Plastics to Aromatics *via* Upcycling of Real-life Waste

[AROMA]

Project Initiator(s)

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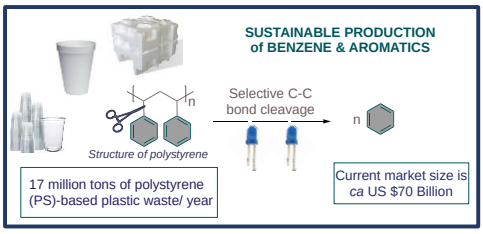
Project context

Aromatic compounds have high demand in end-user industries (current market size is *ca* US $70 Billion). However, current synthesis of aromatics is entirely dependent on petroleum and coal-based feedstocks. Additionally, the rapid growth of plastic waste is alarming for the society. As a solution to both, I would like to develop a sustainable strategy for the synthesis of aromatics from real-life polystyrene (PS)-based waste.

Innovation goal



The presence of iterative benzene rings in PS and selective cleavage of the benzene ring *via* C_{SP^3}-C_{SP^2} bond should provide a straightforward and sustainable strategy for the synthesis of aromatic building blocks. Inspired by the selective bond cleavage reactions in hydrocarbon molecules by photocatalysis, I argue that the presence of a hydrogen atom transfer (HAT) process should generate a selective carbon-centered radical on the Ph-ring bearing carbon in PS. In fact, under photocatalytic conditions, C-H bonds can be abstracted selectively by HAT in a straightforward and selective fashion. After generating this carbon-centered radical, the presence of oxidative conditions (O_2) will lead to the formation of an organic peroxide, which under the photocatalytic conditions will undergo C-C bond scission to generate benzene ring (aromatics).

Requested expertise

The main aim of this project is to design heterogeneous photocatalysts which will absorb light to trigger the C-C bond cleavage to achieve benzene ring from PS-based waste in large scale. My group has the right expertise to synthesize the desired heterogeneous photocatalysts, and all the chemical techniques that are required for this procedure. However, the characterization of heterogeneous photocatalysts require further collaboration. Additionally, the aim of this project is also to deliver high quantity of products (aromatics) and to obtain this, flow-photocatalysis will be applied. To improve the flow technique, an advanced flow equipment is essential. Furthermore, some companies which will be able to provide us PS-based waste, will be highly interesting for this project.