Bioactivity of polyoxometalate-chitosan nanocomposites

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Since the 1970s the discovery of new drug delivery systems was continuously improved.[1] The use of biodegradable and biocompatible polymers as encapsulating agents has been proposed as way to enhance the bioactivity and on the other hand to decrease the overall toxicity. Here we investigated the formation and the bioactivity of nanocomposites between polyoxometalates (POMs) and biopolymers (chitosan and carboxymethyl chitosan (CMC)). POMs are negatively charged early oxo-clusters of transition metals (e.g. W, Mo, and V) in their high oxidation states with promising anticancer and antiviral activity.[2] $K_6[P_2W_{18}O_{62}]$ (P_2W_{18}) and $(NH_4)_{17}Na[NaSb_9W_{21}O_{86}]$ (Sb_9W_{21}) were encapsulated either with chitosan or CMC forming nanoparticles in the size range of 100-200 nm. Nanoparticles were investigated with FT-IR, UV-Vis, DLS and electron microscopy (SEM and TEM). The bioactivity of the nancomposites was investigated on HeLa and MRC-5, cancer and fibroblasts cell lines, respectively. Two different behaviour patterns were observed: P_2W_{18} exhibits higher toxicity when it was applied alone compared to the nanocomposite. On the contrary, Sb_9W_{21} showed decreased cytotoxicity in its free form compared to the encapsulated material. This behaviour was maintained when the same compounds were applied on 3D *in vitro* cell model (spheroids). Furthermore, no difference in the bioactivity of the nanocomposites was detected when chitosan or CMC were used as encapsulating agents. The different behaviour types could pave the way to develop a strategy of selective and localized drug release.

[1] Allan S. Hoffman, *Journal of Controlled Release,* **2008**, 132 (3), 153–163.
[2] Toshihiro Yamase, *Journal of Materials Chemistry,* **2005**, *15* (45), 4773-4782.