Abstract of doctoral dissertation of M.Sc. Pauliny Łukaszewicz, entitled:

Development of a procedure for extraction and determination of selected veterinary medicines in soils and evaluation of their hydrolytic stability

The global pharmaceutical market offers a wide range of pharmacologically active substances necessary to combat various diseases. Worldwide consumption of medicines has a continuous upward trend in both the medicine and veterinary sectors. Especially in the latter area, the use of selected medicinal substances takes place in a much less controlled manner, and their use is not only therapeutic, but also preventive and supports the growth of muscle tissue. The consequence of a large intake of veterinary medicines is their widespread presence in the natural environment and the spread of the dangerous phenomenon of drug resistance of bacteria. Despite this, information on the state of soil contamination with residues of these compounds is very limited, which, among others is the result of the lack of appropriate analytical tools. In addition, data on the durability of veterinary medicines in the environment are not known or contradictory.

Therefore, the research carried out as part of this doctoral dissertation included: (i) the development of a set of sensitive and selective analytical methods enabling the determination of mixtures of pharmaceuticals in a complex matrix (soil), (ii) preliminary assessment of the soil pollution of northern Poland with residues of veterinary medicines using the proposed methods and (iii) checking the hydrolytic stability of selected medicinal substances in accordance with the guidelines of the European Organization for Cooperation and Development (OECD 111).The object of research were 18 drugs commonly used in veterinary medicine and aquaculture, belonging to 8 therapeutic groups: tetracyclines, sulfonamides, macrolides, fluoroquinolones, benzimidazoles, β-blockers, phenicols and nitroimidazoles.

As a result of the implementation of scientific research covered by this doctoral dissertation successfully:

- methods for determining final mixtures of veterinary medicines have been developed using high-performance liquid chromatography techniques with spectrophotometric detection (HPLC-UV) and liquid chromatography coupled with tandem mass spectrometry (in the mode of monitoring selected fragmentation reactions, LC-MS/MS(MRM)), with good validation parameters;
- effective conditions for extraction of pharmaceutical mixtures from soil samples were determined, characterized by a varied content of organic matter (as a parameter determining the efficiency of isolating the analytes from the environmental matrix), using the microwave assisted solvent extraction (MAE) technique and conditions for cleaning up the obtained extracts using solid phase extraction (SPE) techniques;

- validation of full MAE-SPE-LC-MS/MS (MRM) analytical methodologies was carried out, confirming their effectiveness and reliability with validation parameters (among others low values of detection limits in the range from 1.0 to 3.3 μg kg^{-1}) and the evaluation of the extraction efficiency (made using absolute recovery and relative recovery), as well as matrix effects;
- analyzes of 40 environmental samples collected from agricultural areas of northern Poland were carried out in order to assess the degree of contamination of this component with residues of selected veterinary medicines, showing the presence of most pharmaceuticals, at the concentration level from 3.6 to 57.0 μg kg^{-1}. The most commonly detected drugs were trimethoprim, sulfadiazine, sulfamethoxazole and oxytetracycline. The determined values of environmental risk factors (RQ) have shown that the presence of enrofloxacin and sulphamethoxazole may pose a real threat to the soil environment;
- hydrolytic stability of 12 selected veterinary drugs was assessed, showing high durability of metronidazole, trimethoprim, florfenicol (at pH 4 and 7), tylosin (at pH 7) and drugs from the group of β-blockers and fluoroquinolones throughout the whole pH range during the preliminary test. Drugs from the group of benzimidazoles and tylosin (at pH 4) were characterized by the highest degree of degradation in the test conditions.
- preliminary identification of hydrolytic degradation products was made.