

## **The occurrence of human pharmaceuticals in wastewater effluents and surface water of Langat River and its tributaries, Malaysia.**

### **ABSTRACT**

This study provides the first investigation on the occurrence of human pharmaceuticals in the tropical aquatic environment of Malaysia. Water samples were collected at seven different sites along the Langat River and effluents from five sewage treatment plants (STPs) in Langat River Basin. Samples were extracted by solid phase extraction (SPE) and analyzed using liquid chromatography coupled with a tandem mass spectrometry (LC-MS/MS) for 18 pharmaceuticals from six therapeutic classes and one metabolite. Fifteen out of these 19 pharmaceuticals were detected in the river water samples. Mefenamic acid, salicylic acid and glibenclamide were detected in all river water samples indicating their ubiquitous nature and resistance to degradation under the warm and humid tropical conditions. The median concentrations of detected pharmaceuticals ranged from less than the method detection limit (<MDL) for furosemide, loratadine, salbutamol, perindopril, metoprolol and nifedipine to 112.7 ng L<sup>-1</sup> for diclofenac. A similar number of pharmaceuticals were detected in the STPs' effluents samples. Several of these pharmaceuticals, namely salbutamol, atenolol, metoprolol, mefenamic acid, salicylic acid and furosemide were detected in all the STPs' effluents samples. The median concentrations for the detected pollutants ranged between <MDL for lovastatin and amlodipine to 1994 ng L<sup>-1</sup> for metformin. The highest concentration detected in the river water samples was for acetaminophen (346.3 ng L<sup>-1</sup>) and in STPs effluents was for metformin (34228 ng L<sup>-1</sup>). The concentrations of most analytes found in this study were comparable to those reported in the other parts of the world. However, this is the first time amlodipine is detected in the environmental samples.

**Keyword:** Human pharmaceuticals; Sewage effluents; Aquatic pollution; Langat River; Malaysia.