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Synthesis and testing of gel metal-oxide composites as filling materials for W-188/Re-188 generator columns

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Rhenium has recently emerged as a useful radioisotope in variety of clinical trials.
At present the carrier –free Re-188 is obtained from W-188/Re-188 generators in which the tungsten-188 in form of sodium tungstenate W-188 solution is adsorbed on the alumina filling of the generator column. A new approach to preparation of packing of chromatographic column of tungsten-188/rhenium generators is application of nanocomposites obtained by mean of the sol-gel technique. A specific method for synthesis of these materials has been elaborated at INCT Warsaw Poland. The initial stage of the process is preparation of the ascorbate- NH^{4+} - tungsten, next separately prepared zirconyl or/and silicon sols are added gradually to the reaction mixture. After gelation step, the geles are thermal treatment at temperatures indicated by thermal analysis (500, 650, 800^{o}C). This way the synthesis of nanocomposites containing of TiO_2-WO_3, ZrO_2-WO_3, ZrO_2-SiO_2-WO_3 with different proportions of oxides were carried out.
The several methods have been used for determination of its structure and chemical purity.
The neutron activation analysis and spectrometry were applied for determination of radionuclidic purity of components
The X-ray diffraction analysis allowed for determination of its crystal structure.
The neutron scattering analysis (wide and small angles) given answer on fractal structure of composites.
Next the elution profile of generator column paced on gels samples activated in nuclear reactor have been studied using as eluent 0,9% NaCl solution. The best results of elution
(profile and eluent purity) are appeared in the case of filling of chromatographic column by materials ;WO_3-ZrO_2 in witch molar ratio of oxides were 1:2 and calcination temperature 500^{o}C and WO_3-TiO_2 with molecular ratio 1:2 and calcination temperature 650^{o}C.
The samples containingWO_3-ZrO_2-SiO_2 did not distinguish by a good elution profile.

Keywords Radionuclide production, W-188/Re-188 gel generator.