Polyoxometalates (POMs) are multimetallic, polyanionic and nanosized metal oxides with potential applications in medicine (as antiviral and antitumoral agents).

Their toxicity, the low stability and the lack of experimental details on their biological activity and on the localization within the cells, however, has hampered the expected development in this field.

Within this scenario, the design of novel hybrid POM-based conjugates with organic ligands may be of interest to improve targeting and delivery strategies, while increasing their hydrolysable stability [1].

To this aim, we report the synthesis of vacant Keggin polyoxotungstates derivatives, as tetrabutylammonium salts, decorated with different fluorophores (such as the Dansyl group), grafted as organosilane pendants (Figure 1). Their solution characterization (ESI-MS, heteronuclear NMR) is in agreement with the bis-functionalization of the inorganic scaffolds.

They also exhibit unique spectroscopic features and sensing applications [2]. The fluorescence of the compounds is maintained under physiological conditions, and they can be used as model compounds to monitor the endocytic trafficking of hybrid POMs, by means of fluorescence microscopy (Figure 1).

Electronic microscopies (SEM, TEM) reveal that they assemble into spherical nanoparticles with ca. 200 nm diameter. Despite the overall negative charge of the assemblies, they can penetrate the cell membrane and the preferential cell localization is strongly dependent on both the organic moiety and on the inorganic scaffold. The hybrid POMs can be indeed delivered into the cytoplasm or in the nuclei. Finally, the overall reduced toxicity of the hybrid POMs, as confirmed by viability/proliferation tests, paves the way to innovative therapy protocols.

References

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