Adsorption of silver ions by hydroxyapatite-alginate microspheres

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Hydroxyapatite (HA) was chosen as a basic component for biomaterials due to its high sorption capacity to metal ions, biocompatibility, osteoconductivity and thermodynamic stability. HA synthesis was following:
$10Ca(NO_3)_2 \cdot 4H_2O + 6(NH_4)_2HPO_4 + 8NH_3 \cdot H_2O \rightarrow Ca_{10}(PO_4)_6(OH)_2 + 20NH_4NO_3 + 46H_2O$.
Obtained HA was washed three times with distilled water and filtered. HA slurry was mixed with 1.5 % sodium alginate (Alg) solution in relation 1:1. Then HA-Alg mixture was added dropwise into 0.1 M $CaCl_2$ solution, washed and immersed into 0.1 M $AgNO_3$ solution. Morphology of obtained microspheres after 24 h immersion is given in the Fig.

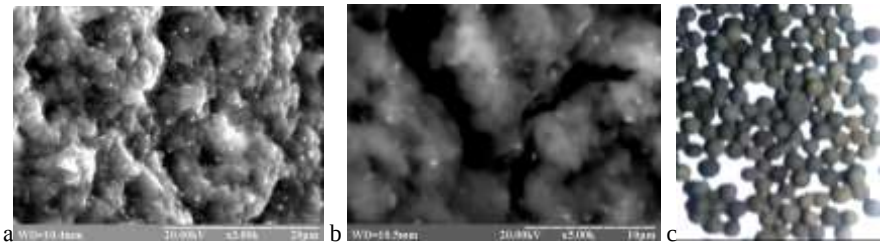

Fig. HA-Alg microspheres obtained in $CaCl_2$ solution and immersed on 24 h into 0.1 M $AgNO_3$ solution. SEM images of *a* - surface, *b* - inside pore, *c* - general view of microspheres

Then the solutions were filtered and concentrations of Ag^+ ions in the filtrate were determined by nephelometric analysis (Table).

Table. Adsorption of Ag^+ ions by HA-Alg microspheres (*m*=1 g) at 36ºC

Sample number	1	2	3	4	5	6
Time period, min	10	60	120	240	600	1440
Concentration of Ag^+ in filtrate, mg/mL	10.70	9.77	6.24	5.14	4.65	4.12
Ag^+ ions concentration, mg/g.	1.00	10.24	45.69	56.00	61.38	66.65

After 60 and 120 min silver was adsorbed only by the surface layer but after prolonged contact it was absorbed completely. More than 60 % of Ag^+ ions from solution are incorporated in HA structure. First the silver orthophosphate was formed and then it was destructed under UV-light with following formation of silver nanoparticles.