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Helping plants to become healthier

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Modern agriculture at present times is facing many challenges. On one hand, society requires crops and plant-related products free of contaminations from Plant Protection Products (PPP) residues; on the other hand, crop quantity and quality should be sufficient to support continuously increasing demand for food. Unfortunately, most often crop yields are reduced by pathogens, insects, other pests or weather conditions, so that forces modern agriculture to focus on finding new and more sophisticated methods of plant protection, even not chemical-based. Systemic Acquired Resistance (SAR) is a phenomenon involving stimulation of natural plant immune system which acts to increase resistance against pathogens, especially viruses (which cannot be controlled via classical plant protection agents). SAR could be induced by biological (pathogens) or chemical agents. One of them is BTH (Benzo-(1,2,3)-thiadiazole-7-carbothioic acid S-methyl ester) discovered in the last decade of 20th century. Unfortunately, usage of this compound was very limited due to its very low solubility in water (~7 mg/L). It was interesting to us to design new ionic derivatives of BTH that could be combined with other functional counterions leading to formation of highly water soluble bifunctional salt. As a result, we have prepared new group of bifunctional salts (including ionic liquids) with SAR inducer ion combined with biocidal agent or water solubility modifier. On the other hand, research on BTH-based compounds showed that not only salts exhibit very high potential in SAR induction but also neutral synthesized carboxylic acid derivatives such as amides or esters have also very high biological potential. Some of the obtained compounds exhibit very high biological activity (up to >99% of infection inhibition) at tested doses (even as low as 20 mg/L). In our opinion such new compounds could be in future successfully used as a new plant protection product.

Figure-1: Antibacterial effect of bthwa; control (left); treated plant (right). Model plant: tomato; bacteria Psuedomonas syringae pv. tomato

Figure-2: Antifungal effect of bthwa; control (right); bthwa treated plant (left). Model plant tomato; fungi: powdery mildew.

Recent Publications

1. Smiglak M, Lewandowski P, Kukawka R, Budziszewska M, Krawczyk K, Obrepalska-Steplowska A and Pospieszny H (2017) Dual functional salts of benzo[1.2.3]thiadiazole-7carboxylates as a highly efficient, eco-friendly weapon, against viral plant diseases. *ACS Sustainable Chemistry and Engineering*; 5(5): 4197- 4204.
2. Stolarska O, Pawlowska-Zygarowicz A, Soto A, Rodríguez H and Smiglak M (2017) Mixtures of ionic liquids as more efficient media for cellulose dissolution. *Carbohydrate Polymers*; 178: 277-285.

Biography

Marcin Smiglak has obtained his MSc Engineering in Technology of Organic Chemistry from Poznan University of Technology. He has completed his PhD in Organic Chemistry from The University of Alabama, USA. He held a position of Post-doctoral Research Associate in Prof. Robin D Rogers's research group at Center for Green Manufacturing and Alabama Institute of Manufacturing Excellence, The University of Alabama, USA. Further, he took a position of Head of Production and Technology R&D in IoLiTec Ionic Liquid Technologies GmbH, Heilbronn, Germany. He hold a position of Head of Materials Synthesis Group at Poznan Science and Technology Park, Poznan, Poland and leads research group oriented toward research on applications of ionic liquids.

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