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Enantioselective degradation of warfarin in soils

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ABSTRACT

Environmental enantioselectivity information is important to fate assessment of chiral contaminants. Warfarin, a rodenticide and prescription medicine, is a chiral chemical but used in racemic form. Little is known about its enantioselective behavior in the environment. In this study, enantioselective degradation of warfarin in a turfgrass and a groundcover soils was examined in aerobic and ambient temperature conditions. An enantioselective analytical method was established using a novel triproline chiral stationary phase in high performance liquid chromatography. Unusual peak profile patterns, i.e., first peak (*S*(2)) broadening/second peak (*R*(1)) compression with hexane (0.1%TFA)/2-propanol (92/8, v/v) mobile phase, and first peak compression/second peak broadening with the (96/4, v/v) mobile phase, were observed in enantioseparation. This unique tunable peak property was leveraged in evaluating warfarin enantioselective degradation in two types of soil. Warfarin was extracted in high recovery from soil using methylene chloride after an aqueous phase basic-acidic conversion. No apparent degradation of warfarin was observed in the sterile turfgrass and groundcover soils during the 28 days incubation, while it showed quick degradation (half-life <7 days) in the nonsterile soils after a short lag period, suggesting warfarin degradation in the soils was mainly caused by micro-organisms. Limited enantioselectivity was found in the both soils, which was the *R*(1) enantiomer was preferentially degraded. The half-lives in turfgrass soil were 5.06 6 0.13 and 5.97 6 0.05 days, for the *R*(1) and the *S*(2) enantiomer, respectively. The corresponding values for the groundcover soil were 4.15 6 0.11 and 4.47 6 0.08 days.