

## Nutraceutical-Ionic Liquids (NILs): Synergists for Insecticide Formulations

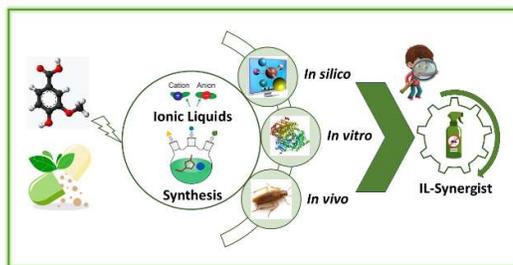
Ramana Pydi<sup>a\*</sup>, Dr. Jennifer Bernard<sup>b</sup>, Dr. Christoph Zutz<sup>b</sup>, Dr. Patrick-Julian Mikuni<sup>a</sup>

<sup>a</sup> Centre for Food Science and Veterinary Public Health, Clinical Department for Farm Animals and Food System Science, University of Veterinary Medicine Vienna, Veterinärplatz 1, 1210 Vienna, Austria.

<sup>b</sup> Kwizda Agro GmbH, Universitätsring 6, 1010 Vienna, Austria.

\* e-mail [ramana.pydi@vetmeduni.ac.at](mailto:ramana.pydi@vetmeduni.ac.at)

**Background:** Synergists in insecticide formulations requiring safer, eco-friendly to enhance insecticide efficacy while reducing health risks and environmental impact. This study explores vanillic acid-based nutraceutical ionic liquids (NILs) as sustainable synergists using the Active Pharmaceutical Ingredient-Ionic Liquid (API-IL) concept.<sup>1</sup>



**Methods:** 10 novel ILs were synthesized in one pot reaction and evaluated for ecotoxicity against bacteria and fungi. Their synergistic potential was assessed through *in vitro* enzyme inhibition of Glutathione-S-Transferase (GST) and Esterase (EST). *In vivo* synergism and efficacy against tolerant *Blattella germanica*, was compared to a commercial synergist.

**Results:** 9 NILs (Out of 10 NILs) were harmless to bacteria and fungi.<sup>2</sup> *In silico* analysis using the AquaBoxIL<sup>3</sup> tool predicted quaternary ammonium ILs are more biodegradable. Our *in vitro* assays revealed significant inhibitory activity of detoxification enzymes (GST, EST), both in its native form and as NILs. On these insights, *in vivo* evaluations of 4 NILs and vanillic acid in *Blattella germanica* revealed efficacy of 4 NILs (Out of 10 NILs) comparable to a commercially available synergist.

**Conclusion:** NILs enhance insecticide efficacy, reduce ecological risks, and enable novel ionic liquids as synergists for insecticide formulations.

### References:

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- (3) Barycki, M.; Sosnowska, A.; Puzyn, T. AquaBoxIL-a Computational Tool for Determining the Environmental Distribution Profile of Ionic Liquids. *Green Chemistry* 2018, 20 (14), 3359–3370. <https://doi.org/10.1039/c8gc01582a>.



Mr. Ramana Pydi is a Ph.D. candidate at University of Veterinary Medicine Vienna, Austria. His research focus on Ionic Liquids for sustainable insecticide formulations. He holds master's degree from Pondicherry University, India. He also worked as a researcher in FSU Jena- Germany, TU Vienna-Austria and NUS Singapore and IIT Chennai-India before joining in Centre for Food Science and Veterinary Public Health, Clinical Department for Farm Animals and Food System Science, University of Veterinary Medicine Vienna, Austria.