Bacterial strain *Labrys portucalensis* F11 degrades the neonicotinoid insecticide thiamethoxam and removes toxicity

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Abstract

The extensive use of neonicotinoid pesticides in the past two decades caused serious impacts on ecosystems due to their toxicity [1]. Finding solutions to eliminate neonicotinoids' residual levels in the environment should be a priority issue. Here, the degradation and detoxification of thiamethoxam (TMX) by the bacterial strain *Labrys portucalensis* F11 was conducted. *L. portucalensis* F11 was able to remove 41%, 35% and 100% of 10.8 mg L^{-1} of TMX, provided as the sole carbon and nitrogen source, the sole carbon and sulfur source and as the sole carbon source, respectively, after 30 days of incubation in mineral salt medium. The supplementation with a second carbon source, acetate, resulted in more than 90% degradation of the same TMX concentration in 3 days. The chemical structure of 12 metabolites was proposed based on UPLC-QTOF/MS/MS analysis. The main degradation pathways proposed are based on nitro reduction, oxadiazine ring cleavage and dechlorination. Toxicity was removed from the medium after biodegradation, as indicated by the results obtained using *Aliivibrio fischeri* and by assessing the synthesis of an inducible β-galactosidase by an *E. coli* mutant (Toxi-Chromo test). Results from the present study reveal that *L. portucalensis* F11 can potentially be used as part of a TMX bioremediation technology for a simpler, ecologically-friendly and sustainable way to remove TMX from the environment.

References

[1] Wood, T.J. *et al.* The Environmental Risks of Neonicotinoid Pesticides: A Review of the Evidence Post 2013. *Environ. Sci. Pollut. Res.,* **2017,** 24, 17285–17325. https://doi.org/10.1007/s11356-017-9240-x.

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