Fate of nanopesticides in soil

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Acknowledgments

Experimental work

Gareth Bryning, Joe Turton, Phil Rushworth, Phil Rooney, Agnieszka Dudkiewicz

Petra Körner, Patrick Machinski

Scientific advice and practical support

Abdul Abu, Sara Monteiro, Karen Tiede

Frank von der Kammer
“Potential to reduce contamination through the reduction in application rates and limited runoff”
ETC, 2004

“Increased toxicity, bioavailability and longevity […] new kinds of contamination”
E.g. Friend of the Earth, 2008

“will revolutionize agriculture and food systems”
Joseph and Morrison, 2006

Nanopesticides = intentional diffuse inputs of ENPs into the environment
>3000 patents,
>100 peer-reviewed papers and reports

→ What are Nanopesticides?
→ Consequences on environmental fate?
→ Is current regulatory framework ready?

Kah et al. (2013)
**What are Nanopesticides?**

Wide **variety** of products (development, ingredients, size, relevance etc…)

<table>
<thead>
<tr>
<th>Increase solubility</th>
<th>Slow release</th>
<th>Nano metals/oxides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nanoemulsion</td>
<td>Polymer-based</td>
<td>Porous hollow silica</td>
</tr>
<tr>
<td>Nanodispersion</td>
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</tbody>
</table>

**Environmental fate?**

Little data available. An effect is expected…which effect? How long?

Are typical experimental protocols suitable?
<table>
<thead>
<tr>
<th></th>
<th>herbicide</th>
<th>insecticide</th>
<th>fungicide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koc (L/kg)</td>
<td>100</td>
<td>236 610</td>
<td>850</td>
</tr>
<tr>
<td>DT50 (d)</td>
<td>28-150</td>
<td>54-174</td>
<td>0.3-87</td>
</tr>
</tbody>
</table>

(Footprint database)
2 agricultural soils (OC%, clay)

**Sorption**

*OECD 106*

**Degradation**

*OECD 307*

**Leaching**

*OECD 312*

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**Characterization** and **separation** techniques
Nanopesticides = wide variety of products

Current knowledge not sufficient to evaluate benefit/risk

Need for:

→ Analytical methods for quantification and characterization

→ More fate studies including evolution with time in realistic conditions

Preliminary results:

Nanoformulations can affect the fate of an a.i.

→ More work to understand mechanisms involved
Thank you for your attention