

Occurrence of β -blockers and β -agonists in hospital effluents and their receiving rivers in southern Taiwan

Tsung-Hsien Yu, Angela Yu-Chen Lin*, Xiao-Huan Wang, Cheng-Fang Lin

Graduate Institute of Environmental Engineering, National Taiwan University, 71, Chou-Shan Rd., Taipei 106, Taiwan, R.O.C.
Tel. +886 (2) 3366-4386; Fax +886 (2) 2392-9828; email: yuchenlin@ntu.edu.tw

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ABSTRACT

The occurrence of pharmaceuticals in aquatic environments has been of increasing concern in developed and developing countries. The major sources of pharmaceuticals in aqueous systems are waste streams from hospital effluents and excretion (in both metabolized and un-metabolized forms) from humans and animals. This study investigated the occurrence and distribution of four β -blockers (propranolol, atenolol, metoprolol and acebutolol) and four β -agonists (tulobuterol, salbutamol, clenbuterol and ractopamine) from three hospital effluents and four rivers in southern Taiwan. Analysis was performed via solid-phase extraction and liquid chromatography/tandem mass spectrometry. All targets were detected at least once in all collected samples. The most frequently detected compounds were propranolol, atenolol, acebutolol, and ractopamine, which were found in >70% of the collected samples. 83% of water samples contained three or more target compounds. Metoprolol was found in relatively higher concentrations (up to 592 ng/L) in one hospital effluent, although most target compounds were detected in ng/L-range. The concentrations of β -blockers and β -agonists observed here were comparable to those reported in previous studies around the world.

Keywords: Pharmaceuticals; β -blockers; β -agonists; Solid-phase extraction; Liquid chromatography/tandem mass spectroscopy

* Corresponding author.