

3rd European Conference on Copper in Plant Protection

15th-16th November in Berlin, Germany



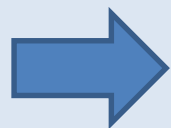
Microencapsulation of an Extract from Hop for the Development of a Tailor-Made Biological Plant Protecting Product

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- Various plant extracts have been found to have an activity against downy mildew
- Challenges for natural extracts in farming:
 - Availability of raw material
 - Chemical and physical properties:
High viscosity, low solubility, low stability



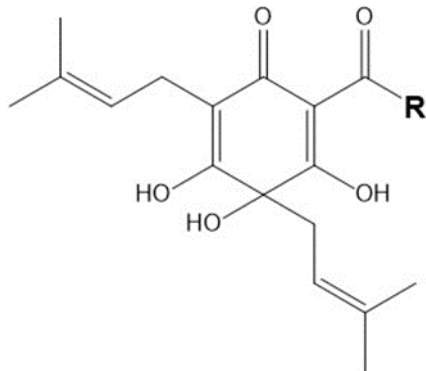
For the use in plant protection, the product properties need to be changed:
“Formulating a tailor made product”

- In this presentation:
 - Closer look at hop extract
 - Definition of a perfect plant protecting product
 - Achieving these goals by microencapsulation

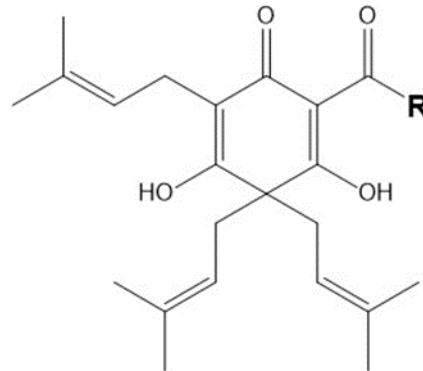


- The substances found inside of Hop Cones can be used against downy mildew in hop itself and other plants.
- Active Substances against downy mildew:

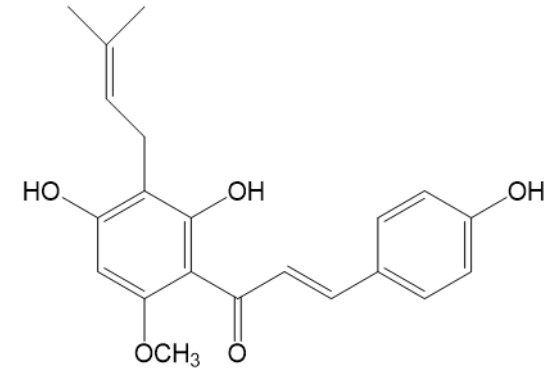
Humulones



Lupulones

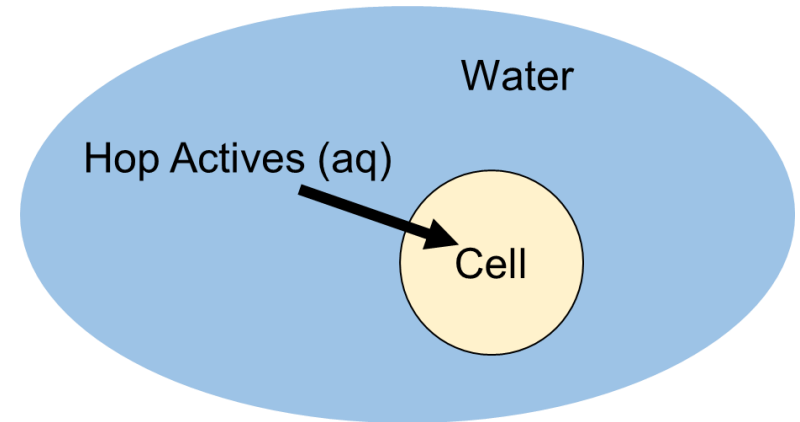


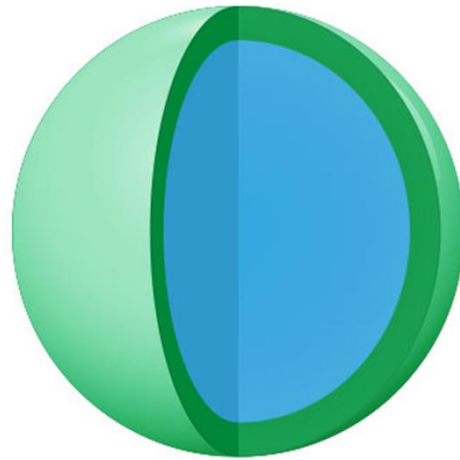
Xanthohumol



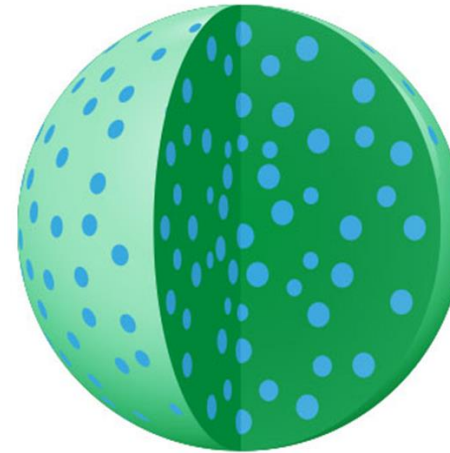
- Usually used in brewing industry: Raw material and extraction Method available in large scale
- Properties:
 - Degraded through oxidation and UV-light
 - Low solubility (<2 mg/L at pH 7 of Lupulones)

- High activity (solubility, permeability)
- Easy Application
- Stability during storage
- Long lasting effect (Rainfastness)
- Safety for user and environment



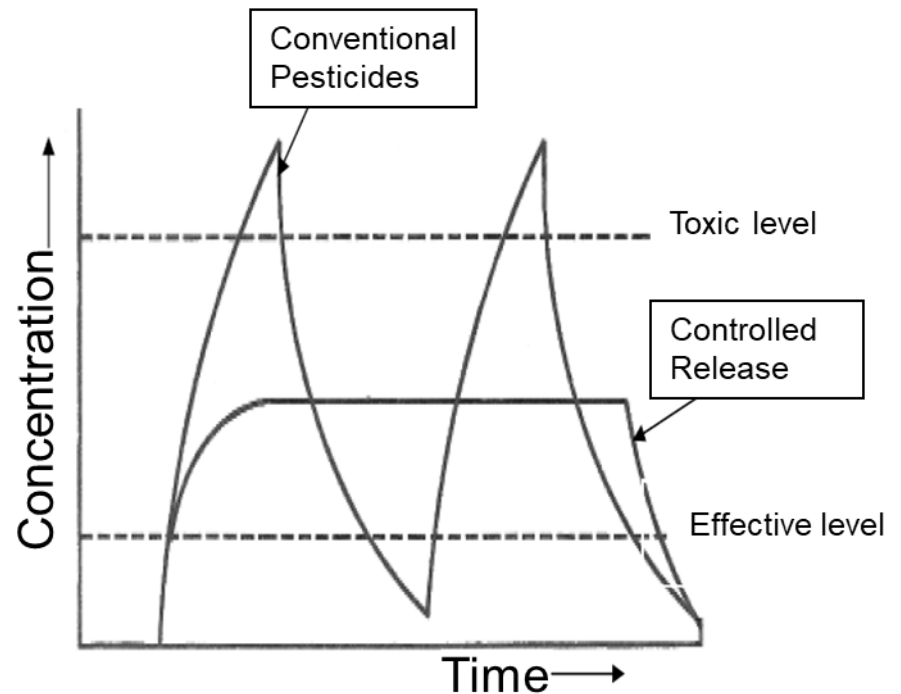


Core-Shell
Capsule



Matrix Type
Capsule

- Generation of new product features
- Protection of the active ingredients
- Combination of materials
- Controlled Release



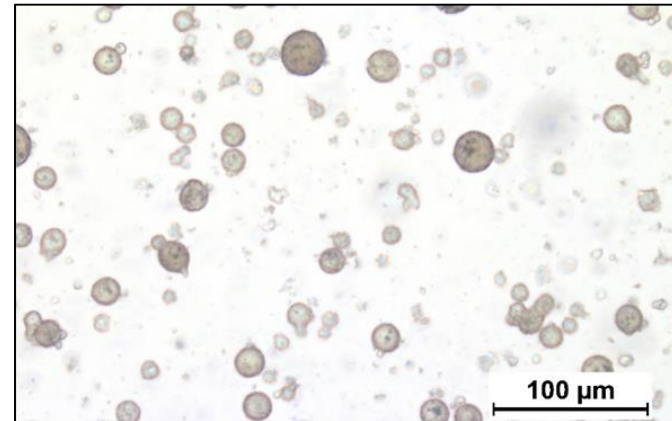
Taken from: Sopeña, F. et al., *Cien. Inv. Agr.* 35(1):27-42. 2009

- Product handling

Flowable Powder



Dispersable in Water



Stable Suspension

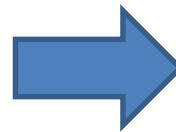
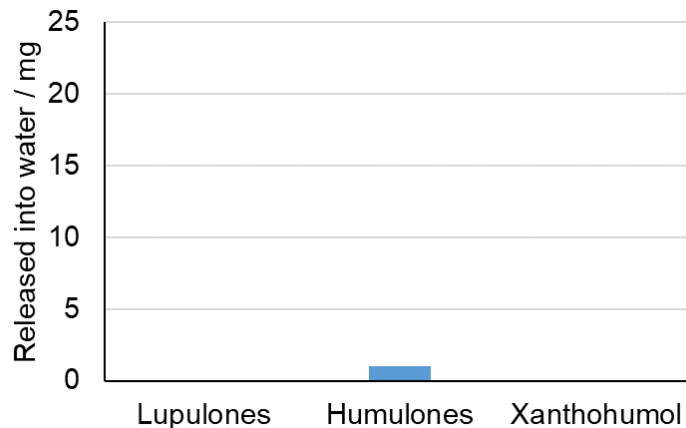


Application
approved in
lab and field

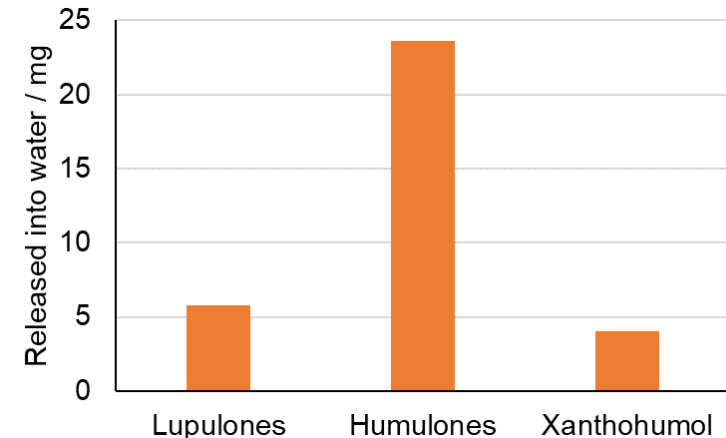


- **Stability of the Extract:**
 - Very little loss of active substances during process
 - Encapsulation slows down oxidation
 - Antioxidants mixed into shell material avoids oxidation
- **Controlled Release:**
 - The actives are bound very heavily to the matrix material
 - For release, solubilizers (emulsifiers) were added to the capsule
 - Release rate controlled by the type and amount of emulsifier

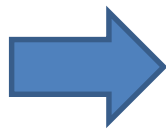
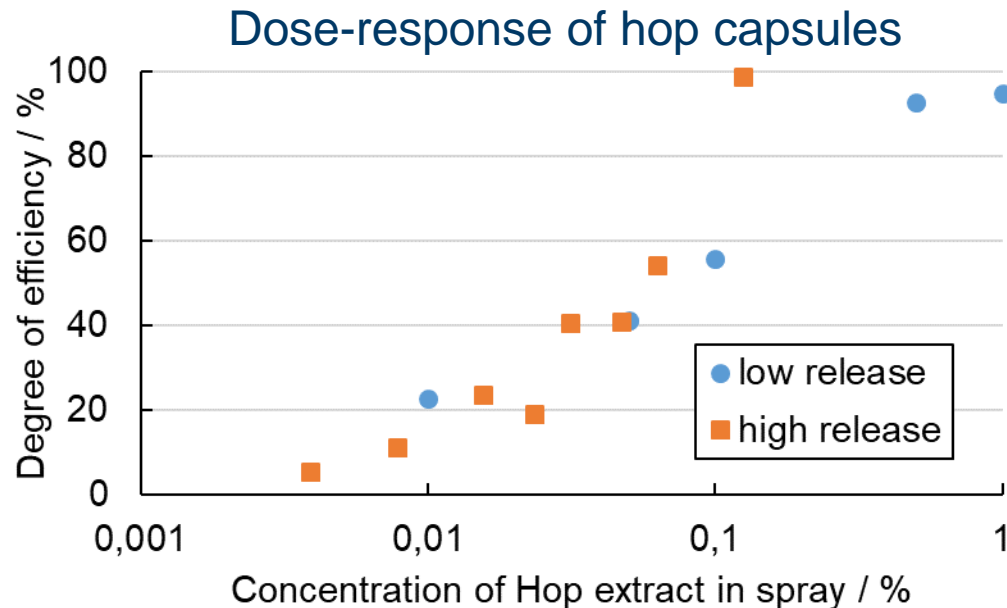
Capsule Without Emulsifiers



Emulsifiers added to Capsule

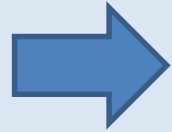


- Activity against downy mildew
 - Leaf disk assays from vine leaves and *Plasmopara viticola* (WBI Freiburg)

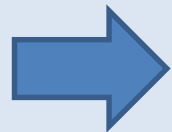


- Capsules work already without release
 - Higher efficiency with emulsifiers for release
- Field studies in hop garden against *Pseudoperonospora humuli*:
No results because of lack of downy mildew

- Development of a tailor made product from hop extract:



Microencapsulation is a suitable process for designing an applicable, efficient plant protecting product from plant extracts



Encapsulated hop extract has great potential in reducing or replacing copper in the fight against downy mildew

- Outlook:
 - Further field tests to determine the actual concentration necessary
 - Evaluation of beneficial effects due to encapsulation in real scenarios (Stability, Rainfastness, Duration of Protection)

Thank You!

This project was funded by:

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The logo for Hopsteiner, featuring the word 'Hopsteiner' in a large, green, sans-serif font. Above the 'e' is a small green triangle containing the letters 'SS'. Below the word is the text 'est. 1845' in a smaller, green, sans-serif font.

In collaboration with the Hop Research Center Hüll