P-A1-008

AEROBIC BIODEGRADABILITY ASSESSMENT OF CEFAZOLIN AND ITS PHOTOTRANSFORMATION PRODUCTS

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The presence of antibiotics in the environment has attracted the interest of the scientific community especially because of the possible contribution to the incresing prevalence of antibiotic resistance. Development of infectious diseases caused by multiple resistant pathogens is a serious threat to society and requires urgent action.

Cefazolin (CFZ) a first-generation cephalosporin antibiotic and it is one of the essential medicines for surgical prophylaxis [1]. A recent study showed that cephalosporin underwent photolysis leading to increased toxicity against the Gram negative bacterium *Vibrio fisheri* in the Microtox acute toxicity test. CFZ exerted the highest acute effect in comparison to other cephalosporins, namely cephapirin, cephradine, cephalexin and cefotaxime [2]. Therefore it is important to assess the environmental fate of the cocktail of CFZ and its phototransformation products (PTPs).

Photolytic degradation of CFZ was tested with two different light sources (medium-pressure mercury lamp (UV) and a xenon lamp (simulating sun light)). Aerobic biodegradability of CFZ and the mixtures resulting after 1, 2, 4, 64 min of UV-photolysis were investigated employing two OECD tests: (Closed Bottle test (CBT) and Manometric Respirometry test (MRT)). The primary elimination of CFZ was monitored and the possible formation of stable products by microbial or photolytical transformation was investigated by LC-MS/MS. Furthermore, elimination of dissolved organic carbon (DOC) as a measure for mineralization was monitored.

LC-MS revealed that new PTPs were formed. CFZ underwent photolysis with both xenon and UV lamp. CFZ was completely transformed after 4 min of UV photolysis. However, mineralization was 7% only after 128 min. Under treatment by the xenon light source 56% CFZ only was transformed after 128 min without any mineralization. CFZ was not readily biodegradable in CBT and MRT. No biodegradation was observed for CFZ samples after 1, 2, and 4 min of UV photolysis in CBT and CFZ sample after 64 min of UV photolysis had partial biodegradation in CBT about 12%.

The results demonstrate that CFZ and its PTPs were not biodegradable at low bacterial density and not fully mineralized by phototreatment and may pose a risk to the environment. Further assessment of the PTPs is recommended.

References:

1- World Health Organization. WHO Model List of Essential Medicines ADULTS -- 18th edition (April 2013) -- Rev. Oct.2013. http://apps.who.int/iris/bitstream/10665/93142/1/EML_18_eng.pdf?ua=1 (accessed May 02, 2014).
2- Wang X, Lin AY. Environ. Sci. Technol. 46(22):12417–26 (2012).