

## **Project overview**

Cadmium and other heavy metals occur naturally in soils and can accumulate in plants. Maximum levels are established in legislation and while levels found in Irish produce do not present an unacceptable risk to the consumers it is necessary to continually strive to reduce levels in food.

The presence of heavy metals in crops is problematic, since they can be taken up by bio sorption into the roots and accumulates in the edible crops parts, inevitably ending up in the food chain. A method for accurate in-situ determination of these metals in soils would be of great benefit. Development of electrochemical sensors can provide a platform where a portable in-situ determination of extremely low levels of these metals would be possible. Since levels expected are in the low ppb range modification of classical carbon electrode surfaces are required to reach the required sensitivity. In the present study, electrodes will be subjected to a range of modifications using graphene, gold nanoparticles, calixarene ligands and a nafion polymer.

The modified electrodes will be used to determine total and available Cd (and other relevant metals) in real soil and plant samples using the optimised sensor platform and incorporated into studies of soil-Cd dynamics, *in situ* soil remediation and/or plant physiology.

This will provide a fundamental understanding of the soil chemistry, and lead to development of novel rapid in-situ detection method leading to a sustainable, effective solution for farmers, while adhering to good agricultural practice.

This project "CREDIT" will harness a range of scientific, knowledge transfer, farming and policy & regulatory expertise to develop appropriate strategies to manage cadmium and heavy metals in crops. The various project outputs will support key stakeholders, including farmers, agronomists, the horticultural industry and policy makers & regulators to combat these issues.

## **Project title**

Cadmium and other Heavy Metals - Detection and Mitigation in Horticultural Produce, Soils and other Crops.

## **Description**

To determine total and available Cd (and other relevant metals) in real soil and plant samples using the optimised sensor platform and incorporation into studies of soil-Cd dynamics, *in situ* soil remediation and/or plant physiology.

## **Objective(s):**

- To synthesise and characterise the different components necessary for the stepwise modification of glassy carbon and screen printed carbon electrode surfaces.
- To modify these surfaces with the previously synthesised complexes to determine their ability to enhance voltammetric signals in the detection of Cd and other relevant metals, namely Pb and Hg in soil and plant samples. Each modification will be evaluated both individually and co-operatively.
- To optimise the voltammetric parameters for the determination of trace levels of Cd, Pb and Hg in model solutions by Square Wave Anodic Stripping Voltammetry (SWASV) using the previously synthesised complexes and the previously described modifications.

**Deliverables**

- An electrochemical method using SWASV with modified electrodes will be developed and validated for determination of Cd and other pertinent metals in soil and crop samples.
- A portable electrochemical platform will be developed for *in-situ* measurements of Cd and other relevant metals using disposable screen printed electrodes.