NEW APPROACH OF USING IONIC LIQUIDS (ILS) AS GREEN EXTRACTANTS IN THE ADSORPTION PROCESS OF RADIONUCLIDES FROM WASTE AQUEOUS SOLUTIONS

Goal of the project

The overall goal of the proposed project is to investigate a new approach of using the room temperature ionic liquid (RT IL) as extractants impregnated onto various solid supports in the adsorption process of radionuclides from waste aqueous solutions. The project has an interdisciplinary character presenting an integrated concept of waters depollution with radionuclides content.

Short description of the project

The use of ionic liquids (ILs) so called "green extractants", instead of the volatile organic solvents as new separation media of metals from aqueous solutions is in agreement with the principle of the sustainable development and in full compatibility with the environment protection. Various ILs will be used, which will be impregnated onto various solid supports, and the resulted extractant impregnated materials (EIM) after characterization, will be used as adsorbent materials in the removal process of radionuclides from waste aqueous solutions. Using some solids supports impregnated with ILs as adsorbent materials is expected to achieve very good performance in the removal process of radionuclides from waste aqueous solutions because the adsorbent properties of the solid supports and the advantageous properties of ILs are combined, thus opening and establishing the new science based on both adsorption technology and ionic liquids.

Project implemented by

Faculty of Industrial Chemistry and Environmental Engineering

Adsorbent	q_w, mg/g
PAN/zeolite	0.011
Dolomite	1.172
Hydrous ceric oxide	0.106
Chromium (IV) oxide	0.055
Florisil impregnated with Cyphos IL-101	2.94
Silica impregnated with Cyphos IL-101	3.97

Implementation period

01.05.2013-30.11.2015

Main activities

The whole system consisting of radar sensor, sensor fusion, risk assessment and vehicle control has a high potential to be launched in serial cars because the majority of components is already standard equipment in series cars. The additional equipment required should not be a show-stopper from a pure technical point of view.

Measures for VRU protection might be divided into passive and active systems. Because of basic physical properties, passive measures can provide limited protection potential only. Therefore (active) actuators are necessary to achieve the desired protection for VRUs. For example, vehicle deceleration seems to be a potential approach for active VRU protection with high benefit and high potential for high volume series cars, as they are already in use in high-end limousines.

The environmental sensing will be conducted with a novel high performance but low-cost 24 GHz narrowband radar system. From an operational viewpoint, this RF frequency fits exactly into the existing ISM band from 24,000 GHz to 24,250 GHz. Due to this techno-political feature this radar has a long term perspective on European and world-wide markets.

Results

The nature of the solid support used for the impregnation of various ionic liquids has a significant influence onto the adsorption properties of the obtained supported ionic liquids (SILs) in the removal process of various radionuclides from aqueous solutions. The highest adsorption capacities were obtained by the inorganic solid supports. Because the impregnation method can affect the properties and the application of the SILs, 4 different methods of impregnations were studied: dry method, stirring method, the wet impregnation method and a new method, ultrasound method. The most efficient methods of impregnation proved to be ultrasound method. Compared with other adsorbents Florisil and Silica impregnated with Cyphos L-101 developed good efficiency in the adsorption process of Cs and Sr.

Applicability and transferability of the results

The project topic is answering a well-defined problem/question with practical relevance – in the waters depollution with radionuclides content. All results were validated by publication in scientific journals and presentation at scientific conferences.

Adsorbent	q_m, mg/g
Nano-zirconium vanadate	9.1
Resorcinol-formaldehyde RF	5.56
Ceiling tiles	0.2128
Vermiculite	0.646
Florisil impregnated with Cyphos IL-101	3.086
Silica impregnated with Cyphos IL-101	1.48

Research centre

Research Centre for Environmental Science and Engineering

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