Phototransformation and toxicity evaluation of anthelmintic febantel in aqueous media

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Introduction
As the pharmaceutical consumption rises by each day, people have become aware of pharmaceutical persistence and transformation into variety of products in the environment. Problem of the veterinary pharmaceuticals in environment is much less elaborated than one of the human ones but is as the same importance. Once they enter in the environment – directly by agriculture or aquaculture treatments or indirectly, excreted through urine or feces of treated animals – parent compounds and their metabolites are exposed to variety of surrounding conditions which can cause their transformation. Beside biotransformation by microorganisms, one of the most important processes responsible for structural changes of such compounds is phototransformation by sunlight. It is complex process with more than one reaction often leading to multiple products and possible increase of toxic effect to organisms in environment. Therefore the identification of such arisen products and the elucidation of photolytic reaction pathways in environment are of great importance.

Identification of the phototransformation products
Liquid chromatography/mass spectrometry (LC/MS), because of its selectivity and sensitivity and its suitability for compounds with a wide range of masses and polarities, is one of the most powerful methods for performing the identicifation of the arisen products. One possible way of determination of the accurate mass and empirical formula is using orthogonal acceleration time-of-flight (oaTOF) analyzers [1,2].

In the present work, the phototransformation of the diphenylsulphide anthelmintic drug febantel, deworming agent in the treatment of many types of intestinal worms was studied in HPLC-grade water and in artificial freshwater. Environmental conditions were simulated by the solar simulator that generated an emission wavelength spectrum similar to natural sunlight. For the structural identification of the formed products a quadrupole-time of flight (QqTOF) mass spectrometer was used providing an accurate mass of the molecular ion as well as fragment ions and the MS2 fragmentation.

Ecotoxicity
Short-term ecotoxic effects of the many pharmaceuticals are unlikely, but the concerns over the long-term and low-level exposure and followed chronic effects that are raised by more researchers each day are approvable [3]. Any risk assessment of the pharmaceutical based only on parent compound cannot show the real state, but the degradation products have to be involved. As for the lack of the information about febantel environmental toxic impacts the short-term and long-term tests of parent compound and its phototransformation products on three different classes of organisms, marine bacteria Vibrio fischeri, green alga Selenastrum capricornutum and planktonic crustaceans Daphnia magna, were performed.

Keywords: febantel, phototransformation products, ecotoxicity
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