Golnaz Asghari-Ezzati

ESR 11, Work Package 4

Project Title: Sustainable treatment technologies using mixed waste media to mitigate agricultural contaminants in land drainage

Beneficiary, Host research institute: Teagasc, Johnstown Caste, Co. Wexford, Ireland

Host organisation for secondment: University of Sheffield, Sheffield, UK

Duration: Feb-Apr 2019

"This report has been prepared for INSPIRATION (Managing soil and groundwater impacts from agriculture for sustainable intensification) Marie Skłodowska-Curie Innovative Training Network (Grant agreement no. 675120)" as a report on completed secondments.

Introduction

In order to fulfil the requirement of attending secondment(s) at one of the partner research organizations/institutes within the INSPIRATION ITN project, the third (final) secondment for ESR 11 in work package 4 was undertaken with University of Sheffield during February-April 2019.

The aim of this report is to present the outcome of 2-month secondment in Sheffield University, benefiting from the guidance and supervision of prof .Thornton (ITN lead and ESR 11's supervisory team) from both a scientific and personal-development point of view.

The working plan was:

1) Data analysis/interpretation of Column Adsorption Study (at two scales).

This would ultimately help in developing field-scale nutrient interceptor in a novel time/cost saving technique for the treatment of excessive loads of Ammonium and Phosphorus in drainage water leaving the Johnstown Castle farm in Ireland

2) Organizing SWOT analysis session for the already developed Decision Support Tool FarMit for selection of locally sourced media for nutrient mitigation in drainage water

Progression

1- Scientific Progress

1.1.1. Post INSPIRATION-Workshop4 (Wexford, Ireland; Oct2018) meeting to develop publication from outcome of group work exercise and workshop on indictors of sustainable intensification and their impacts on agriculture from different stakeholders' points of view.

1.1.2. Column Adsorption Study – Data interpretation/analysis/modelling

As for meeting the 4th Objective of this PhD in WP4 [development of field scale nutrient interceptor (structure) filled with locally sourced media for treatment of drainage water leaving the farms], all required data have been collected from Nov 2016 to Jan 2019. This included all required laboratory batch studies along with field-data collection (on quality of water at different sampling points, water flow, and soil chemistry in the ditch).

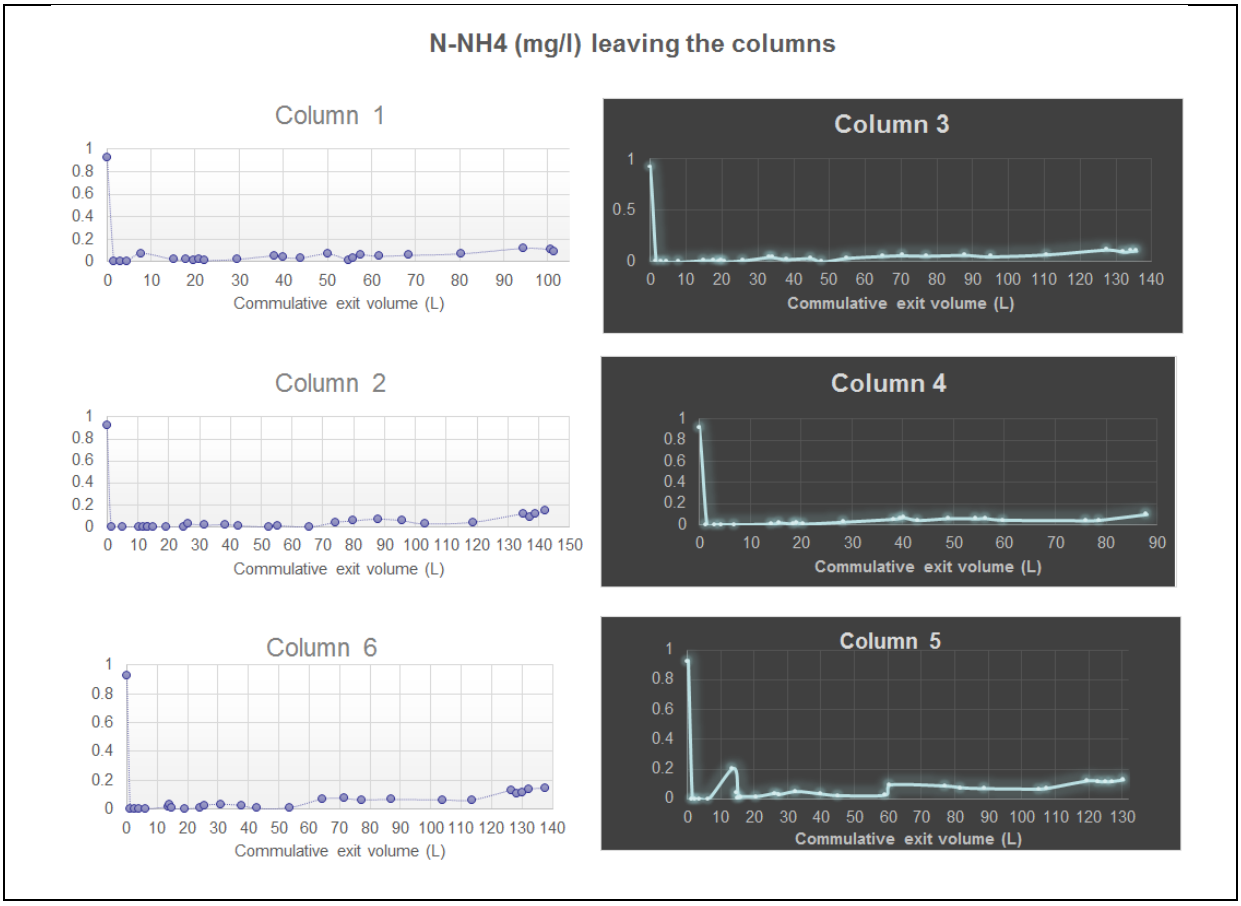
Following on from Column adsorption studies at two different scales (large scale of 1 meter columns and small scale columns of 10-40 cm) have been conducted to provide necessary data for the design and development of a field structure using the adsorption capacity of selected media in column studies.

During the secondment in Sheffield University, all data interpretation and analysis on column studies were completed. The data were graphed and the application and limitation of different models (two/three parameters) such as Frenudlich, Langmuir, Temkin, etc or software such as PHREEQC were investigated. Ultimately, and according to primary objective of this

study, the model developed by Callery & Healy (2015) was applied. Also, weekly supervisory meetings with in-house as well as supervisors outside UK were held.

The two different scale column studies showed that small scale adsorption columns can be used as substitute to provide sufficient information for the development of field scale structure. This novel method saves considerable time and cost for collecting data on field structure design and development e.g. structure dimensions, required amount of media, lifetime, etc.

This opportunity helped me to see how best to format data and interpret them and turn this experiment into a publication.



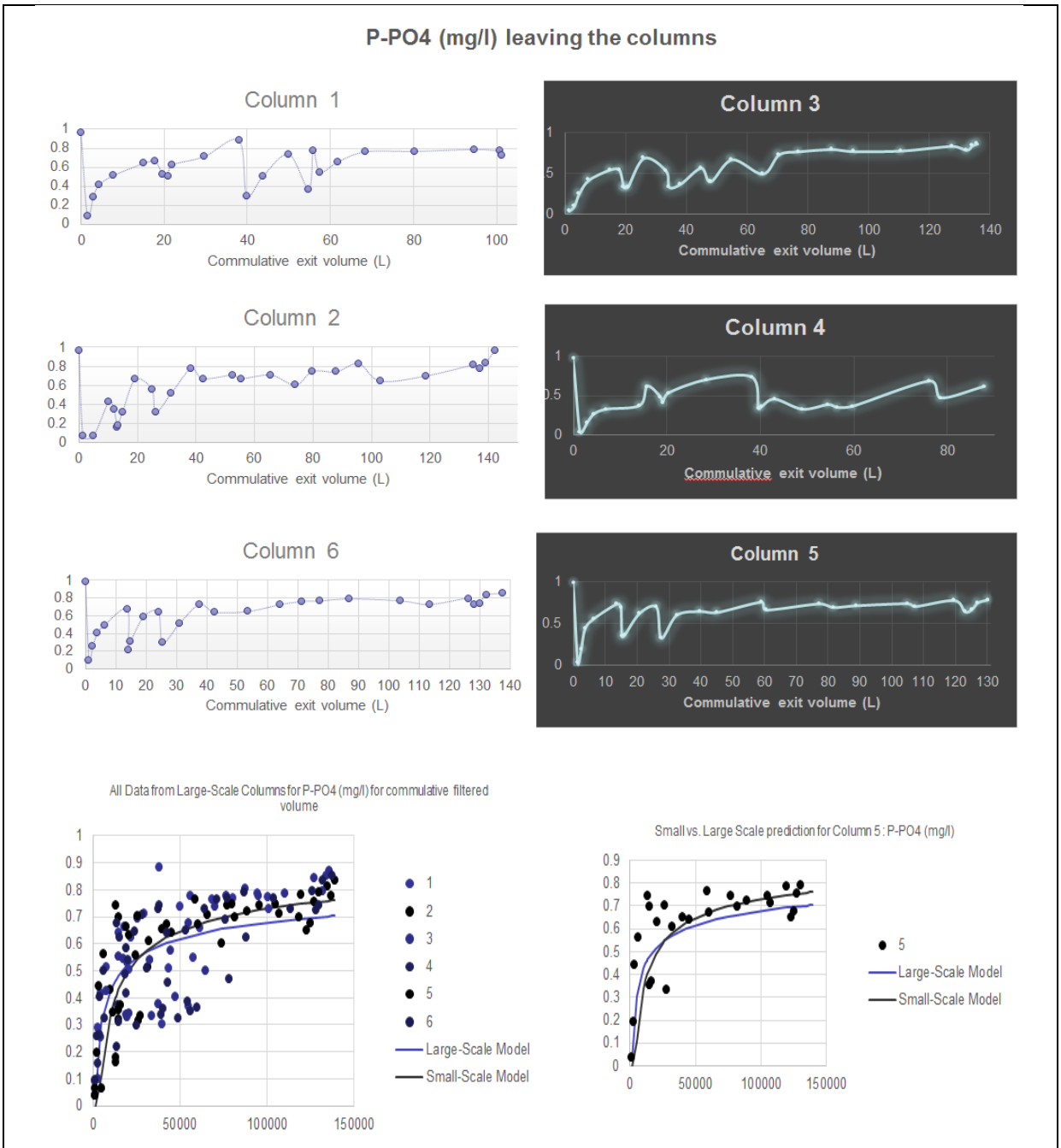


Figure 1. Examples of results/graphs from Large and Small Scale Column Study data interpretation

1.2. SWOT Analysis Workshop

In the earlier stages of this project, a Decision Support Tool called FarMit (Farm Mitigation) was developed to enable operators across the world to choose the most appropriate type of locally sourced media for the mitigation of pollutants at any site (e.g. Nitrate, Ammonium, or dissolved reactive phosphorus), considering the geographical-specific condition into account (i.e., cost to bring the media to the farm and availability of the media to the farmer)

A SWOT (strength, weakness, opportunities, threat) analysis workshop was organised during the secondment with local staff from the Water Research Group/ Groundwater Protection researchers at Sheffield University, was one of SWOT analysis workshops held to validate the FarMit DST. The publication of this work is now in preparation.

This tool enables any users around the world to match on-site pollutant discharges with a suitable locally sourced media, which could potentially be used by an engineer to mitigate such losses in an engineered structure placed at the delivery point of said discharges (Section 1.1).

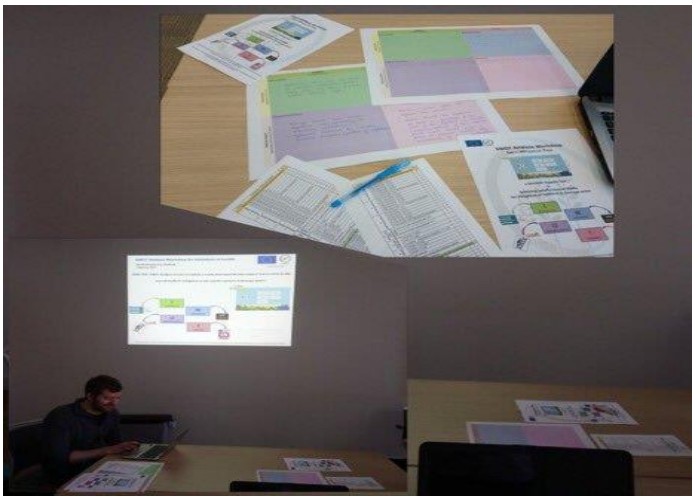


Figure 2. SWOT Analysis Workshop with Water Research Group

2- Personal development

The opportunity of working in an international environment and networking with young/established/experienced researchers in interdisciplinary fields provided great opportunities to learn beyond the scope of the project and interact with different people.
Also, meetings with Prof. Thornton as one of my supervisors and his insights into modelling column adsorption studies, as well as developing the PhD thesis, publications, post-PhD career and life were invaluable.

The encouragement and personal development advice and suggestions I received during my time in Sheffield with a view towards doing a Marie Curie PhD and beyond, was definitely a great motivation and turning point in my Early Stage Career journey.

Acknowledgment:
I would also like to thank Dr. Kakoyni for her constant support to get settled in Sheffield and be registered in Sheffield University, and her help to smoothen any possible administration-wise complications during my stay.