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The measurement of pharmaceuticals concentration in Slovenian sewage and the development of a novel advanced technology for their degradation

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1. Introduction and aim

The consumption of pharmaceuticals is rising around the globe; the excreted active substances can occur in wastewater and consequently in surface, ground and drinking water. In non-target organisms and also in humans, they can cause unwanted effects. Our goal was to develop a method for quantification of a wide range of pharmaceuticals for their monitoring in wastewater and also to support the development of new treatment technology using the advanced electrochemical oxidation being developed by the Slovenian company Arhel, our collaborator on the project LIFE PharmDegrade (LIFE13 ENV/SI/000466).

2. Materials and methods

More than 100 analytes from different therapeutic groups were included. Samples of wastewater (250 mL) collected as composite 24-hour samples of effluents from various treatment plants across Slovenia were extracted by the SPE-DEX Horizon 4790 extraction system. The eluates were further concentrated and analyzed using the LC-MS/MS system Agilent 1290+6460. The analytical method was successfully validated. Electrochemical treatment of wastewater samples was carried out by a boron-doped diamond electrode in a patented cell and power supply, both developed by Arhel.

3. Results

The results showed the presence of a majority of monitored analytes in the concentration range from 1 ng/L to 2 µg/L and up to 10 µg/L. The new electrochemical purification technology has proven to be moderate to very effective, depending on the chemical composition of each specific compound.

4. Conclusions

Our results show a noticeable burden of Slovenian wastewaters with a large range of active substances. Even though they were found in relatively low concentrations, they should nevertheless require systematic monitoring and careful planning of their removal for the preservation of clean surface, ground and drinking water in the future. One of the possible technologies for achieving this goal is the advanced electrochemical degradation.