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The role of tryptophan in the anticancer effect of mono- Ag, Au, and bimetallic AgAu nanoparticles

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Previously we suggested bimetallic "alloy" AgAu nanoparticles (NPs) stabilized with amino acid tryptophan (Trp) as effective in attenuating potential hepatotoxicity and nephrotoxicity of NPs during their in vivo application. Furthermore, colloidal AgAu NPs were studied in order to define the optimal metal composition in bimetallic particles with maximal antitumor effect. In the present study, we investigated bimetallic AgAu NPs obtained in the presence of double molar excess of Trp, AgAu/Trp(1/2), and compared their efficacy with previously studied AgAu/Trp(1/1), obtained with equal molar amount of reagents.

We hypothesized that AgAu/Trp(1/2) will show antitumor effect selectively in cancer cells due to their preference to metabolize α-amino acid. Thus we estimated the potential nanotoxicity of prepared NPs in three different cell lines: 4T (breast cancer), HCT116 (colon cancer) and HEK293, embryonic kidney, (non-cancerous).

Double molar excess of reducing agent Trp caused the formation of smaller AgAu/Trp(1/2) nanoparticles compare to AgAu/Trp(1/1). The localized surface plasmon resonance bands in absorption spectra of NPs, especially with predominance of silver content, were more narrow and symmetrical, indicating less intensive aggregation process that was confirmed by DLS size distribution.

Among others, bimetallic AgAu NPs with metal ratio Ag:Au = 3:1 were the most toxic in both cancer cell lines starting from 5μg/μl (38,85% reduction of cell viability for 4T1 cell line and 20,05% for HCT116 cell line), while the final viability in 40 and 50μg/μl was between 5-10% for 4T1, when HCT116 seems to be more resistant (15-40%). On the other hand, AgAu NPs with metal ratio Ag:Au = 1:3 seems to be the less toxic. Comparing two sets of synthesized colloidal solutions, we noted that AgAu/Trp(1/2) were less toxic than AgAu/Trp(1/1) for all used cell lines. Consequently, we propose the latter as probably more useful "chemotherapeutic agent" due to efficacy towards cancer cell lines and less toxicity in HEK293 non-cancerous cells.