussion

- High Cd bio-accumulation (7-20): higher than previous findings
  - Van der Fels-Klerx et al. (2016):  $9.5 \pm 3.6$
  - Diener et al.(2015):  $2.94 \pm 0.09$
- Meat/vegetarian:
  - Larval PAH16 slightly higher in V; opposite for Cd (higher in M)
- Carton/plastic:
  - Higher BAFs for Cd, dioxins, mono-ortho PCBs for C vs P



# 5. Conclusions

## **For BSFL, FFP containing up to 3.5% packaging (carton/plastic):**

- No negative effects BSF growth / survival
- Concentrations analysed contaminants <MRL for feed
- Mean BAF>1 for almost all contaminants, except PAH16
- *Meat/vegetarian*: little differences between results
- *Carton/plastic*: higher BAF for C vs P

# Acknowledgements

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