As a part of developing new systems for continuously monitoring the presence of pesticides in groundwater, a microfluidic amperometric immunosensor was developed for detecting the herbicide residue 2,6-dichlorobenzamide (BAM) in water. A competitive immunosorbent assay served as the sensing mechanism and amperometry was applied for detection. Both the immunoreaction chip (IRC) and detection (D) unit are integrated on a modular microfluidic platform with in-built micro-flow-injection analysis (µFIA) function. The immunosorbent, immobilized in the channel of the IRC, was found to have high long-term stability and withstand many regeneration cycles, both of which are key requirements for systems utilized in continuous monitoring. The IRC was regenerated during 51 cycles in a heterogeneous competitive assay out of which 27 were without the analyte (the highest possible signal level) in order to assess the regeneration capability of the immunosorbent. Detection of BAM standard solutions was performed in the concentration range from 62.5 μg L⁻¹ to 0.0008 μg L⁻¹. Non-linear regression of the data using the four-parameter logistic equation generated a sigmoidal standard curve showing an IC₅₀ value (concentration that reduces the signal by 50%) of 0.25 μg L⁻¹. The strongest signal variation is observed in the concentration range between 0.02 and 2.5 μg L⁻¹, which includes the 0.1 μg L⁻¹ threshold limit set by the European Commission for BAM in drinking water. The presented results demonstrate the potential of the constructed µFIA immunosensor as an at-line monitoring system for controlling the quality of ground water supply.

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