

Phenolic Compounds from Rapeseed Protein Side Stream as Potential Emerging Xenobiotics

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INTRODUCTION & AIM

The circular economy of the biofuel industry drives valorisation of process side streams. During alkaline extraction of rapeseed meal — the first step of protein isolation — phenolic acids are released into aqueous solution.

These polyphenols, dominated by sinapic acid, are linked to xenobiotics and show antimicrobial and antioxidant activity. Once recovered and concentrated, they may act as emerging environmental contaminants.

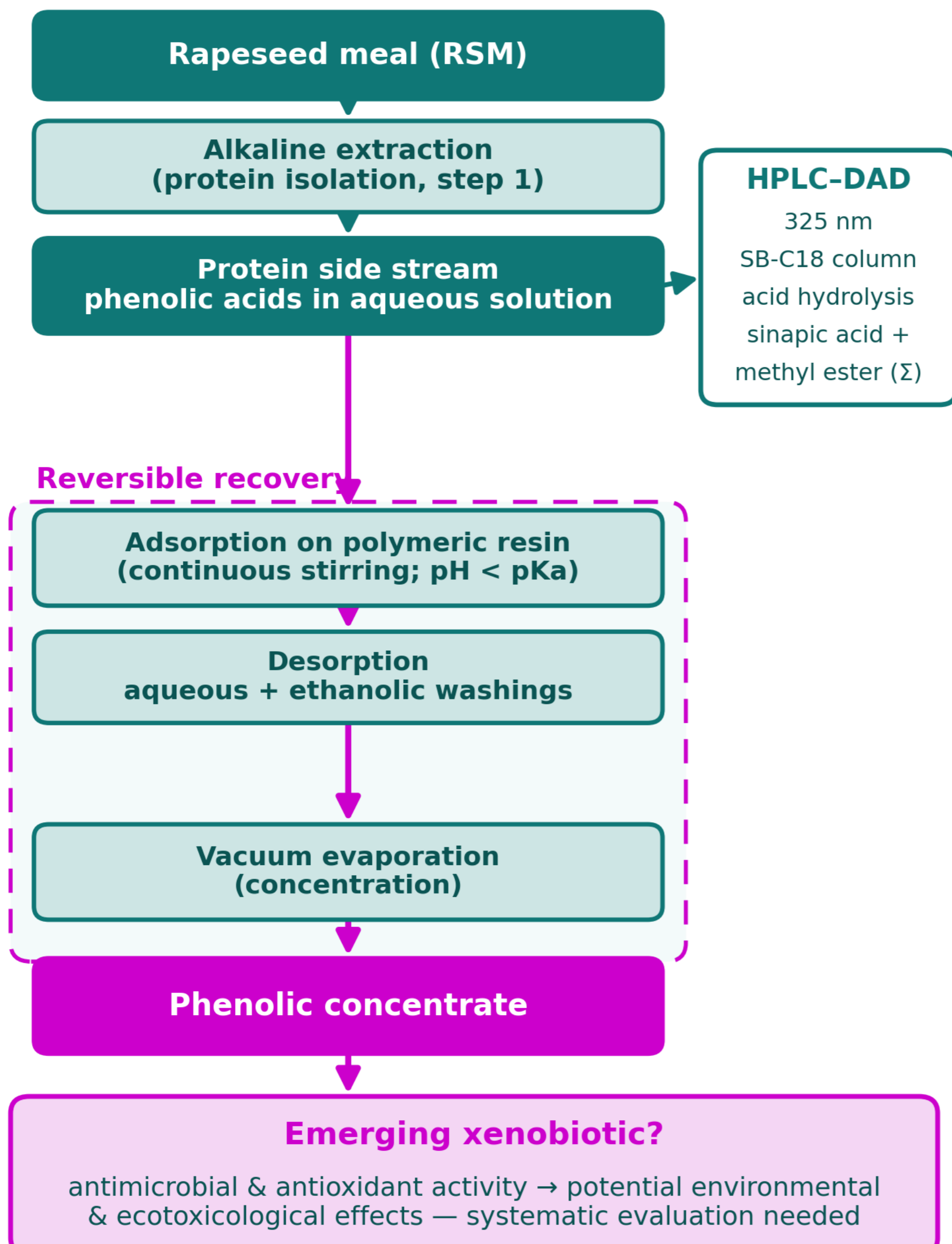
Aim

To recover phenolic compounds from the rapeseed protein side stream using reversible adsorption–desorption, and to characterise the concentrate as a potential emerging xenobiotic for ecotoxicological evaluation.

Table 1. Phenolic acids in rapeseed meal (mg·kg⁻¹)

Phenolic acid	Content (min–max)
Σ phenolic acids	391–444
Sinapic acid	339–379
Protocatechuic	13.3–16.0
4-Hydroxybenzoic	12.8–14.6
Ferulic	10.0–11.4
9 further acids	< 4 each

METHOD



RESULTS & DISCUSSION

Phenolic-acid profile of the side stream

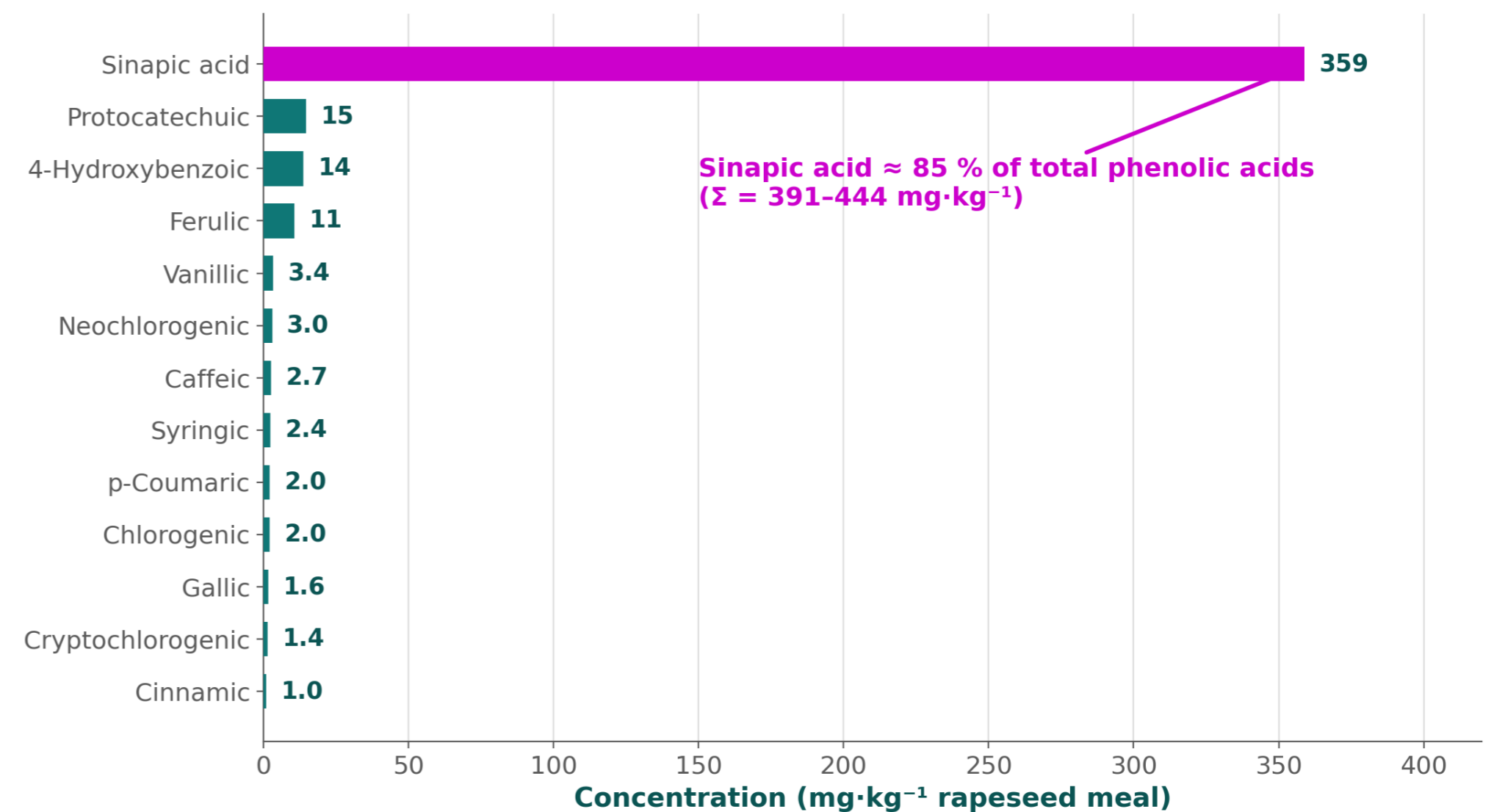


Fig. 1 Sinapic acid dominates the phenolic fraction (HPLC–DAD; mean of min–max).

≈ 85 %

sinapic acid share of total phenolic acids

0.62 g·L⁻¹

sinapic acid in the fresh side stream

pH < 4.6

below pKa — boosts reversible adsorption

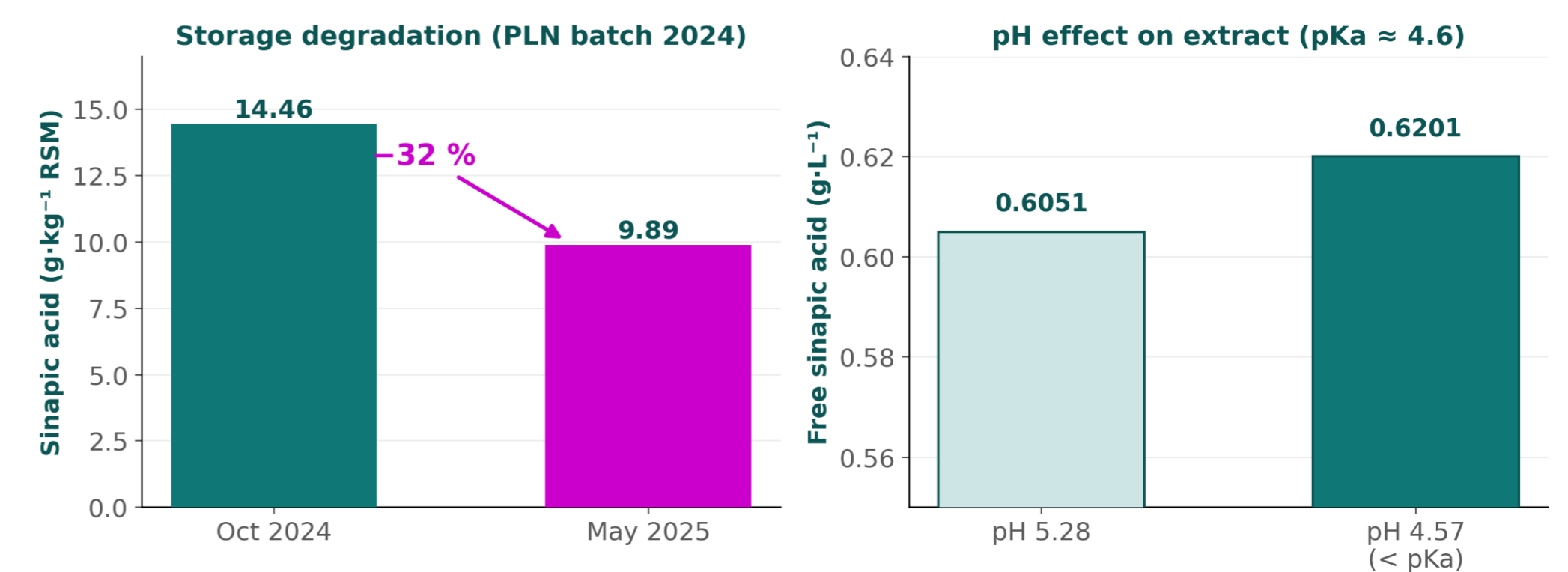


Fig. 2 Sinapic acid falls ~32 % on storage; pH below its pKa raises the free, recoverable fraction.

Why an emerging xenobiotic?

Recovered, concentrated polyphenols are expected to be biologically active (antimicrobial, antioxidant) and may exert environmental and ecotoxicological effects — marking them as emerging contaminants of concern.

CONCLUSION

- Reversible adsorption–desorption on a polymeric resin, with vacuum concentration, recovers phenolic compounds from the protein-isolation side stream.
- The concentrated polyphenols most likely behave as emerging xenobiotics.
- Systematic evaluation of their persistence, environmental fate and ecotoxicology is needed — with experimental validation of biological activity and environmental impact.

FUTURE WORK / REFERENCES

Future work

- Optimise polyphenol separation (ongoing)
- Experimentally validate biological activity
- Assess persistence, fate & ecotoxicology

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Keywords

polyphenols · by-products · environmental impact · separation