Organized by Endorsed by
8th IUPAC INTERNATIONAL CONFERENCE ON GREEN CHEMISTRY
9 - 14 September 2018, Shangri-La Hotel, Bangkok, Thailand

8th ICGC 2018 Session:

Catalysts to the rescue for destroying and monitoring agrochemicals: from waste to nanomaterials

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Abstract:

Chemical security has been a global concern because of the imminent risks involved. The abusive and indiscriminate use of agrochemicals and in the addition the stockpiles of prohibited substances (including chemical warfare) requires effective methodologies to destroy these stocks efficiently. The monitoring of these toxic agents is also of interest. Our group has been engaged in developing novel catalysts targeted for degrading organophosphates, hence detoxifying it. We use different scaffolds from nanomaterials (thin films, magnetic, powder) to waste, by chemically modifying with reactive functional groups: imidazole, thiol and hydroxamate. Moreover, waste has been used to anchor groups and have shown prominent activity towards toxic pesticides. We emphasize the reuse of rice husk, one of the greatest agricultural waste and also arabic gum, a tannin industrial waste. In addition, we report the development of sensors for monitoring organophosphates. For example, a cheap homemade colorimeter that can detect the presence of pesticides in only 5 min, promising for field analysis. In summary, we present various catalysts that are able to degrade pesticides, with rate enhancements > 10^7-fold and that were recycled with 3 cycles without significantly loosing activity. A thorough mechanistic study is also conducted to confirm the preferable reactions pathways.

Born in 1984, Prof. Orth has a P.h.D (2011) degree in Chemistry from UFSC (Brazil) and post-doctoral from UFPR (Brazil, 2012). Since 2012, is Professor at the Department of Chemistry- Federal University of Paraná in Brazil, where she leads the research Group of Catalysis and Kinetics. She received in 2016 the International Rising Talents award from L'Oreal-UNESCO (France) and in 2015 the L'Oréal-UNESCO-ABC Award For Women in Science (Brazil). Her research focuses on organophosphates and efficient ways to destroy and monitor them, which rely on mechanistic elucidation, novel sensing apparatus and designing catalysts: sustainable derived from waste and nanomaterial-based.