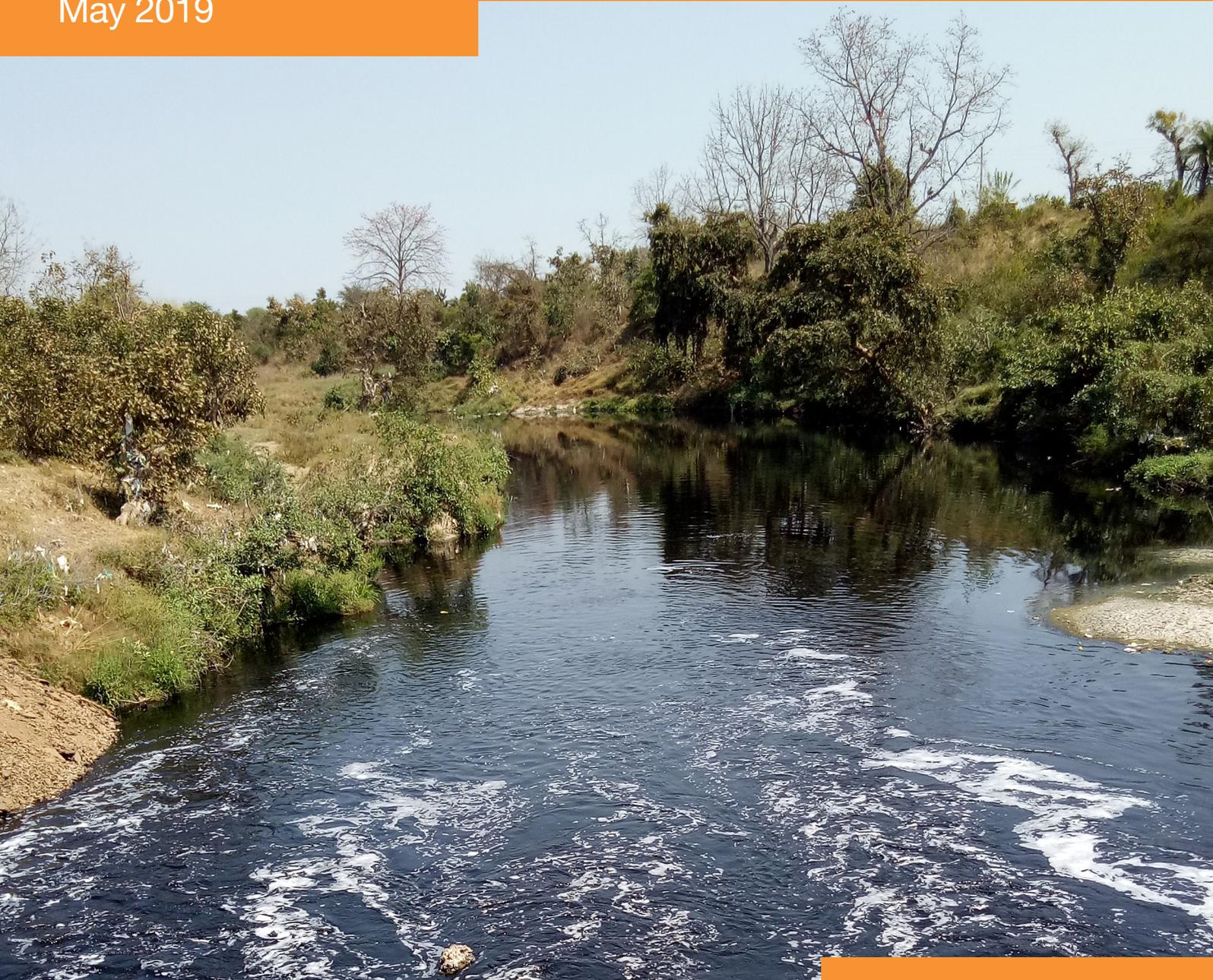


A Small Scale Monitoring Study for a Range of Pharmaceuticals in the River Foss Catchment and Comparison to Concentrations in the River Nag, India

Report of Researcher Exchange March 2018

May 2019



INDIA-UK
Water Centre
भारत-यूके
जल केन्द्र

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www.iukwc.org

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The India-UK Water Centre promotes cooperation and collaboration between the complementary priorities of NERC-MoES water security research.

भारत-ब्रिटेन जल केंद्र एमओईएस-एनईसीआरसी(यूके) जल सुरक्षा अनुसंधान के पूरक प्राथमिकताओं के बीच सहयोग और सहयोग को बढ़ावा देने के लिए करना है

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Executive Summary

This report represents an overview of the activities and conclusions of a Junior Researcher Exchange undertaken at the University of York from 7th March 2018 - 27th March 2018 convened by Akanksha Singh Kachhawaha (CSIR-National Environmental Engineering Research Institute, India) and Dr Alistair B.A. Boxall (University of York, UK). It outlines the aims of the exchange, describes the programme and the activities developed to meet the objectives, and details the outputs generated, as well as the ongoing and future collaboration. Finally, it assesses the support received from the IUKWC through the Researcher Exchange Scheme. The present report is intended for India-UK Water Centre members and water security stakeholders.

1. Activity Leads

The Researcher Exchange was supported by the India-UK Water Centre (IUKWC) and led by the Activity Leads:

Lead Researcher:

Akanksha Singh Kachhawaha

Senior Research Fellow, Ph.D. student

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Host Researcher:

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The Exchange was held at University of York, UK 7th March – 27th March 2018.

2. Activity Aims

The India-UK Water Centre is based around five key cross-sectoral themes and aims to deliver a portfolio of activities across these themes. This activity cuts across two themes: Transforming science into catchment management solutions and Improving freshwater monitoring frameworks and data for research and management.

The objective of the Researcher Exchange was to perform monitoring of the River Foss, UK and the River Nag, India in the month of February for a range of pharmaceuticals using a single analytical method and sampling protocol. The River Foss, is a tributary of the River Ouse flowing through the city of York. River Nag, on the other hand flows through the city of Nagpur, India. Due to excessive sewage discharge in the river, it has turned into a drain. The rivers were monitored for a range of pharmaceuticals from different therapeutic classes, including antibiotics. The aims of the objective were as follows:-

- Selection of sampling sites in both the rivers;
- Sampling and proper storage of the samples;
- Analysis of the samples by Liquid Chromatography-Mass Spectrometry;
- Interpretation of the data produced by the Mass Spectrometer;
- Comparison of the exposure of pharmaceuticals in the UK and India.

3. Activity Structure

The researcher exchange was aimed at basic understanding of the exposure of pharmaceuticals (emerging contaminants) in the aquatic environment of the UK and India. The two rivers, Nag (river cum drain) and Foss (improved river) were selected in both the countries. A few skype meetings were held before the exchange to decide the sampling sites on the rivers, understand the sampling protocol, and procedures for handling and transportation of the samples from India to the UK. The pre- exchange discussions through skype calls and emails facilitated the systematic planning of the activity to be performed during the exchange period.

The rivers were selected on the basis of the following criteria:

1. It is freshwater;
2. Receives wastewater input (i.e., wastewater treatment discharge, untreated sewage discharge or suspected septic tank seepage) and;
3. Flows through a populated (village, town or city) area.

Eleven samples (in triplicates) from different sites were collected from both the rivers including a sample upstream from the populated area, a sample both upstream and downstream from at least one wastewater input (e.g., wastewater treatment plant), both up and downstream from any point of interest (i.e., pharmaceutical manufacturing company, hospital, agricultural area, etc.) or confluence with another river and at a point after the river has left the populated area to be monitored for 40 pharmaceuticals including five antibiotics (trimethoprim, sulfamethoxazole, erythromycin, clarithromycin and metronidazole). The samples from both the rivers were collected in the month of February, 2018. Samples collected in India were taken along with the Activity Lead to the UK.

The samples were processed in the University of York and quantified using an HPLC-MS/MS method originally developed by Furlong et al. (No. 5-B10. US Geological Survey, 2014). Limits of detection ranging from 0.9 ng/L (carbamazepine) to 12.4 ng/L (gabapentin) were achieved by direct injection of 100 µL river water filtered in the field with a 0.7 µm syringe filter. Positive

electrospray ionisation was used to generate two transition ions per target analyte and internal standard, one transition for quantification and the other for confirmation. Analysis was performed using a Thermo Endura Triple Quadrupole Mass Spectrometer operated in multiple reaction monitoring mode, with a Phenomenex Zorbax Eclipse C18 Plus Chromatography Column. Deuterated internal standards were used and robust quality control measures were employed throughout sample collection and analysis.

4. Activity Conclusions and Outputs

4.1. Key outcomes

This project provides a snapshot of pharmaceutical exposure comparison in the aquatic environment of two different countries that is expected to provide information on differences in the occurrence of pharmaceuticals across the two countries.

A notable outcome of the exchange is the outline of a paper that, once finished, will be submitted to a peer-reviewed journal, with explicit acknowledgement to the IUKWC funding. This comes together with the knowledge and capacity building exchange between the Lead and Host researchers.

4.2. Conclusions and next steps/recommendations from the activity

Overall, the Researcher Exchange was highly beneficial for the Lead and Host researchers providing not only new knowledge and skills to both parties, but also establishing a solid relationship and understanding that will enhance future collaboration. It is especially positive for early career researchers that have limited funds to do this type of research travel and creating their contact networks.

5. Annexes

Annex A - Exchange Agenda

Date	Activity
7.3.2018	Meeting with Exchange Host Dr Alistair Boxall and his postdoctoral research associate Dr John Wilkinson
8.3.2018 – 9.3.2018	Meeting with all the Ph.D. students in the department working on various aspects of emerging contaminants and exchange of ideas
12.3.2018 – 14.3.2018	Processing of samples collected in India and injection to LC-MS/MS
15.3.2018 – 16.3.2018	Data interpretation- samples from India, attending relevant lectures in the university
19.3.2018	Understanding mass spectrometers along with handling of the software in centre of excellence for mass spectrometry in the university
20.3.2018 – 21.3.2018	Processing of samples collected in UK and injection to LC-MS/MS
22.3.2018 – 23.3.2018	Attending intra-departmental conference on the occasion of World Water Day
26.3.2017 – 27.3.2018	Understanding additivity models for prediction of toxicity through discussions with the host and his Ph.D. student Kamsia Budin



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