THE EDUCATION UNIVERSITY OF HONG KONG
FACULTY OF LIBERAL ARTS AND SOCIAL SCIENCES

Research Output Prize for the Dean's Research Fund 2018-19

Brief Introduction of Awardee's
Research/KT Publication/Study/Output and Future Research/KT Development

Awardee (Dept):	Dr. Li Wai Chin, Assistant Professor (SES)
Publication Title/KT project:	Effects of Fe plaque and organic acids on metal uptake by wetland plants under drained and waterlogged conditions

A. Briefly introduce your research/KT publication/study/output for which you have received the prize.

This summary describes the significance of a refereed article titled "Effects of Fe plaque and organic acids on metal uptake by wetland plants under drained and waterlogged conditions" published in Environmental Pollution in 2017 (DOI: 10.1016/j.envpol.2017.08.012). Published by Elsevier (ISSN 0269-7491), Environmental Pollution is a world-class journal and ranked Q1 in 'Health, Toxicology and Mutagenesis', 'Pollution' and 'Toxicology' subject area and category.

A striking feature in wetland plants is the presence of iron (Fe) plaque, which provides a reactive substrate for metal sequestration on root surface. The greater the extent of Fe plaque on root, the more the metal immobilized. However, there are conflicting reports as to whether the presence of Fe plaque reduces or increases metal uptake by wetland plants. The discrepancies in effects of Fe plaque on metal uptake may be related to the inconsistence of metal uptake under dry and flooded conditions which need to be resolved. As a result, it is necessary to understand how metal uptake and translocation respond to waterlogging in wetland plants with different root oxidizing ability and Fe plaque formation.

Although metal tolerance in wetland plants mainly depends upon their metal exclusion ability, the higher-than-toxic-level of metal concentrations in shoots of some species indicated that internal detoxification metal tolerance mechanisms might also exist. It has been demonstrated that organic acid is accumulated in roots of some wetland plants in response to flooding. In particular, malate is a kind of metal chelator, this metabolic product may simultaneously play a role in metal detoxification in some flood tolerant species.

This study aims to assess the role of Fe plaque in metal uptake and translocation by different wetland plants and examine the effects of organic acids on metal detoxification in wetland plants. It is found that although exposed to a similar level of metals in rhizosphere soil solution, metal uptake by shoots of *Cypercus flabelliformis* and *Panicum paludosum* are greatly reduced, consequently leading to a better growth under flooded than under drained conditions. This may be related to the enhanced Fe plaque in the former, but due to the decreased root permeability in the latter under anoxic conditions. The Fe plaque on root surface has potential to sequester metals and then reduce metal concentrations and translocation in shoot tissues. However, whether the Fe plaque acts as a barrier to metal uptake and translocation may also be dependent on the root anatomy.

There are many indications that organic acids are involved in tolerance, transport and storage of metals in plants, including Cd, Ni and Zn etc. In the present study, the positive correlations exhibited between organic acid (citric acid and malic acid) and internal Pb/Zn in *P. fugax* and *P. paludosum* also supported that organic acid is able to combine excess internal metals. The varied metal uptake and tolerance among species when exposed to the same level of metal would also be related to internal detoxification strategies. The fact that *P. paludosum* could tolerate the highest Zn and *C. flabelliformis* had higher tolerance to similar internal Zn in the shoot than *P. fugax* results from the high levels of malic or citric acid in their shoots. Lastly, the research suggested that malic or citric acid in shoots of *P. paludosum* and *C. flabelliformis* may account for their internal detoxification for Zn.

B. *How you used/will use your prize and perhaps its usefulness to your research/KT development?*

The funding will be used for conducting an investigation about this topic. Based on the existing background information, the role of organic acids in metal detoxification in wetland plants, Fe plaque and soil solutions needed further study. Other mechanisms such as thiol metal binding and antioxidant enzyme activities should also be investigated.

C. *Expected research/KT outcomes/outputs/impacts arising from this prize.*

The data generated will assist the preparation of a GRF proposal.