CONCENTRATING OF RHENIUM BY PLANTS

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The sorption of metals by biosubstrata (bacteria, algae, funguses, plants, blood erythrocytes) is interesting for the solution of the different technological and analytical purposes: for extraction and accumulation of precious metals, radionuclides, with the purpose of clearing of the contaminated sites, preconcentration of trace of elements for their subsequent quantitative determination etc.

It is known that the ions of metals are sorbed and concentrated by plants. The selectivity of this process concerning concrete metal is determined by a number of factors (specific peculiarities, elemental composition of tissues, kind of tissue). The special role is played by an elemental composition of tissues - contents of functional groups of organic compounds (NH-, COO-, SH-), presence of proteins, polysaccharides, and also composition and pH of solutions, contact time, rate of oxidation, chemical form of metal.

It is known that many plants specifically accumulate some rare and dispersed chemical elements. However plants - super concentrators meet rather seldom. Differing from the ion-exchange resins (containing, as a rule, one functional group), the biomaterials contain several reaction groups and are capable to selective accumulation of metal ions. This property of organisms can be used in biotechnology for concentrating and extraction of trace of metals. Therefore detection of plants concentrating definite metals and radionuclides for recovery of soils, contaminated by radioisotopes, or revealing of plants-super concentrators for extraction of rare, expensive and biologically active chemical elements from sewages, tailing ponds and stores is the important problem.

We have developed a number of methods of quantitative isolation of rhenium from biomaterials. The control of stages of extraction of rhenium implemented with application of radioactive isotope ^{186}Re. The highly sensitive methods of its determination, founded on its catalytic properties, including tests-means for activity in field conditions are designed also.

In laboratory conditions the accumulation of rhenium in plants (*pelargonium*) from soils and synthetic medium containing potassium perrhenate is studied. The high degree of accumulation of rhenium in green leaves (concentration factor 100 and more) is discovered. It is shown also, that at processing treatment of leaves of *pelargonium* by means of ardent ethanol the rhenium quantitatively passes in the fraction containing chlorophyll.

The determination of rhenium in plants selected from different geographic regions is conducted. The total Re content in meadow plants of the Moscow river is 4 ng/g of dry matter. To a lesser degree Re is accumulated by green algae, high fungus and soil microflora. It was shown that rhenium is concentrated in green mass of plants on without barrier type of accumulation (concentrating factor 100-1000 and more compared to the average contents of this element in earth crust (clarke), equal to 10^{-7} %. In regions of ore mineralization of rhenium its contents in plants reach anomalously high values. So, in region Tirniauz ore field the concentration of rhenium in a green biomass exceeds the clarke in 20000-30000 times and makes 15-20 g/ton, that is comparable to the contents of rhenium in industrial raw. The high visibility of rhenium biogeochemical anomalies largely is favored with small abundance it in earth crust and its low background concentrations, conditioned by it, in barren regions (from 4 to 14 ng/g of dry matter). Thus, on value of the contents of rhenium in green mass of plants it is possible to reveal regions of rhenium anomalies, and the coefficient of biological accumulation of rhenium for plants can serve as biogeochemical indicator in during of prospecting of rhenium mineralizations. Its value is not exceeding 7-10 in barren regions and in the territories of ore Re mineralizations this value increased very sharply (from 140 to 14213).

The simple methods of processing of green mass of vegetative materials (calcination with the subsequent quantitative extraction of rhenium by acids, alkalis or ethanol) are offered, which one creates the reasons for biotechnological production of rhenium.

Some of existing data require new assessment by means of more effective analytical methods. There is a necessity for revision of existing clarke of rhenium in earth crust. The high need for rhenium will promote hereafter increase of its flows in the biosphere and, despite of gentle toxicity and accumulation of connections of rhenium, prognostic assessment of its biological effect are extremely relevant. Except for analysis of abundance of rhenium in different organisms, features of its bioaccumulation, the relevant role is played with connection of rhenium with other trace elements (Mn, Se, Mo) in biogeochemical processes, pathogeny of endemical diseases animal both man and problems of bioindication.