New iron nanofertilizers to amend chlorosis in soybean plants

Tânia Moniz*[1,2,3], Simão Pinho[2,4], Carla Santos[4], Andreia Granja[2], Marta Vasconcelos[4], Baltazar de Castro[1], Maria Rangel[3] and Salette Reis[2]

[1]LAQV, REQUIMTE, Departamento de Química e Bioquímica, Faculdade de Ciências, Universidade do Porto, Rua do Campo Alegre, s/n 40169-007 Porto, Portugal;
[2]LAQV, REQUIMTE, Departamento de Ciências Químicas, Faculdade de Farmácia, Universidade do Porto, Rua de Jorge Viterbo Ferreira, 228, 4050-313 Porto, Portugal;
[3]LAQV, REQUIMTE, Instituto de Ciências Biomédicas de Abel Salazar, Universidade do Porto, Rua de Jorge Viterbo Ferreira, 228, 4050-313 Porto, Portugal;
[4]CBQF - Centro de Biotecnologia e Química Fina, Escola Superior de Biotecnologia da Universidade Católica Portuguesa, Porto, 4169-005 Porto, Portugal

tmoniz@ff.up.pt

Iron deficiency chlorosis (IDC) is a nutritional condition affecting plants that can lead to significant crop yield losses when plants are grown in calcareous alkaline soils (circa 30% of the world's arable land). In the present work, we designed and produced new polymeric nanofertilizers based on nanoparticles loaded with iron (III) chelates from the 3-hydroxy-4-pyridinones (3,4HPO) family. These chelates have shown their efficacy in reducing chlorosis in soybean plants (*Glycine max L.*) [1].
The work comprised the production, optimization, and characterization of different formulations of polymer-based nanoparticles, varying in size, and labelled with a fluorescent marker (rhodamine B). The labelled formulations were tested to infer about their uptake using confocal fluorescent microscopy whereas iron-loaded nanoformulations were tested regarding their ability to amend chlorosis. Morphological and biochemical parameters were assessed, and the results showed improved efficacy of the developed nanoformulations compared to the non-encapsulated chelates. These findings pointed out the potential of these nanoparticles to treat IDC by providing a necessary supply of iron to chlorotic plants.

Acknowledgements

We thank the support from the projects (FCT/MCTES): UIDB/50006/2020, UIDP/50006/2020.

Funding

We thank the financial support from the project EXPL/QUI-QIN/0411/2021.

References

[1] C. S. Santos, E. Rodrigues, S. Ferreira, T .Moniz, A. Leite, S. M. P.Carvalho, M. W. Vasconcelos and M. Rangel, Physiologia Plantarum, 173 (2021) 235.