

# MODERN TOOLS AND APPROACHES TO STUDY FATE AND BIOAVAILABILITY OF PESTICIDES IN SOILS AND RELATED ENVIRONMENTAL COMPARTMENTS

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Current systems of agricultural management and crop production indispensably rely on the use of herbicides, fungicides and insecticides. Although the soul idea of pesticide as a substance is to reach the target organism, make the intended effect and then quickly disappear, their residues can be found in the environment even long time after application. Moreover, due to their persistency and global long range transport it is often possible to find them in areas, where they have been never applied. After discoveries of dangerous properties of DDT and other organochlorine pesticides, a number regulations including Stockholm Convention (UNEP, 2016) were adopted which prohibited or significantly limited their production and use. However, the continuing need for plant protection products has resulted in parallel development of other types of pesticides (including those currently used - CUPs) again leading to a constant flow of heterogeneous substances into environment. Despite the fact that there are many non-bioaccumulative ( $\log K_{OW} < 0$ ), non-persistent, quickly degradable CUPs (MCPA, 2,4-D, glyphosate, chlormequat, etc.), there are also CUPs for which bioaccumulation and persistency in soils can be expected, based on their  $K_{OW}$ ,  $K_{OC}$ , and  $DT_{50}$  (Lewis et al., 2016). However, in real ecosystems, complex interactions occur (between pesticides, soil, microbes, earthworms, plants...) and these are poorly understood. Hence, in this contribution (lecture), the novel microcosm experiment will be described, where the combined effects of soil properties, microorganisms, plants and earthworms on CF multimedia fate and bioavailability were evaluated. In particular, the CF fate (by means of total, desorbable and freely dissolved concentrations) and bioavailability (by means of uptake to model fauna, flora and passive samplers) was studied in complex microcosm systems consisting of agriculturally used fluvisols under the addition of selected model compounds (epoxiconazole, tebuconazole, flusilazole, prochloraz) at background levels (0.5 mg/kg), seeding plants (*Lactuca sativa*), earthworms (*Eisenia fetida*), SPME passive sampling fibers, Silicon rubber sheets and Chemcatcher® passive samplers.