Stability and safety of wastes-based packaging materials
(EcoBioCAP-WP 4)
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Stability and safety of wastes-based packaging materials (EcoBioCAP - WP 4)

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Objective

To investigate the suitability of packaging materials developed in EcoBioCap as food contact materials (INRA, FRAUNHOFER, CSIC, UNIROMA)

MATERIAL STABILITY
Structural, physico-chemical & microbiological

FOOD SAFETY
Related to raw materials and final packagings

Under food contact conditions
Study case: PHBV / Wheat straw fibres biocomposites

**MATRIX** = PHBV

**FILLER** = Wheat straw fibres

100 microns
Overall migration in Liquid Food simulants

PHBV (Tianan)

Liquid Food Simulants:
- Water
- Acetic acid 3% (w/v)
- Ethanol 20% (v/v)
- Ethanol 95% (v/v)
- Isooctane
- Olive oil


Overall migration (mg/dm²)

10 days, 40°C
Overall migration in Liquid Food simulants

PHBV (Tianan) + 20 wt% wheat straw fibers ($d_{50} = 150 \mu m$)

<table>
<thead>
<tr>
<th>Liquid Food Simulant</th>
<th>Overall Migration (mg/dm²)</th>
<th>PHBV</th>
<th>PHBV/20WSF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>-0.28</td>
<td>✔️</td>
<td>✗</td>
</tr>
<tr>
<td>Acetic acid 3% (w/v)</td>
<td>0.77</td>
<td>✔️</td>
<td>✗</td>
</tr>
<tr>
<td>Ethanol 20% (v/v)</td>
<td>3.50</td>
<td>✔️</td>
<td>✗</td>
</tr>
<tr>
<td>Ethanol 95% (v/v)</td>
<td>9.20</td>
<td>✔️</td>
<td>✗</td>
</tr>
<tr>
<td>Isooctane</td>
<td>0.80</td>
<td>✗</td>
<td>✔️</td>
</tr>
<tr>
<td>Olive oil</td>
<td>-1.07</td>
<td>✔️</td>
<td>✗</td>
</tr>
</tbody>
</table>

10 days, 40°C
Challenge tests & specific migration using surrogates

Surrogates = molecules representative of migratable substances

- **PESTICIDES**
  - **STEP 1**: Enriching with surrogates
  - **STEP 2**: Extraction of surrogates (at each step of the process in the case of challenge tests)
  - **STEP 3**: Analysis

- **PACKAGING ADDITIVES**
Toxicological risks of wheat straw fibres?

• **Epoxiconazole**: the most used fungicide
  - Acceptable Daily Intake (ADI) = 0.008 mg/kg body weight and per day, i.e. 0.56 mg/day for a human of 70 kg
  - Median residue in wheat straw: 2.71 mg/kg of wheat straw (EFSA, 2008)

• **Worse case of migration for PHBV/wheat straw fibres trays**
  - Trays (30g, 140x130x35 mm³, i.e. 3.7 dm²) in full contact with food
  - 20 wt% of wheat straw fibres
  - Maximal quantity of migratable epoxiconazole = 0.026 mg/kg of food
  - This would mean that a daily ingestion of more than 21 kg of food in contact with this kind of packaging... to reach the value of 0.56 mg/day

• **Taking into account the decontamination efficiency (≈80%)**
  - This would mean that a daily ingestion of more than 88 kg of food in contact with this kind of packaging... to reach the value of 0.56 mg/day
Conclusions

- **Wheat straw fibres = no safety concern**: Up to 80% of decontamination of surrogates + if the remaining quantity migrated integrally from the packaging towards the food, it did not represent any danger for human health (<ADI)

- **Inertness of PHBVs**: Can be used as food contact materials for all types of food.

- **Stability negatively affected by the addition of wheat straw fibres**: Can be used as food contact materials only for low or intermediate water activity products and/or fat products.
QUESTIONS ?