Macromolecular Ruthenium catalyst for applications in flow photochemical reactions and in-situ recovery through size-exclusion nanofiltration

Javier Guerra,a,b David Cantillo,a and C. Oliver Kappea

a Institute of Chemistry, Karl-Franzens-University of Graz, Heinrichstrasse 28, A-8010 Graz, Austria
b Crystal Pharma SAU, Gadea Pharmaceutical Group-AMRI, Parque Tecnológico de Boecillo, Valladolid, 47151, Spain

email: franciscojavier.guerra@gadea.com

website: http://www.maos.net

Introduction

• [Ru(bpy)3]2+ is a powerful single-electron-transfer (SET) agent that makes possible redox reactions catalyzed by light under mild and environmentally benign reaction conditions.[13-16] Nevertheless, the high price of this catalyst based on Ruthenium metal requires its recovery and recycling to reach a complete sustainable process.
• In-situ catalyst recycling facilitates the product purification and diminishes the cost of the whole synthetic process. Therefore for chemical processes that could be applied in the industrial sector, it is essential to find a procedure to reuse the catalyst.
• A 2nd generation Polyamidoamine (PAMAM) dendrimer is chosen as platform to anchor [Ru(bpy)3]2+ units. Dendrimer are hyperbranched macromolecules with low polydispersity, comprising a multifunctional core, several branching points and outer surface moieties.

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Catalyst Synthesis, Purification, and Characterization

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Flow Set-Up

Photochemical Reactions

Recycling experiments through nanofiltration

• Appel reaction crude mixture can be recycled although size exclusion-membranes are not stable under DMF and 50% of the catalyst is lost.
• Reduction experiments currently showed a drop in the catalytic activity in the 2nd cycle due to catalyst decomposition. Further studies in this topic are presently performed in our laboratories.

Acknowledgement

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Theoretical Ru atoms per dendrimer is 16. Both techniques are in agreement and show the average of a statistical dendrimer population.

Technique

UV-Visible Spectroscopy

ICP-MS

Average Ru atoms/dendrimer

15.4

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