Università degli Studi di Padova

LYMON - Laser-assisted sYnthesis of Magnetically mOtile plasmonic chiral Nanocatalysts

Catalysis holds immense significance in chemical manufacturing, being a key player in developing sustainable industrial processes with limited energy & resource consumption. In pharmaceutical industry, catalysis is crucial for enabling mass production of affordable life-saving drugs. However, developing efficient catalysts for this sector poses a formidable challenge due to the inherent asymmetry of many biological processes. This is particularly critical in producing anticancer drugs because their synthesis relies on intermediates or reactions whose asymmetric nature, known as chirality, withholds their massive production, limiting equal global access to best health treatments. An up-and-coming solution to address this dilemma is resorting to chiral plasmonic nanoparticles (NPs), as their outstanding optical rotation activity makes them well-suited for applications like polarization-sensitive photocatalysis, especially in the context of anticancer drug development. However, unleashing its full potential hinges on imbuing these chiral NPs with unusual properties like magnetism, allowing safe removal from products & recyclability without generating chemical waste. To date, creating a plasmonic structure that seamlessly integrates chirality with magnetic motility remains largely underexplored. The LYMON project addresses this conundrum by expanding the repertoire of chiral nanocatalyst construction methods through a groundbreaking laser-based pathway. This innovative approach, supported both experimentally & theoretically, promises to bring a new generation of highly specific magnetic chiroplasmonic nanocatalysts characterized by their ability to be reused multiple times. All of this permiting reducing wasteful side reactions & improving control over pharmaceutical production, especially for anticancer drugs. Moreover, it promises to expand the horizons of synthetic chemistry, paving the way for cutting-edge routes to produce highly efficient & selective molecules.

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