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Determining the Potential Effects of Veterinary Drugs and Their Mixtures in the Environment

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Extended Abstract

Large quantities of veterinary pharmaceuticals (VPCs) are in use worldwide as feed additives, growth promoters and for prophylactic and therapeutic purposes. As animals do not completely metabolise these compounds, a high proportion of them are released to the environment in faeces and urine. Being quite resistant to any elimination processes, once disposed of in the environment they can be transported to different compartments, like surface and drinking waters (Kemper 2008; Sarmah et al., 2006). Their continuous discharge as well as their biological activity can be sufficient to pose a real threat not only to terrestrial and aquatic organisms but also to human health. However, knowledge of their (eco)toxicity is still limited and is restricted to just a few of these substances. Data relating to the long-term exposure of non-target organisms, and especially how continuous exposure for several generations may affect a whole population is missing. Moreover, as these compounds occur in natural media not as a single, isolated drug but usually together with other compounds of the same family or the same type, accumulated concentrations or synergistic-antagonistic effects need to be considered. This lack of knowledge has resulted in a substantial amount of ongoing effort to develop data and approaches that might prove useful for assessing the impact of VPCs in the environment.

Therefore, the objective of this work was to evaluate the ecotoxicity potential of selected, most commonly used VPCs (sulfonamides, tetracyclines, fluoroquinolones, benzimidazoles, macrocyclic lactones and nitroimidazoles) and to assess the threat that their residues in the environment may pose to whole ecosystem. For this purpose a flexible (eco)toxicological test battery was used, including luminescence marine bacteria *(Vibrio fischeri)*, soil bacteria (*Arthrobacter globiformis)*, limnic unicellular green algae (*Scenedesmus vacuolatus*), duckweed (*Lemna minor*) as well as crustacean (*Daphnia magna*) in order to take into account organisms representing different trophic levels. Furthermore, the aim of our study was also to determine the mixture as well as chronic toxicity of VPCs; in particular sulfonamides, towards organisms like algae and higher plants (duckweed) – since there is already sufficient evidence showing that the individual compounds are toxic towards these organisms (Białk-Bielińska et al., 2011). All the data generated in our study were obtained according to internationally accepted test guidelines (e.g. OECD, ISO) or on specific (e.g. national) testing guidelines (e.g. DIN). Hence, according to the European Medicines Agency (EMEA, 2008) our results can be classified under "reliability index 1".

Finally, as highlighted by Escher et al. (1997) special emphasis should be placed on the importance of understanding the interplay between environmental chemistry and toxicology, thereby linking the

concepts of bioavailability and the mechanism of ecotoxicity. Thus, all ecotoxicological tests have been performed in combination with chemical analysis (using liquid chromatography with spectrophotometric detection, HPLC-UV), which enabled to acquire a complete view of the exposure and to obtain a valuable data in the risk assessment.

As a result of such a comparative (eco)toxicological analysis, the potential effects of these VPCs on the environment have been identified. This data contributes to the environmental risk assessment of the pharmaceuticals.

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