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A cationic Zn(II) porphyrin immobilized on chromatographic silica-gel as photocatalyst for decoloring of a model dye, bromothymol blue

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Zn(II) porphyrins (ZnPs) are potent photosensitizers for photodynamic therapy strategies and for photodegradation of organic compounds/environmental pollutants [1,2]. The immobilization of ZnPs on inert supports, such as silicas, represents a promising approach to developing heterogenized photocatalyst. Hereon, we describe a new SiO_2-based material decorated with a cationic ZnP (Fig. 1) as a potential photocatalyst for dye decoloring reactions. Thus, *meso*-tetrakis(*N*-pyridinium-4-yl)porphyrinatozinc(II) (ZnTM-4-PyP^{4+}) was immobilized onto ordinary chromatographic silica-gel. Silica was chosen due to its inertness and low point of zero charge (PZC) pH, which renders its surface negatively charged when exposed to aqueous solutions of a wide range of pH values, including neutral ones. This facilitates the ready electrostatic immobilization of cationic ZnPs. Incubation of ZnTM-4-PyP^{4+} solutions and chromatographic silica-gel resulted in the prompt heterogenization of ZnP to yield the corresponding ZnP/SiO_2 material, which was characterized by diffuse reflectance UV-Vis and luminescence spectroscopies. ZnP loading in ZnP/SiO_2 material was of 4.5 µmol/g. The immobilization yield was quantitative and the material showed high stability against ZnP leaching. Photocatalytic experiments were caried out under visible light irradiation using aqueous Bromothymol Blue (BTB) dye solutions at neutral pH (7.2), as a model decoloring reaction. Adsorption of BTB on either SiO_2 or ZnP/SiO_2 was negligible. Control photoreactions indicated that BTB is rather stable in the absence of photosensitizer or in the presence of SiO_2 alone. BTB decoloring was more effective with ZnP/SiO_2 material (under heterogenous photocatalysis) than with non-immobilized ZnP (under homogenous conditions). Thus, the heterogenization of ZnP on silica represent a simple entry for developing suitable decoloring photocatalysts activated by visible light irradiation.

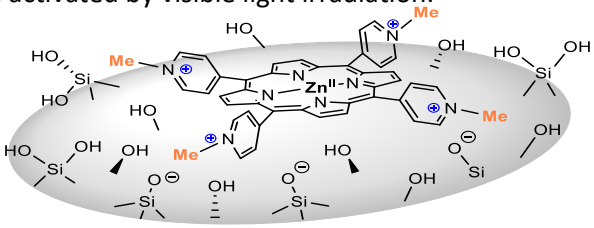

Figure 1. Schematic representation of the ZnP/SiO_2 material.

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References

[1] T.H.S. Souza, J.F. Sarmento-Neto, S.O. Souza, B.L. Raposo, B.P. Silva, C.P.F. Borges, B.S. Santos, P.E. Cabral Filho, J.S. Rebouças, A. Fontes, J. Photochem. Photobiol. C: Photochem. Rev., **49**, 100454 (2021).
[2] D.C.S Martins, I.T. Resende, B.J.R. DA Silva, Environ. Sci. Pollut. Res. Int., **29**, 42384 (2022).