WATER INFORMATICS SCIENCE & ENGINEERING
EPSRC CENTRE FOR DOCTORAL TRAINING

Engineering and Physical Sciences Research Council

Constructed Wetlands: an effective wastewater treatment solution for the removal of emerging contaminants

Zara Visanji, University of Exeter (Contact: zv208@exeter.ac.uk)
Supervisors: Fayyaz Memon & David Butler

INTRODUCTION

Aim: to study the influence of constructed wetlands (CWs) as a wastewater treatment (WWT) option for the removal of emerging contaminants (ECs).

WWT plants were not originally designed to fully remove ECs.

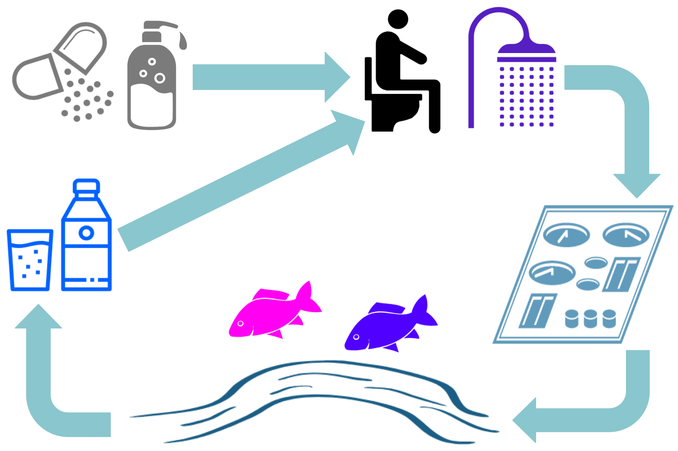
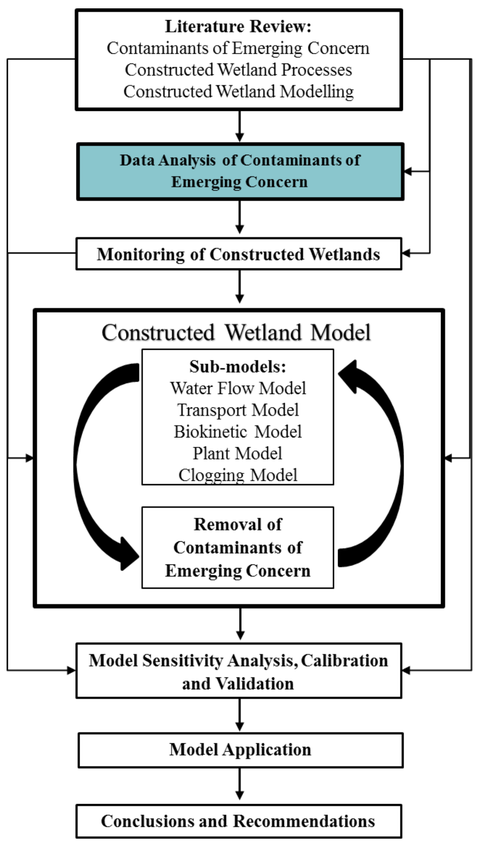


Fig 1: *One of the many pathways that ECs are able to enter our water systems.*



CWs are frequently being used as an addition to existing WWT plants. They provide a sustainable and cheaper alternative to current WWT systems and have shown to remove some categories of ECs up to 100% (Gorito et al., 2017).

Fig 2: *Interaction between various components of PhD research. This poster focuses on the highlighted section.*

DATA ANALYSIS

Objective: To determine the occurrence of ECs in surface waters that are affected by the discharge of WWT plants. A detailed cluster analysis using Wards Linkage Method was carried out on existing data collected in the Chemicals Investigation Programme.

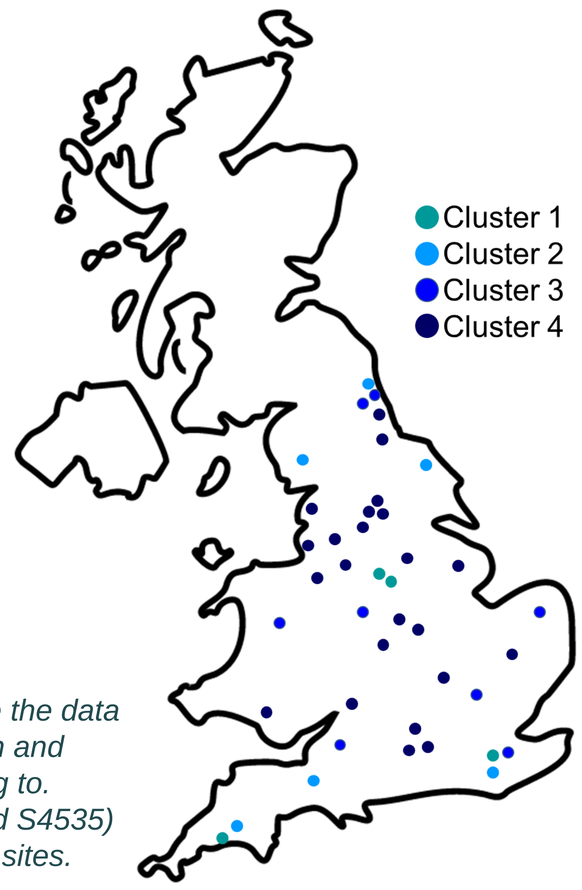
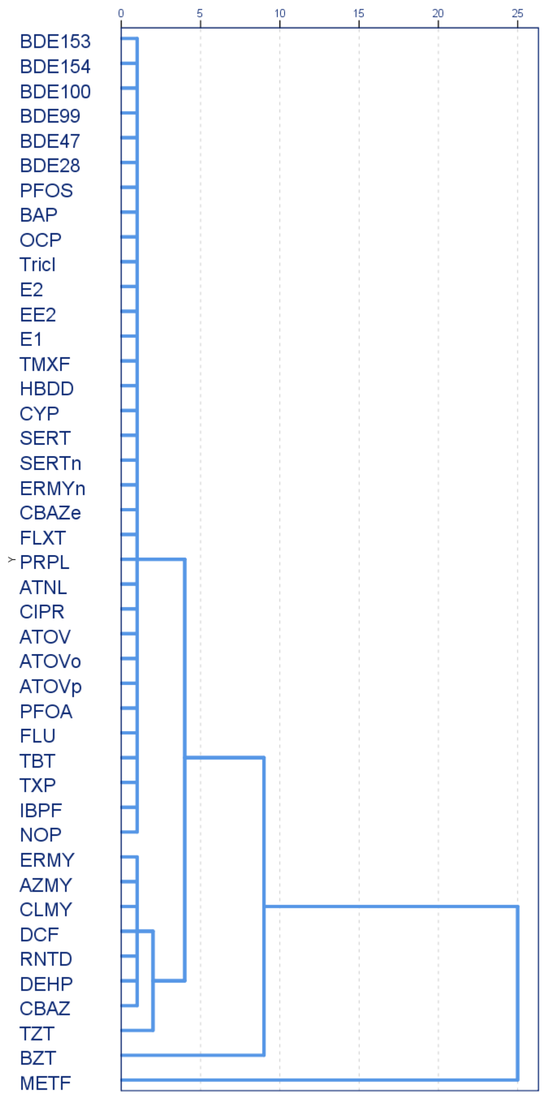


Fig 3 *(Right)**:** UK map showing where the data points of the sites for Fig 5 were taken and which cluster membership they belong to. Two sites are not included (S4660 and S4535) as no location was provided for these sites.*

RESULTS



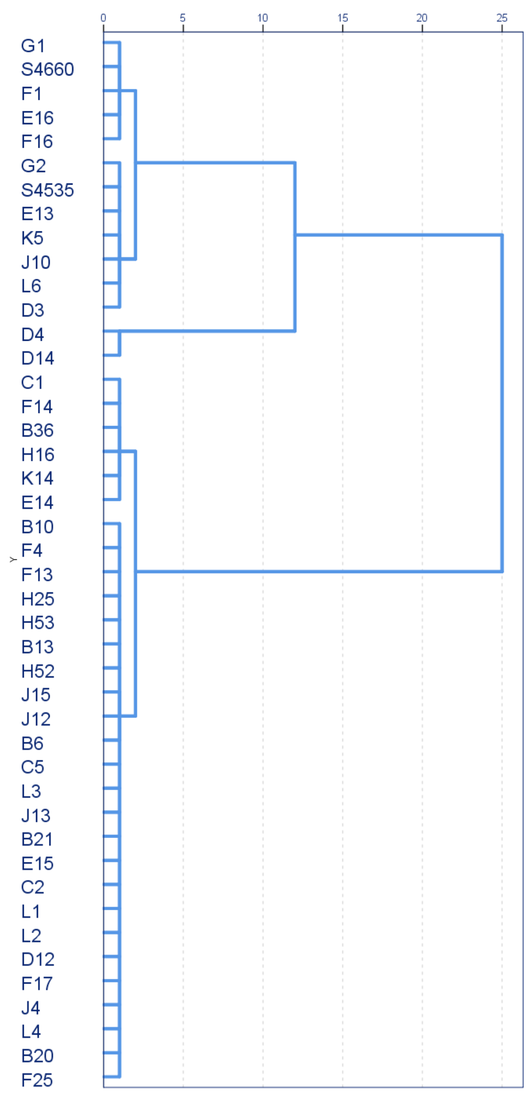


Fig 4 *(left)**:** Dendrogram showing cluster memberships categorised by ECs.*
Fig 5 *(right)**:** Dendrogram showing cluster memberships categorised by locations.*
Table 1 *(below)**:** Showing ECs from the same category that were grouped in different cluster memberships.*

EC Name	Contaminant Category	Cluster
CIPR	Antibiotics	1
ERMYn	Antibiotics	1
ERMY	Antibiotics	2
AZMY	Antibiotics	2
CLMY	Antibiotics	2
FLXT	Antidepressant	1
SERT	Antidepressant	1
SERTn	Antidepressant	1
CBAZe	Anti-epileptic	1
CBAZ	Anti-epileptic	2
ATNL	Beta Blocker	1
PRPL	Beta Blocker	1
CYP	Biocide and Insecticide	1
TBT	Biocide and Insecticide	1
NOP	Industrial Use	1
OCP	Industrial Use	1
TXP	Industrial Use	1
TZT	Industrial Use	3
BZT	Industrial Use	4
DEHP	Industrial Use	2
IBPF	NSAIDs	1
DCF	NSAIDs	2

Summary:

- ECs within the same category behave in a different way due to different physiochemical properties and removal should focus on individual ECs.
- There is a high occurrence on ECs found in rivers across the UK from the discharge from WWT plants.

NEXT STEPS

Placement at IIT Madras, India to carry out hydroponic studies and adsorption studies to better understand phytoremediation potential of plants and physiochemical properties (Ramprasad et al., 2018); whilst monitoring 5 CWs.

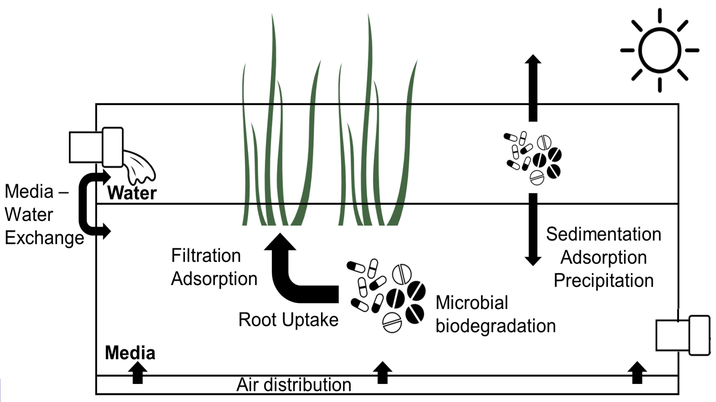


Fig 6: *Example of an aerated horizontal flow CW and the processes that occur aiding in the removal of ECs.*

References
1) **Gorito, A.M.**, Ribeiro, A.R., Almeida, C.M.R., Silva, A.M.T., 2017. A review on the application of constructed wetlands for the removal of priority substances and contaminants of emerging concern listed in recently launched EU legislation. Environmental Pollution 227, 428–443. https://doi.org/10.1016/j.envpol.2017.04.060 2) **Ramprasad**, **C.,** Philip, L., 2018. Contributions of various processes to the removal of surfactants and personal care products in constructed wetland. Chemical Engineering Journal 334, 322–333. https://doi.org/10.1016/j.cej.2017.09.106

UNIVERSITY OF EXETER
UNIVERSITY OF BATH
University of BRISTOL
CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

www.wisecdt.org.uk