

Accepted Manuscript

Research paper

Synthesis and catalytic activity of new, water-soluble mono- and dinuclear ruthenium(II) complexes containing 1,3,5-triaza-7-phosphaadamantane: study of the effect of the visible light

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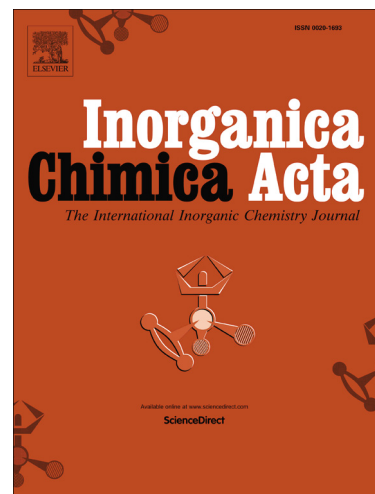
PII: S0020-1693(17)30143-3
DOI: <http://dx.doi.org/10.1016/j.ica.2017.04.054>
Reference: ICA 17559

To appear in: *Inorganica Chimica Acta*

Received Date: 30 January 2017
Revised Date: 26 April 2017
Accepted Date: 27 April 2017

Please cite this article as: A. Udvardy, M. Serrano-Ruiz, V. Passarelli, E. Bolyog-Nagy, F. Joó, A. Kathó, A. Romerosa, Synthesis and catalytic activity of new, water-soluble mono- and dinuclear ruthenium(II) complexes containing 1,3,5-triaza-7-phosphaadamantane: study of the effect of the visible light, *Inorganica Chimica Acta* (2017), doi: <http://dx.doi.org/10.1016/j.ica.2017.04.054>

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Synthesis and catalytic activity of new, water-soluble mono- and dinuclear ruthenium(II) complexes containing 1,3,5-triaza-7-phosphaadamantane: study of the effect of the visible light.

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Abstract

The newly synthesized *mer-trans*-[RuCl₂(OH₂)(PTA)₃] (**1**) is the first compound isolated in solid state containing the Ru(PTA)₃-fragment (PTA = 1,3,5-triaza-7-phosphatricyclo[3.3.1.1^{3,7}]decane). Dissolution of **1** in aqueous HCl leads to *mer*-[RuCl₃(HPTA)₃]Cl₂ (**2**) which is stable in the dark but is transformed into *fac*-[RuCl₃(HPTA)₃]Cl₂ (**3**) under visible light. Irradiation with visible light of an aqueous solution of **1** at room temperature or refluxing of the same solution in the dark leads to the formation of [{Ru(PTA)₃}₂(μ-Cl)₃]Cl (**4**). The dinuclear complex **4** was also formed upon irradiation of solutions of PTA and various Ru(II)-complexes ([RuCl₂(DMSO)₄], [{RuCl₂(η⁶-*p*-cymene)}₂]) or *cis-cis-trans*-[RuCl₂(DMSO)₂(PTA)₂]. All complexes were characterized by elemental analysis and NMR spectroscopy, furthermore solid state structures of **2**·1.25H₂O, **3**·HCl·2H₂O and **4**·9H₂O were also determined by single crystal X-ray diffraction. We have investigated the influence of the above photochemical processes on reduction of benzaldehyde and cinnamaldehyde with *trans*-[RuCl₂(PTA)₄] and *cis-cis-trans*-[RuCl₂(DMSO)₂L₂] (L=PTA, (PTA-Me)CF₃SO₃, (PTA-Bn)Cl; Me=methyl, Bn=benzyl) complexes as catalysts. The effect of visible light on benzonitrile hydration with various Ru(II)-PTA catalysts is also reported.

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