**Fate of glyphosate and metamitron in the water-sediment systems: a detailed insight into the biodegradation processes**

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Glyphosate and metamitron are two of the most widely herbicides and are frequently detected in the surface water. In the freshwater sedimentary environments, the sediment plays a key role in the fate of pesticides. However, up to date, studies on the fate of glyphosate and metamitron in the water-sediment system have not been published yet. Therefore, the purpose of this study was to investigate the environmental fate of glyphosate and metamitron in the water-sediment system with a particular focus on its microbial metabolization processes. Stable isotope tracers (13C and 15N) were used to determine the 13C315N-glyphosate and 13C6-metamitron turnover mass balances and the formation of 13C3(15N)-amino acids over an incubation period of 80 days. 55.7% of 13C3-glyphosate and 49.2% of 13C6-metamitron were finally mineralized. In contrast, the mineralization of glyphosate and metamitron in the water system (without sediment) was low and amounted to 2.4% of initially applied 13C3-glyphosate and to 8.7% of initially applied 13C6-metamitron, respectively, demonstrating the key role of sediment in the degradation of these herbicides. Glyphosate was completely removed from the water compartment after 40 days and finally constituted 4.89% of 13C3-glyphosate equivalents. In analogy to glyphosate, metamitron was completely eliminated from the water compartment after 40 days. However, in contrast to glyphosate, no 13C6-metamitron was found in the sediment compartment at the end. A rapid increase in the contents of glyphosate main metabolite aminomethylphosphonic acid (AMPA) was noted after 10 days and it constituted ultimately 26.2% of the 13C3-glyphosate and 78.5% of the 15N-glyphosate equivalents. Low contents of metamitron metabolite -deaminometamitron after 4 days were found (1.2% of initially applied 13C6-metamitron) and it reached ultimately 1.9% of initial 13C6-metamitron equivalents. At the end, 10.0% and 12.3% of the 13C and 15N-label accordingly was incorporated into amino acids from 13C315N-glyphosate and 13.4% of 13C-label from 13C6-metamitron, indicating the biogenic residues formation. Glyphosate was biodegraded initially via sarcosine pathway, as shown by co-labeled 13C315N-glycine and via AMPA in the later degradation phase as shown by the contents of 13C-glycine. Nearly all the NER originating from 13C315N-glyphosate were biogenic and amounted to 20.0% of the initially applied 13C and to 24.8 % of the initially applied 15N. In case of metamitron, biogenic residues constituted 66% of the total NER and accounted for 26.8% of initial 13C6-metamitron equivalents.