



A JOINED-UP APPROACH TO THE IDENTIFICATION, ASSESSMENT AND MANAGEMENT OF
EMERGING FOOD SAFETY HAZARDS AND ASSOCIATED RISKS (FOODSAFER)

BICYCLE: Biosensor for Cereal Yield requiring Contaminant Level Evaluation

Ids Lemmink

11-06-2026



This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101060698



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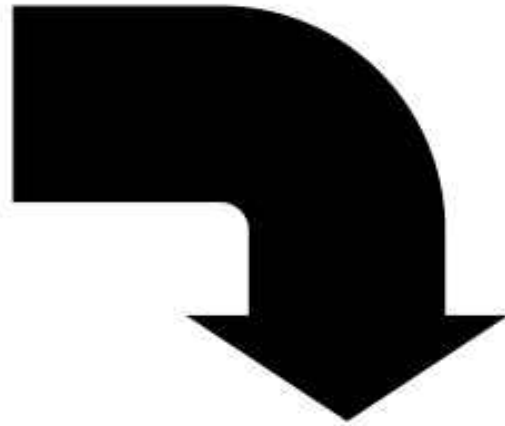




Pasta



Cereal field



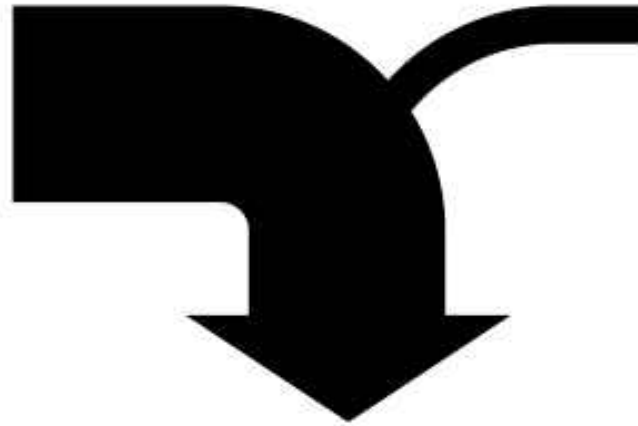
Pasta



Mechanical harvesting



Datura stramonium



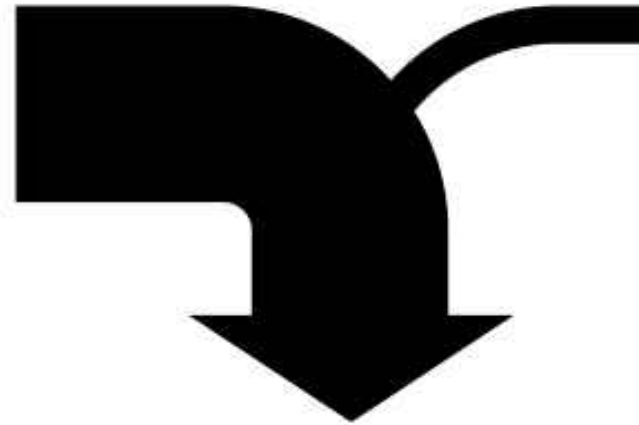
Pasta



Mechanical harvesting



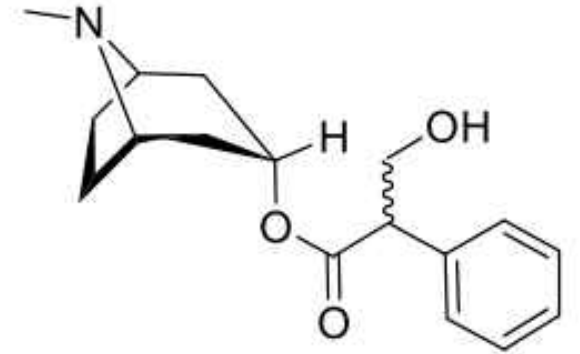
Datura stramonium



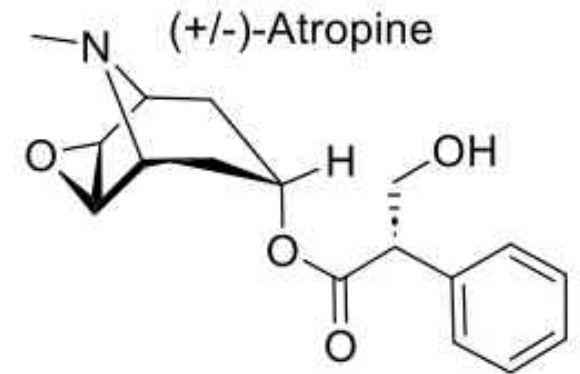
Pasta



Tropane alkaloids



(+/-)-Atropine

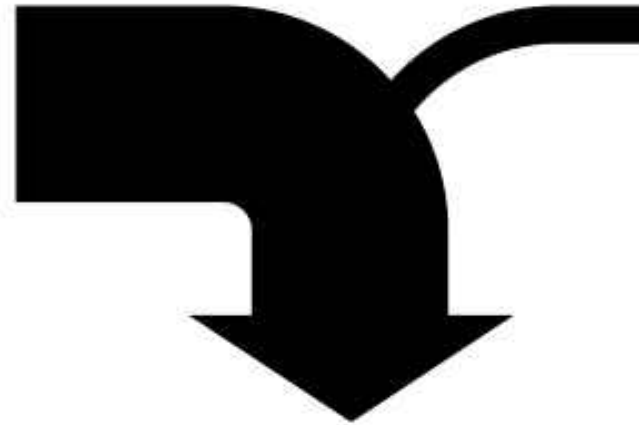


(-)-Scopolamine

Mechanical harvesting



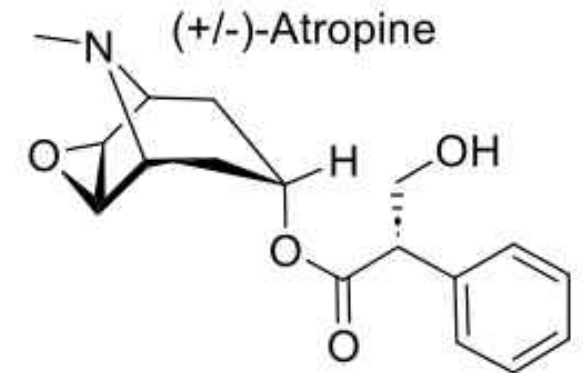
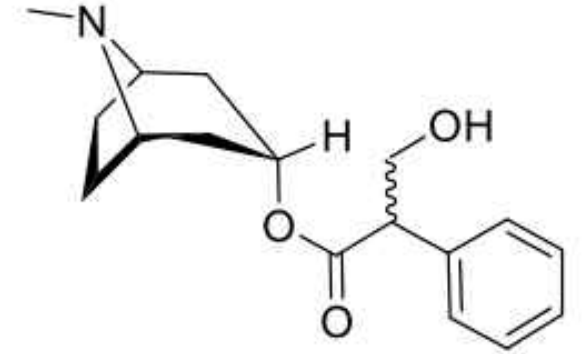
Datura stramonium



Pasta



Tropane alkaloids



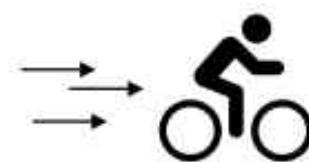
(-)-Scopolamine

Buckwheat cereals

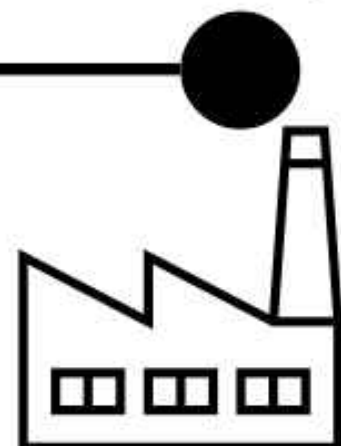
10 $\mu\text{g kg}^{-1}$

FoodSafeR

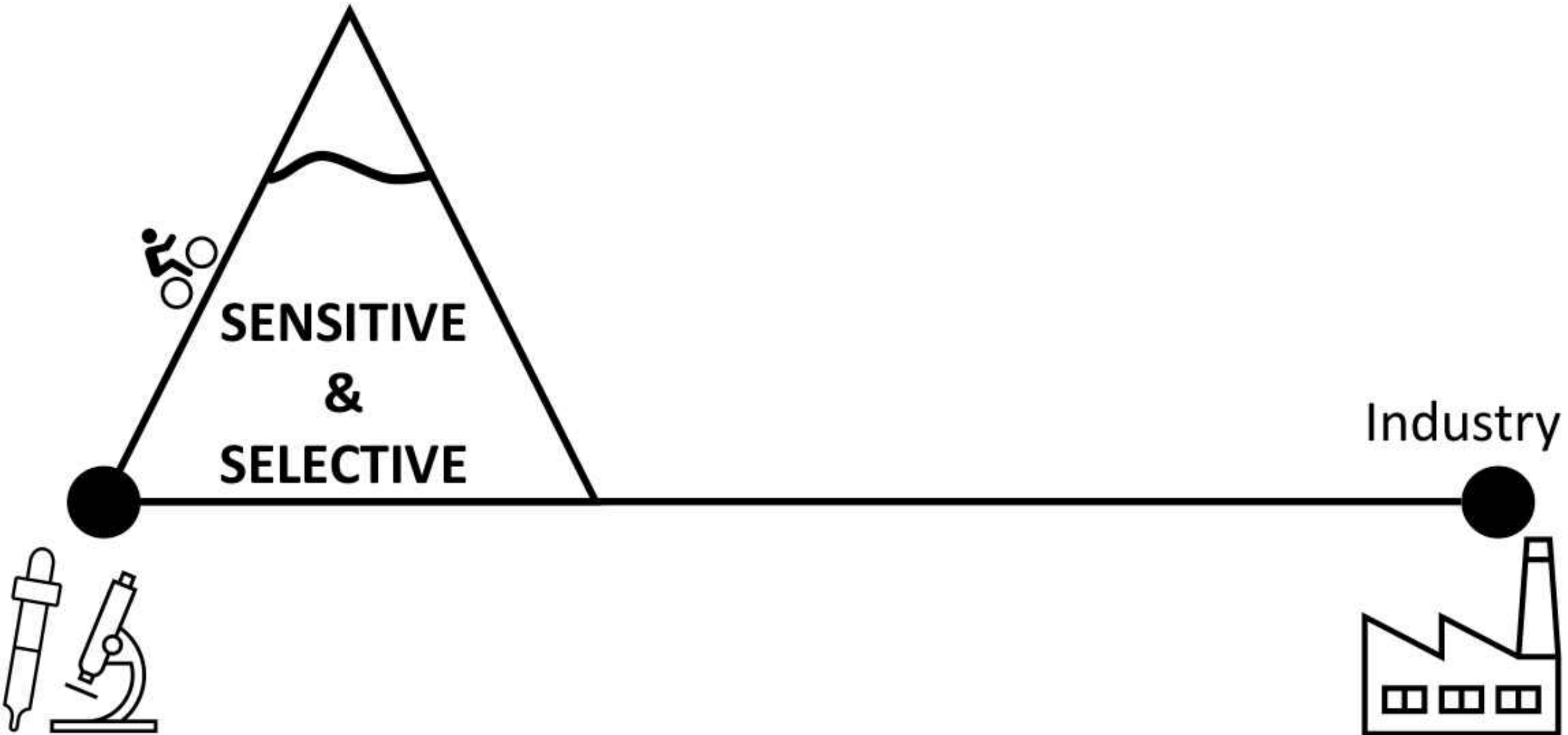
Laboratory



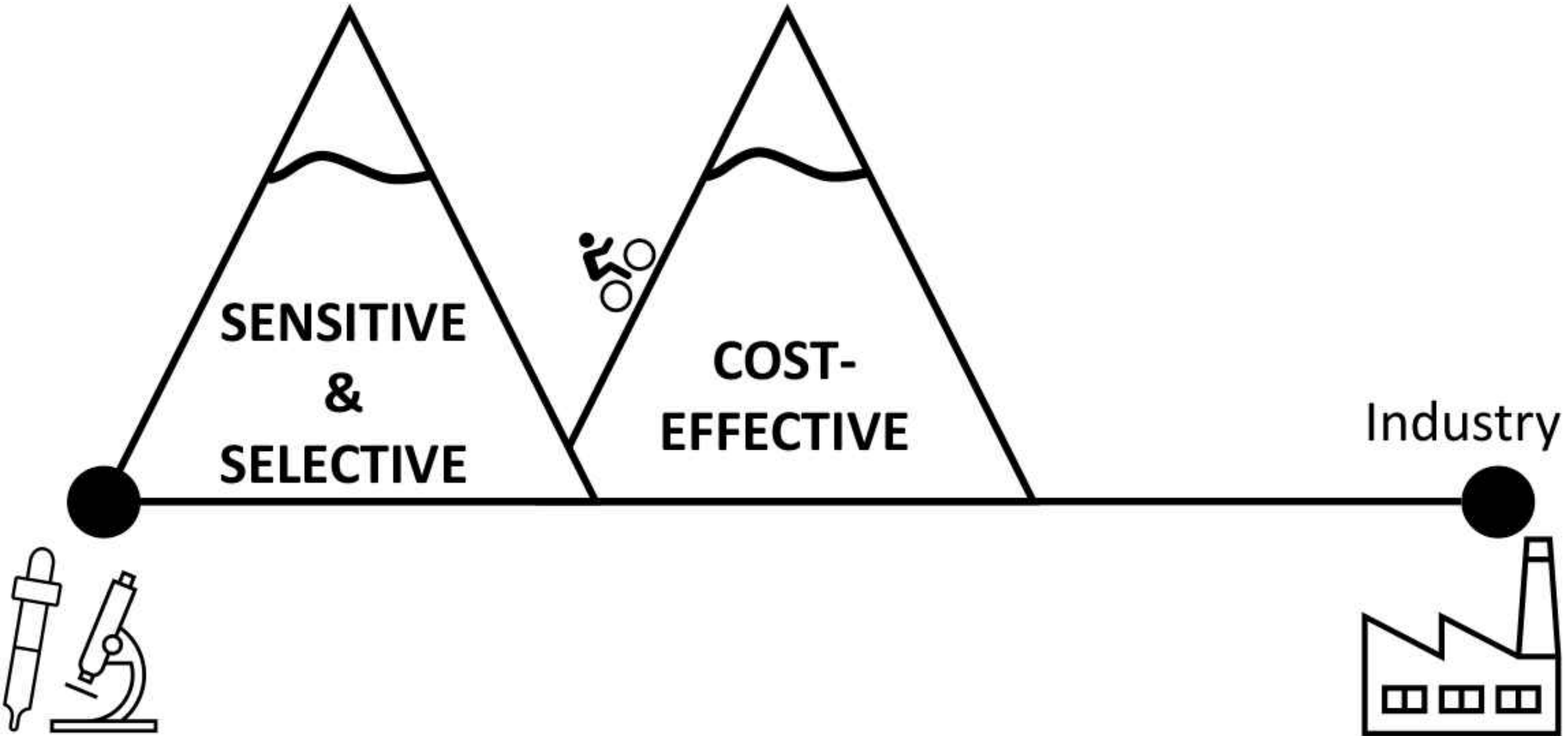
Industry



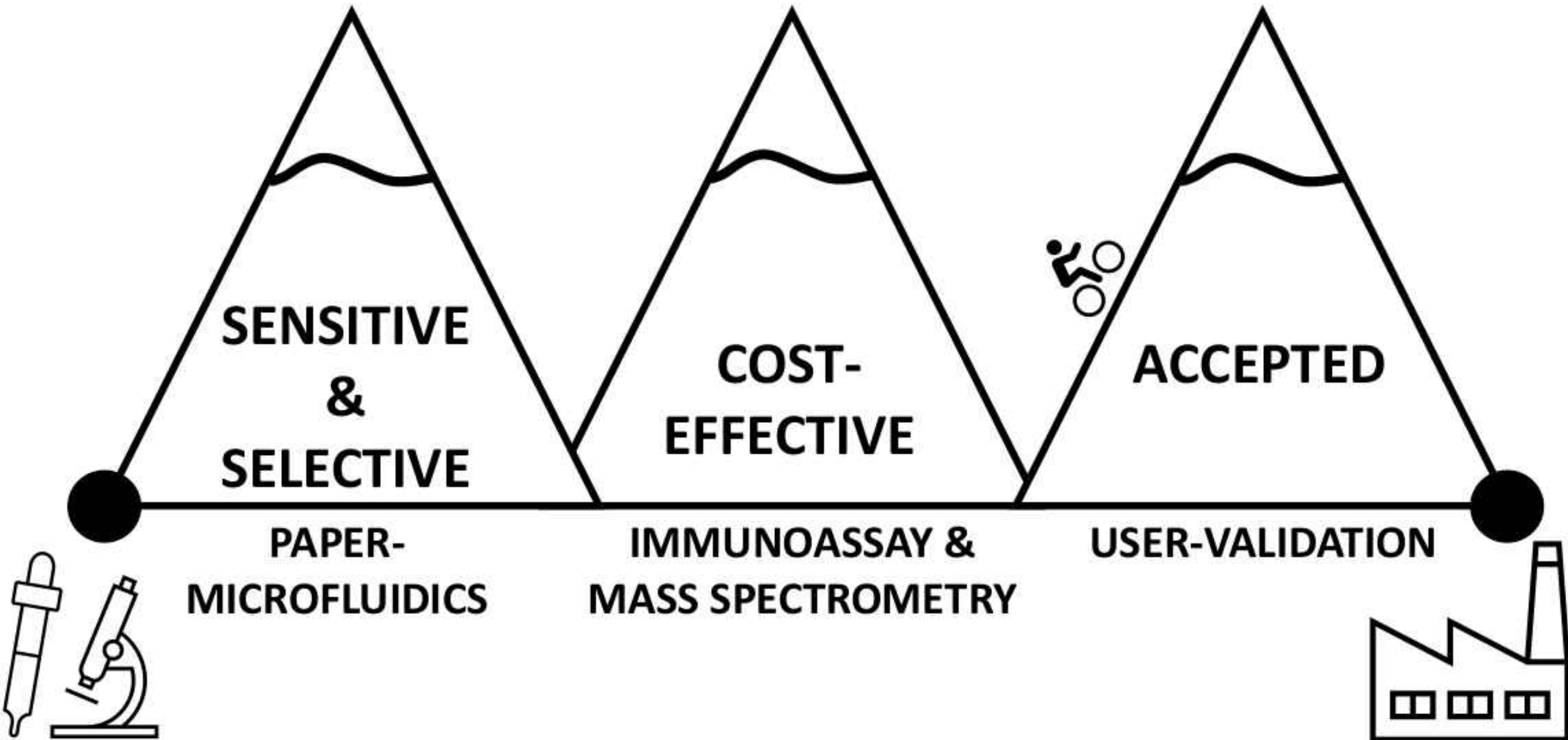
FoodSafeR



FoodSafeR



FoodSafeR





Paper-based workflow

Solid Liquid extraction



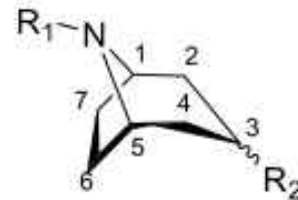
Matrix



Solid Liquid extraction



Generic structure



Ex **Matrix** -up

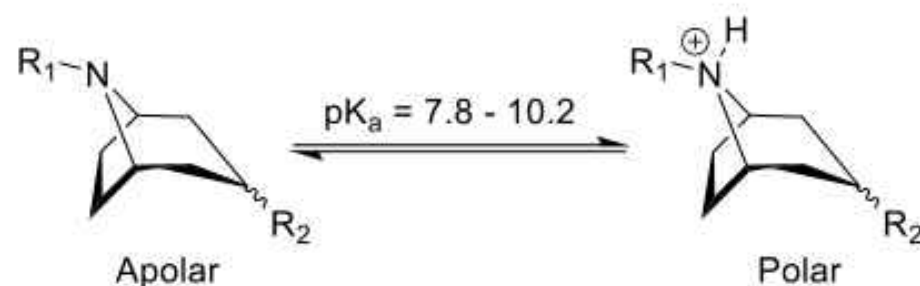


1 gram cerea
10 mL 0.1% (v/v%) FA in H₂O

Solid Liquid extraction



pH-dependent polarity



Ex **Matrix** up

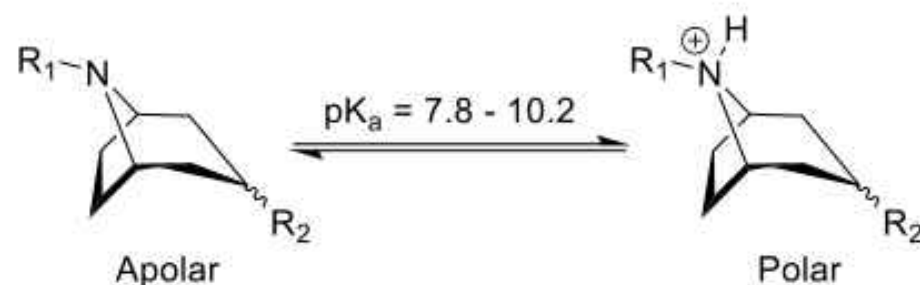


1 gram cereal
10 mL 0.1% (v/v%) FA in H₂O

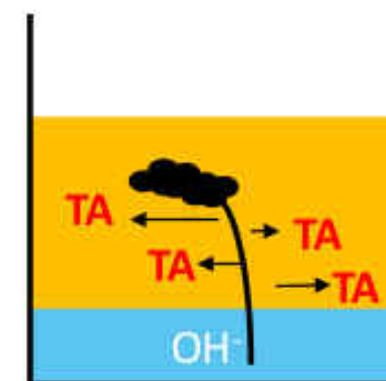
Solid Liquid extraction



pH-dependent polarity

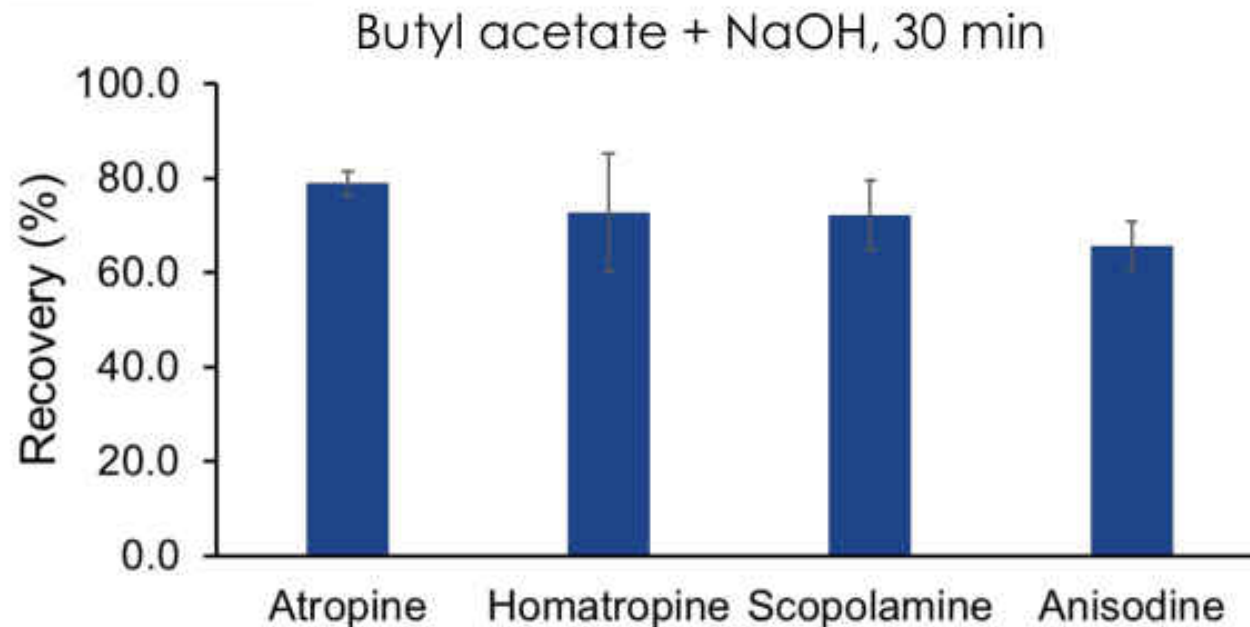


Experimental set-up

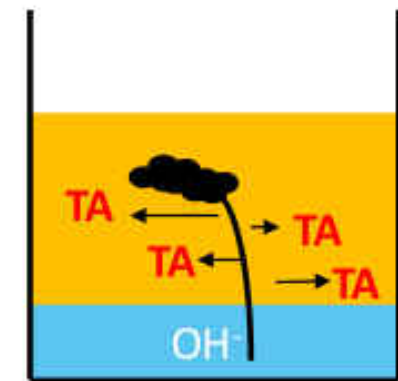


1 gram cereal
2 mL 0.05M NaOH in H₂O
10 mL butyl-acetate

Solid Liquid extraction

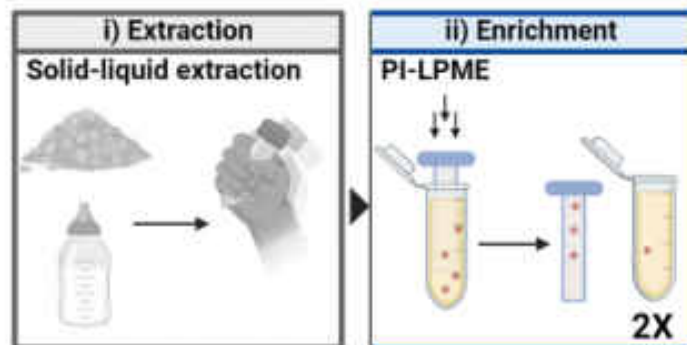


Experimental set-up

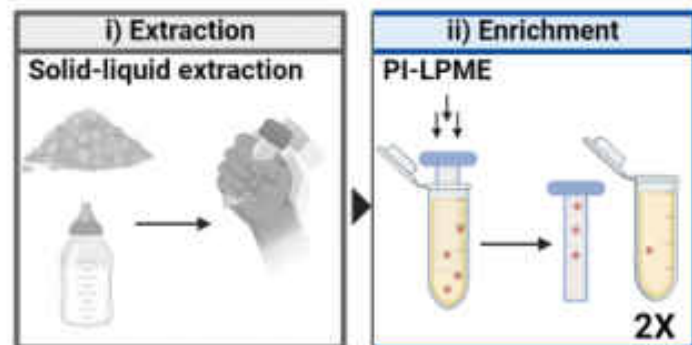


1 gram cereal
2 mL 0.05M NaOH in H₂O
10 mL butyl-acetate

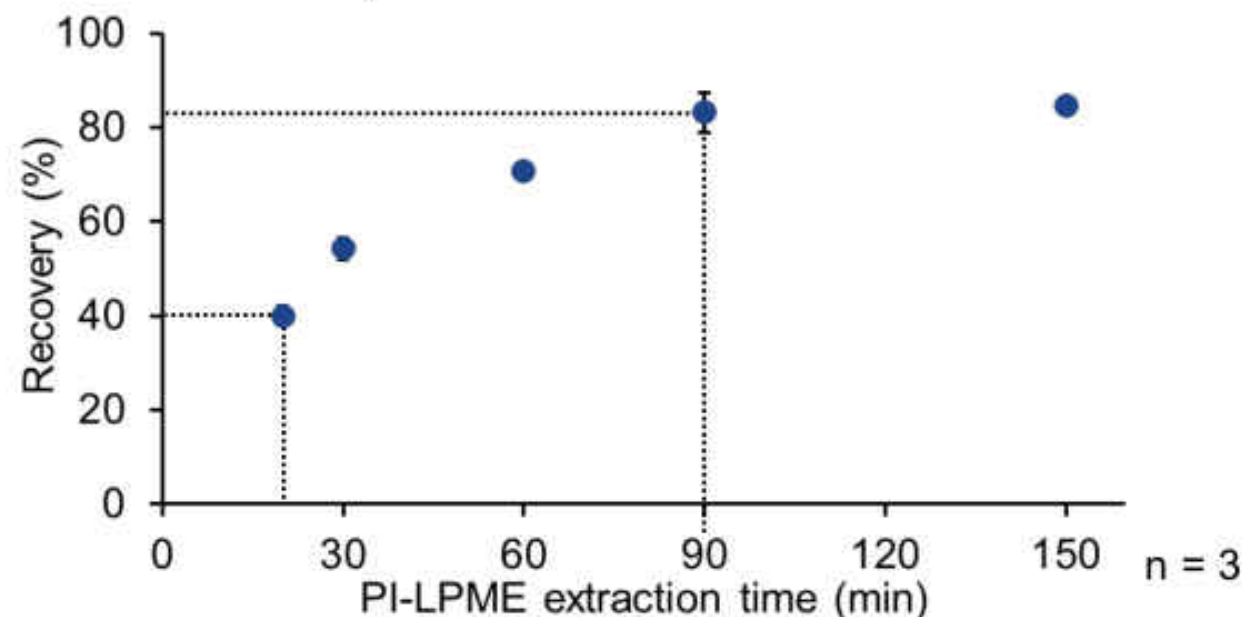
Paper-immobilized liquid-phase microextraction



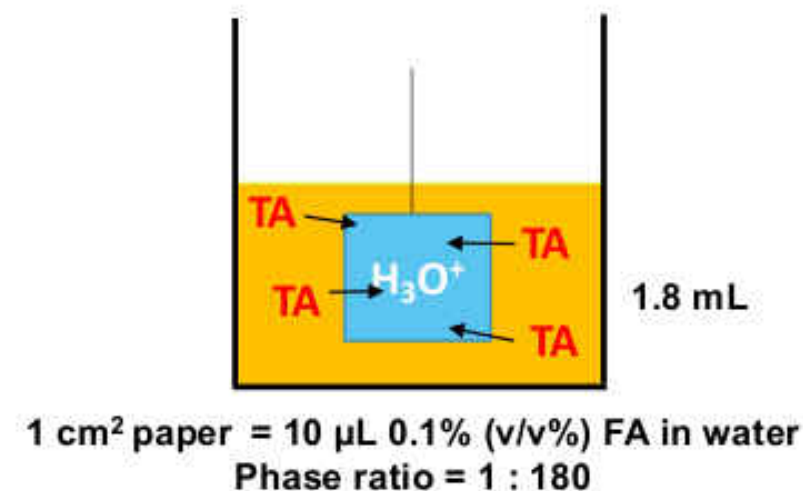
Paper-immobilized liquid-phase microextraction



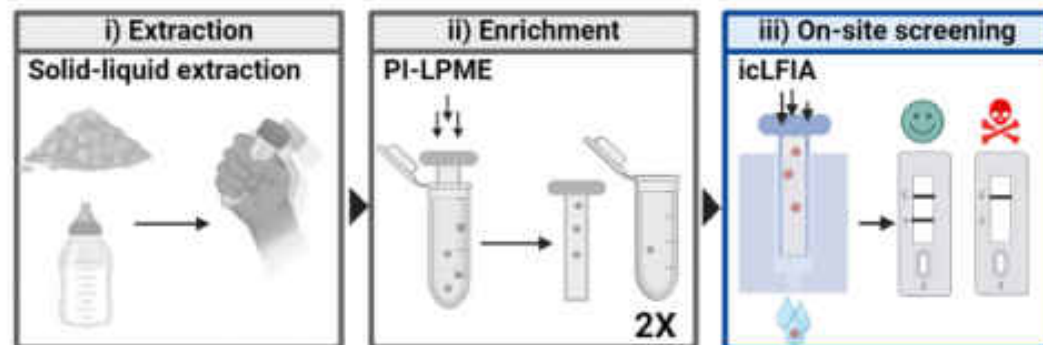
PI-LPME of atropine from buckwheat cereal extract



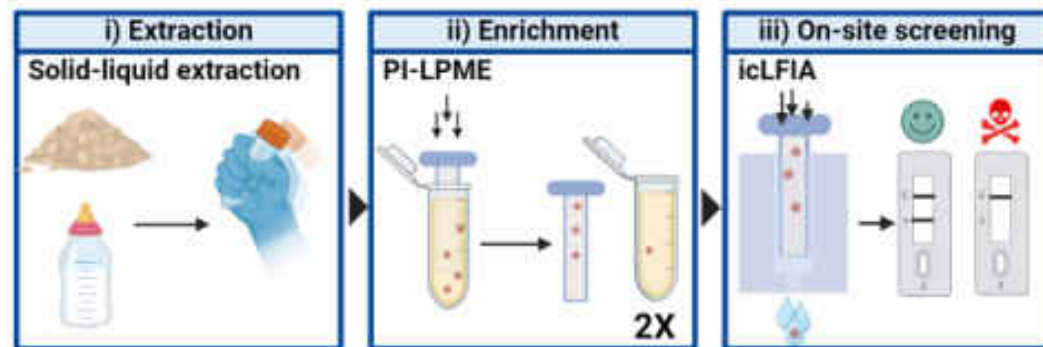
Experimental set-up



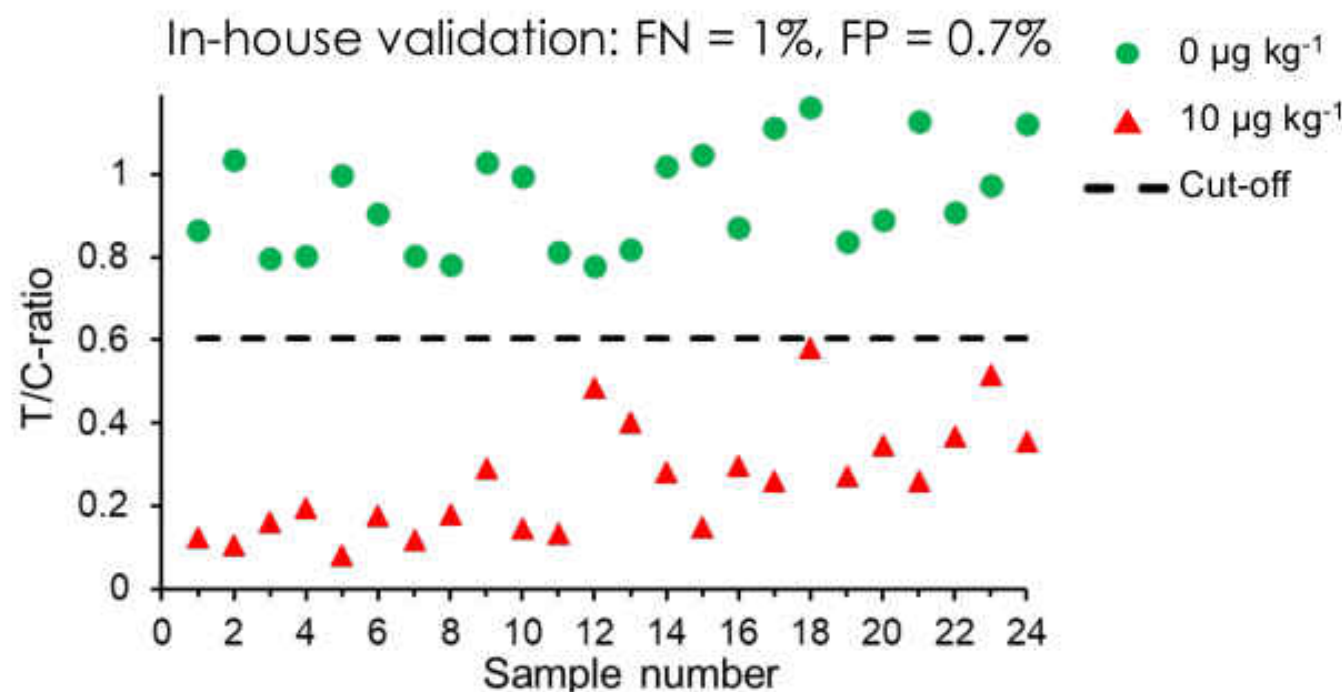
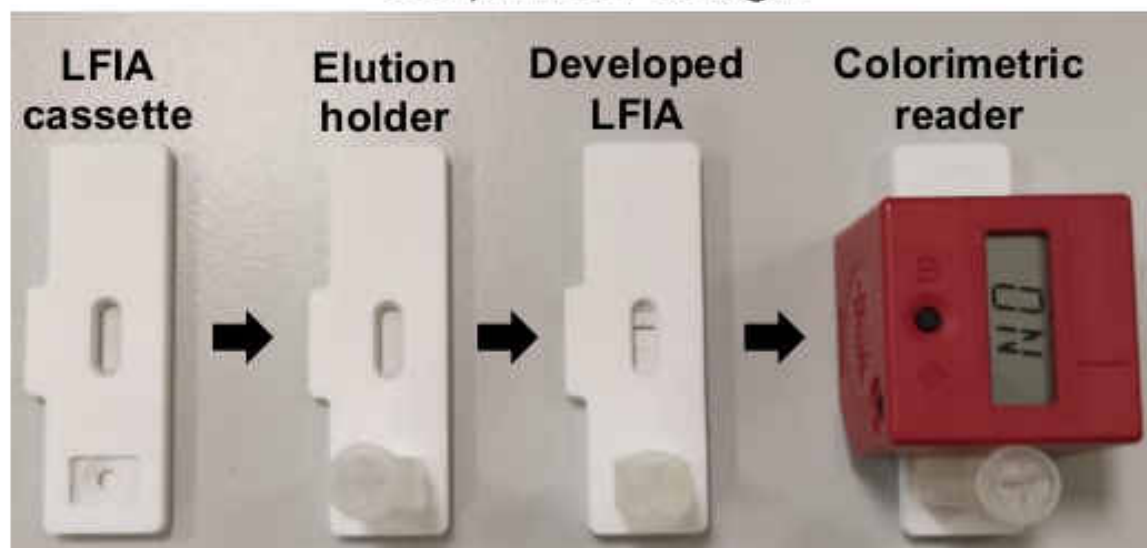
Lateral flow immunoassay (LFIA)



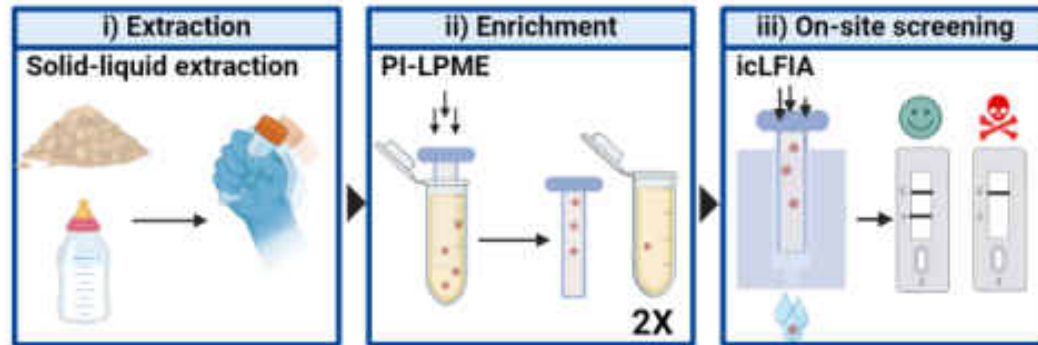
Lateral flow immunoassay (LFIA)



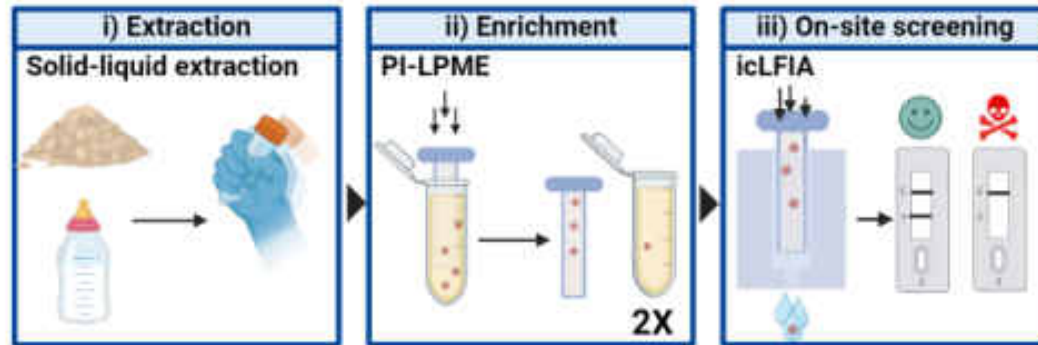
3D-printed design



User-validation

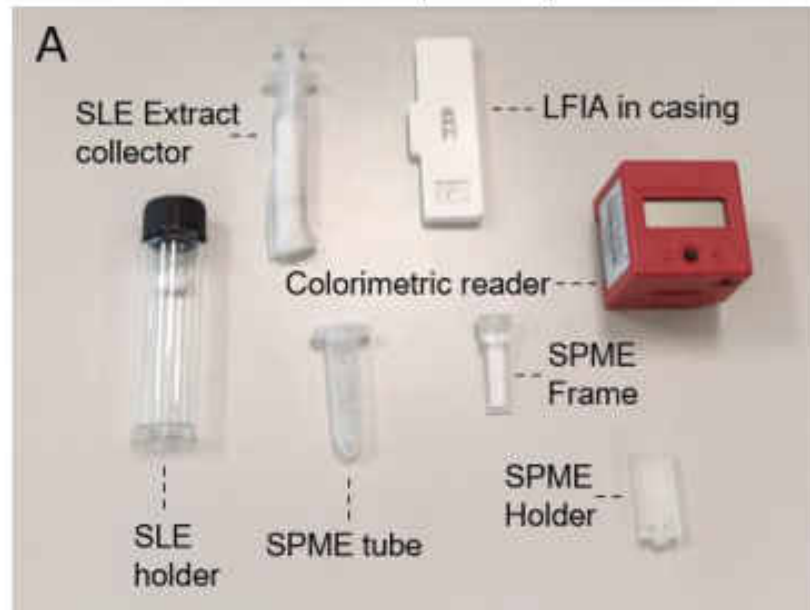


User-validation



Proof-of-principle

Prototype



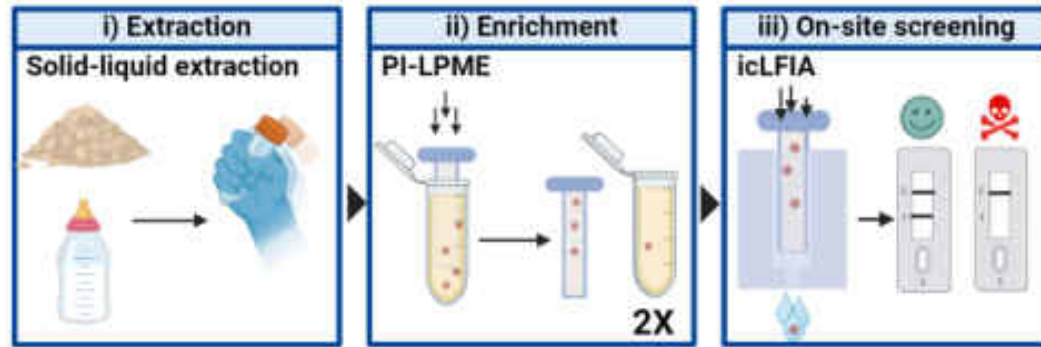
Liza Portier



Erik Beij



User-validation



Collaborators

Prof. Dr. Michele Suman

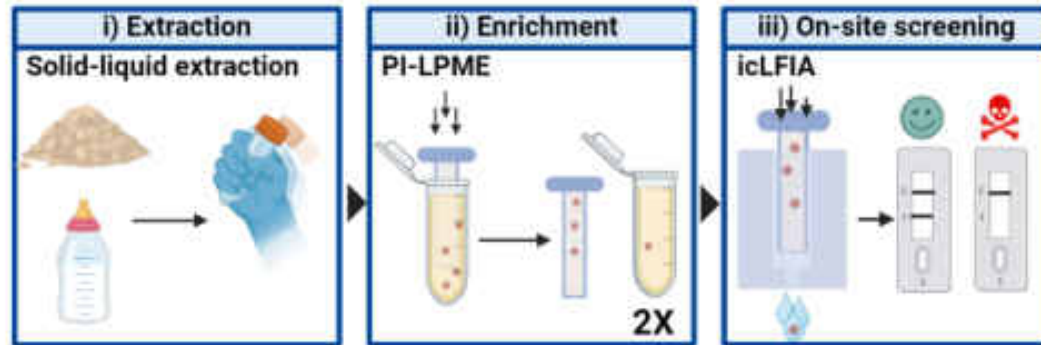
Dr. Eleonora Rollo



World's largest pasta-producer



User-validation



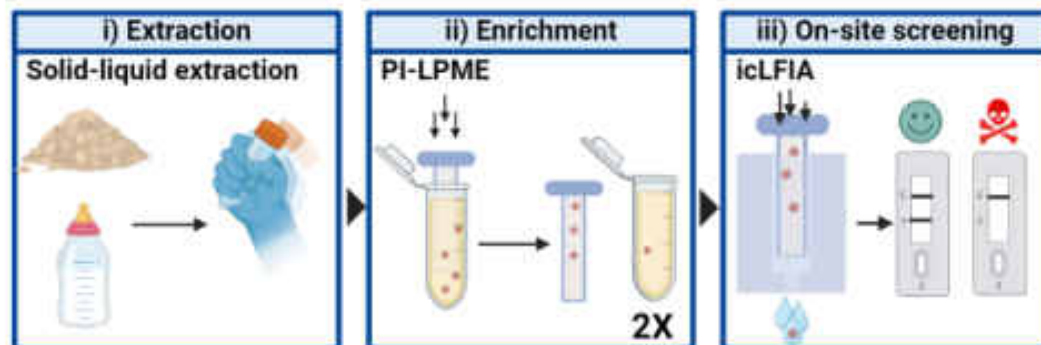
User-validation: execution



World's largest pasta-producer



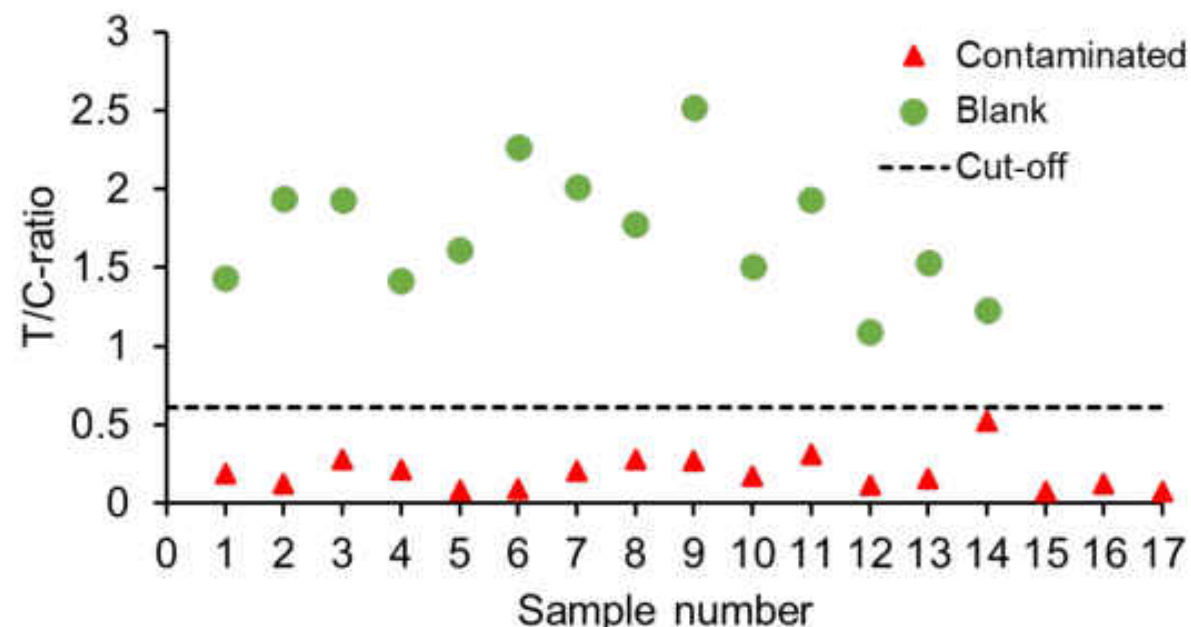
User-validation: Workflow accuracy



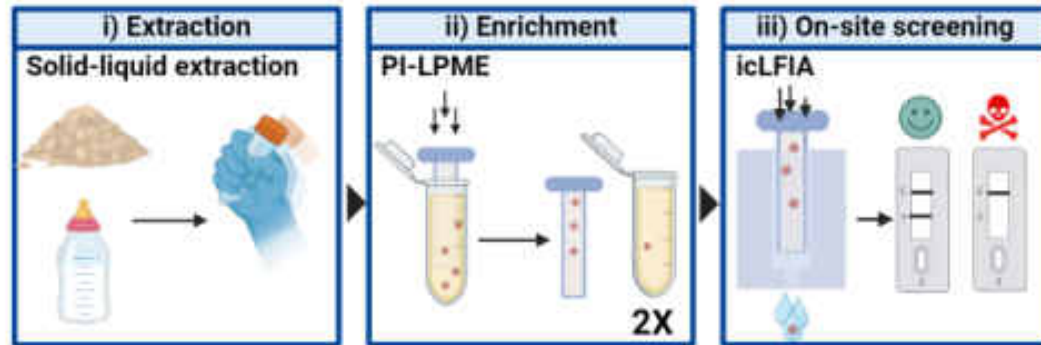
User-validation: execution



Atropine-testing at Barilla: results

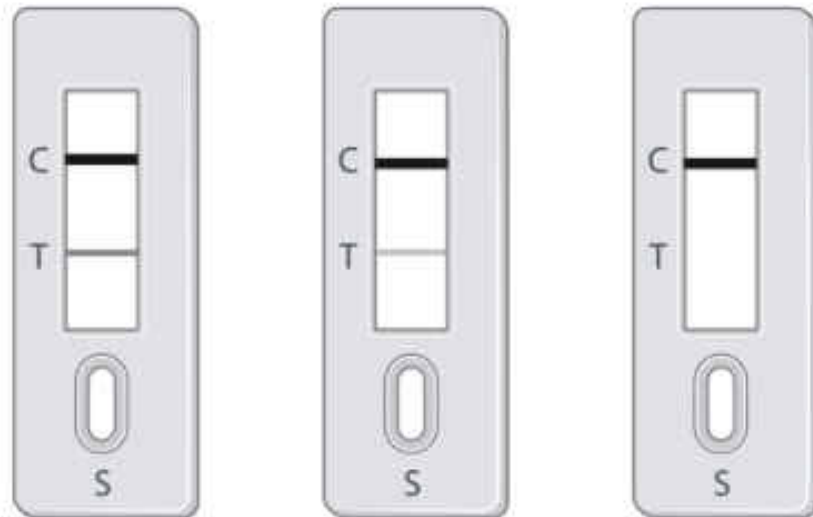


User-validation: Read-out accuracy

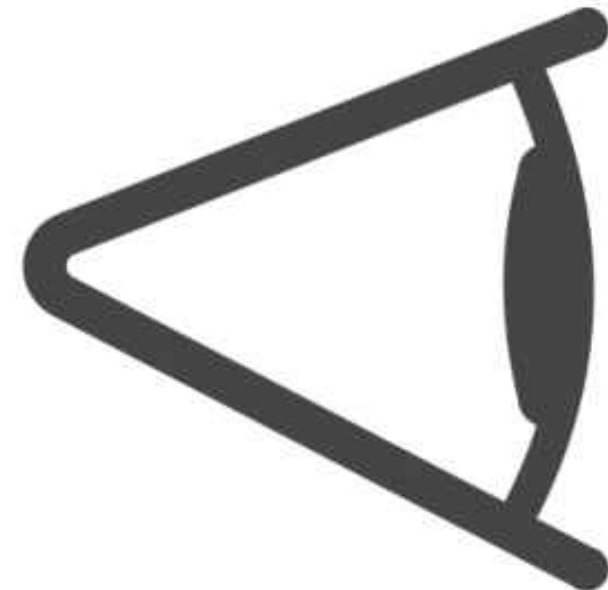


Read-out of a competitive lateral flow immunoassay

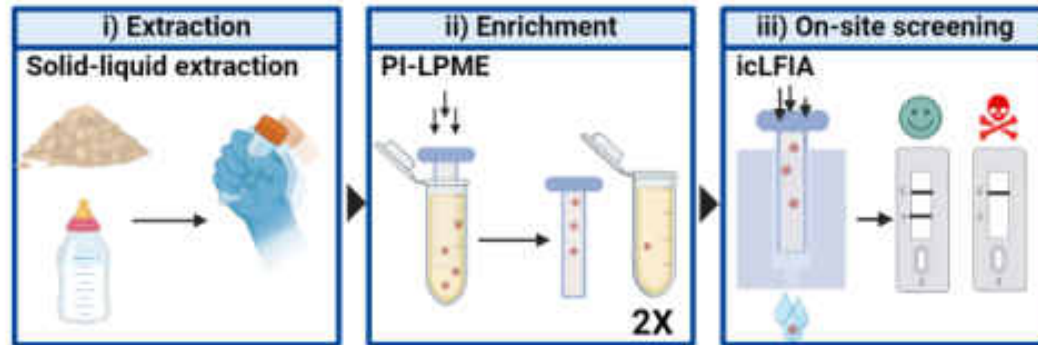
NEGATIVE **POSITIVE** **POSITIVE**



Visual read-out

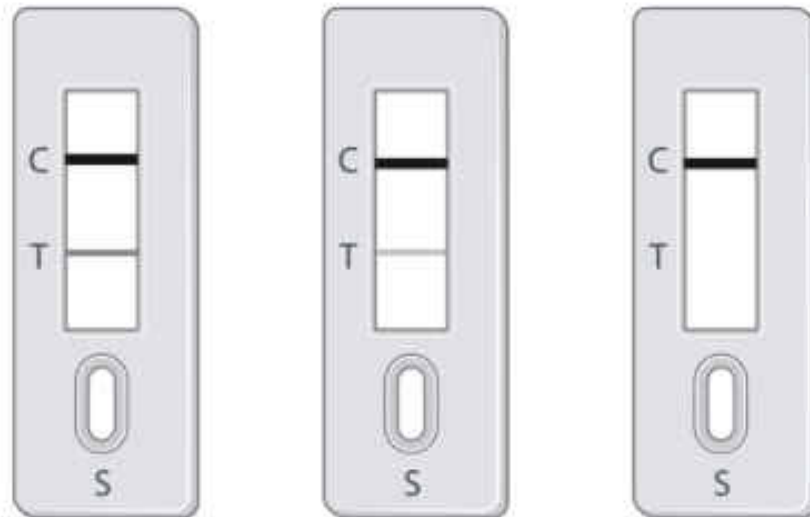


User-validation: Read-out accuracy



Read-out of a competitive lateral flow immunoassay

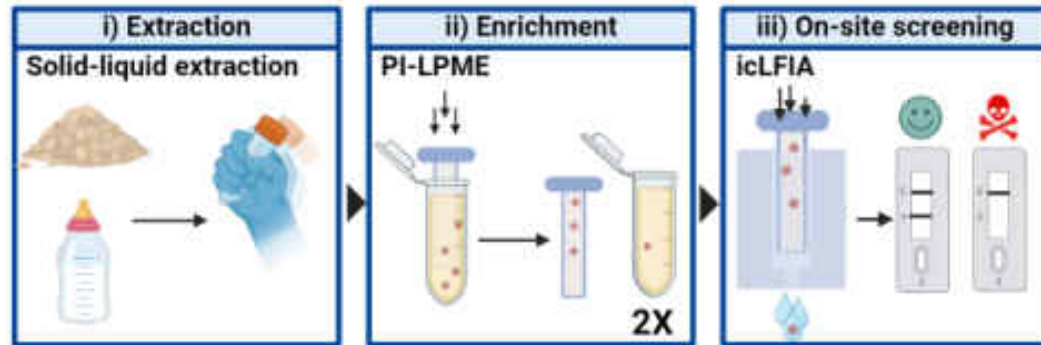
NEGATIVE **POSITIVE** **POSITIVE**



Visual read-out
Interpretation

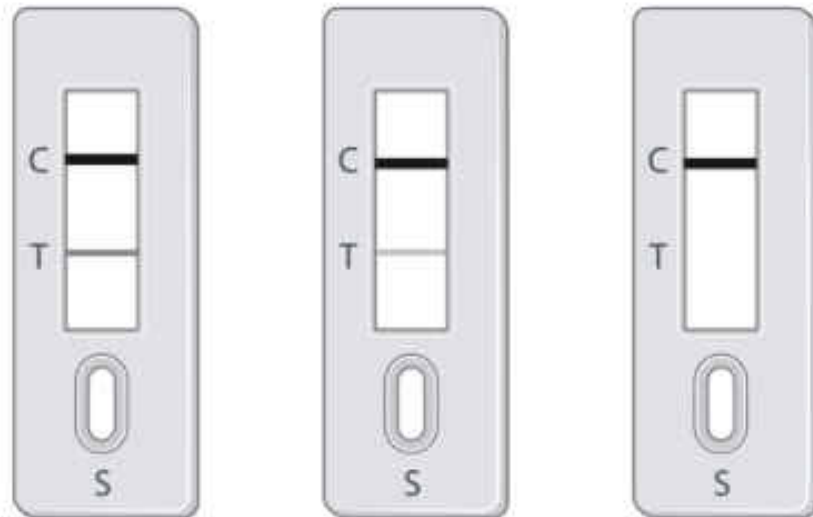
Ground truth		Positive	Negative
	Positive	27	0
	Negative	9	17

User-validation: Read-out accuracy

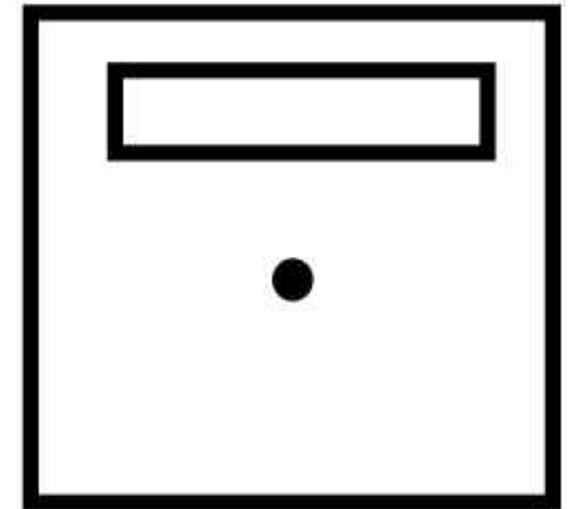


Read-out of a competitive lateral flow immunoassay

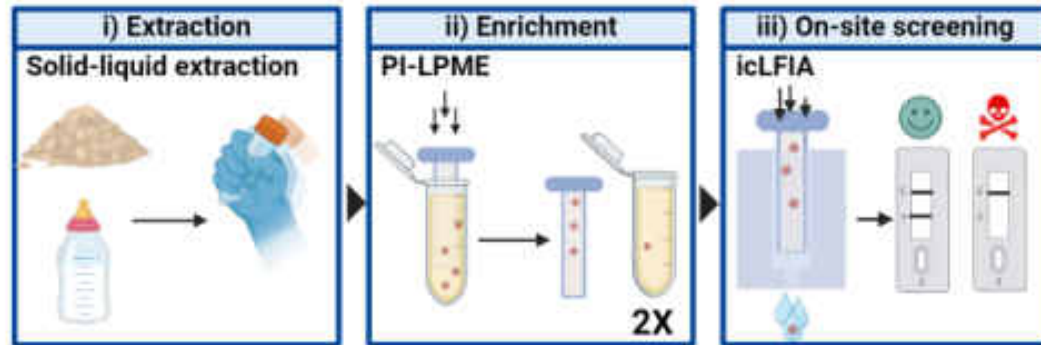
NEGATIVE **POSITIVE** **POSITIVE**



Automated read-out

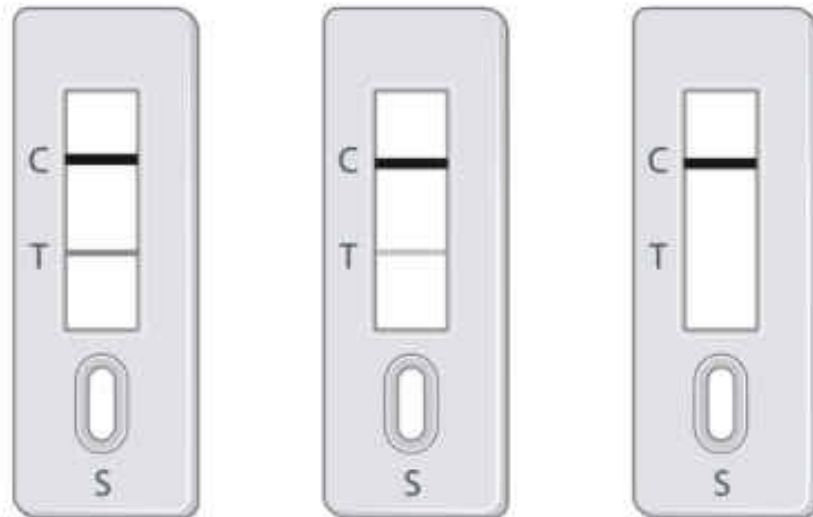


User-validation: Read-out accuracy



Read-out of a competitive lateral flow immunoassay

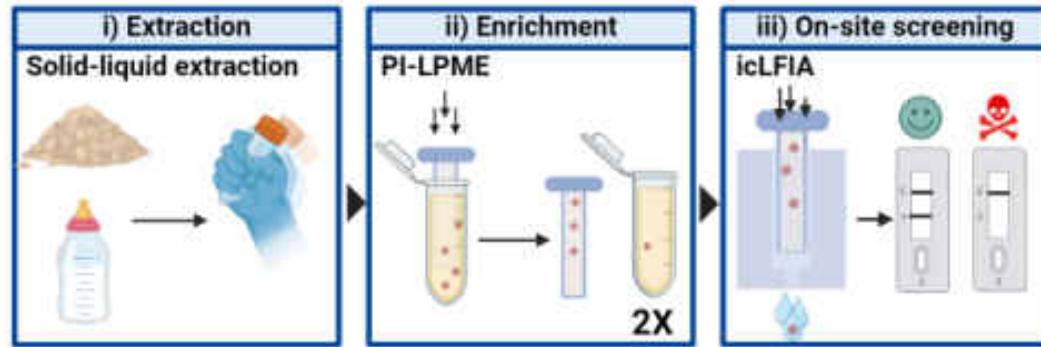
NEGATIVE **POSITIVE** **POSITIVE**



Automated read-out
Interpretation

Ground truth		Positive	Negative
	Positive	27	0
	Negative	0	26

User-validation: Usability



System Usability Score

88/100

Excellent

Nasa-Task Load Index

24/100

Medium workload

Acknowledgments



SUPERVISOR team

- Dr. Gert Salentijn
- Prof. Dr. Han Zuill
- Dr. ir. T. J. J. Bovee



AUSTRIAN INSTITUTE
OF TECHNOLOGY



Wageningen Food Safety Research

- Erik Reij

Laboratory of Organic Chemistry

Sinke Bosma
Dr. Si Huang
Frank Claassen



Barilla G.R. F.lli SpA



Bundesinstitut für Risikobewertung

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AGRICULTURAL UNIVERSITY OF ATHENS



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Termőföldtől az asztalig





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