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Combining metal recovery and micellar catalysis with surfactants

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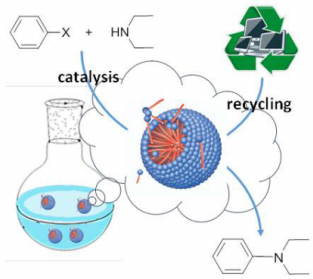
PURPOSE OF THE ABSTRACT
As our economy faces more and more metals supply risks, the recovery of palladium (Pd) from Waste of Electrical and Electronic Equipment (WEEE) appears more and more as a possible alternative to traditional mining [1]. The recovered Pd can be used for various applications, such as catalysis. Micellar catalysis is particularly attracting as this technique enables to replace synthetic solvents by water, containing low concentrations of surfactants. These surfactants allow the solubilization of hydrophobic organic chemicals, and to carry out different types of cross-coupling reactions such as Suzuki, Heck or Buchwald [2,3]. Combining Pd extraction from waste and direct use into micellar catalysis was recently demonstrated at our laboratory [4], so that straightforward short economic cycles are now possible. This technical breakthrough was achieved by stabilization of Pd(II) into micellar nano-reactors, obtained from simple tailor-made amphiphilic surfactants endowed with polymeric and dendronic TAC heads (derived from a Tris-Acrylamide polymerizable monomer [5]) in water.

Different surfactants have been designed and synthesized and their efficacy to extract Pd(II) has been tested and compared with the standard one used for micellar catalysis, TPGS-750M. Their self-assembly in water with and without Pd was fully characterized (form and structure factor, size, shape ?) using SAXS in order to specify the Pd location and where the reactions occur in the nano-reactor. Structural analysis performed with NMR also complemented the study. All our results will be detailed, including the complete proof of concept going from used electronic components to Suzuki coupling in water. To our knowledge, this study is the first one that demonstrates the possibility to use waste directly into applied chemistry, without intermediate isolation of the recovered metal.

FIGURES



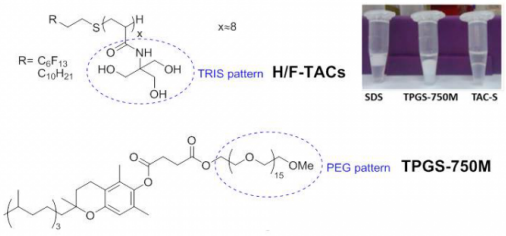


FIGURE 1

Combining Pd recovery and catalysis

Pd recovered from e-waste is directly employed into aqueous micellar Suzuki coupling reactions

FIGURE 2

Surfactants employed in the study

TACs-surfactants enable clean phase separation and Pd stabilization

KEYWORDS

e-waste | palladium | extraction | catalysis

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