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Note: Images available at https://nyutandon.photoshelter.com/galleries/C0000DKT3j1lAvpA/G0000YyNXok9k2As/Miguel-Modestino-Trends-in-Chemistry

Immediate Release

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NYU Tandon Team Charts Path to Sustainable, Solar-Driven Chemical Manufacturing

BROOKLYN, New York, Wednesday, February 20, 2019 – A team of researchers from New York University Tandon School of Engineering is working to upend energy-intensive, fossil fuel-dependent chemical manufacturing processes and replace them with sustainable, solar-driven reactions that rely on renewable feedstocks. Led by Miguel Modestino, assistant professor of chemical and biomolecular engineering, the team recently designed a novel reactor that uses solar energy and plant waste to sustainably produce adiponitrile, an precursor material used in Nylon production.

The team's work is featured in the inaugural issue of *Trends in Chemistry*, a review journal published by Cell Press that aims to address major questions across all areas of chemistry. In a paper entitled "Organic Electrosynthesis for Sustainable Chemical Manufacturing," Modestino and NYU Tandon doctoral student Daniela Blanco review the challenges and opportunities facing the global chemical industry amid pressure to decrease carbon emissions. The technology is employed by the sustainable Nylon startup Sunthetics, launched in 2018 by a team that includes Blanco, Modestino and NYU Tandon 2018 valedictorian Myrian Sbeiti.

The chemical industry commands roughly one quarter of the world's energy demand, mostly in the form of fossil fuel-generated heat needed to drive thermochemical reactions. As the availability of renewable energy soars, organic electrosynthesis — relying on electricity, not heat, to drive reactions— can now easily be generated via solar, wind, or other renewable means. Estimates show

that up to a third of chemical products—as well as new products that result from yet-untapped chemical transformations— could be produced through electrosynthesis.

Modestino identified three major areas where multidisciplinary research could yield solutions to obstacles preventing industrial-scale organic electrosynthesis:

- Boosting the electrochemical stability of the aqueous electrolyte solutions upon which electrosynthesis relies;
- Improving the solubility of organic molecules in aqueous electrolyte solutions;
- Developing strategies for mitigating unwanted reactions during electrochemical processes.

Modestino noted that organic electrosynthesis stands to have significant impact on pharmaceutical development and the petrochemical sector, where the process may yield new methods of upgrading methane.

“Electrochemical reactors can impact a wide range of chemical transformation, providing a direct path towards the electrification of the chemical industry and further boosting renewable energy deployment,” he said.

Modestino and his collaborators are actively developing solutions by focusing on “greening” the most prevalent electrochemical reaction in today’s chemical manufacturing landscape: the process by which acrylonitrile (AN) is converted to adiponitrile (ADN), a precursor material for making Nylon.

“In our research group we get to innovate with purpose,” said Blanco. “We target large-scale problems such as a polluting chemical industry and develop strategies that help us design processes that are sustainable and efficient at the same time. The opportunity to launch startups and commercialize technologies like this one make our work more tangible and help us understand what is needed to bring lab-scale technologies to large-scale scenarios.”

In 2017, Modestino was awarded the Global Change Award from the H & M Foundation to further the development of a proof-of-concept solar-powered reactor capable of converting AN into adiponitrile that can be used to make sustainable Nylon. He and his team recently demonstrated methods for improving the efficiency of current industrial ADN production in a paper that was featured as the cover story in the journal Reaction Chemistry and Engineering.

Modestino’s work is supported by a grant from the H & M Foundation.

“Organic Electrosynthesis for Sustainable Chemical Manufacturing,” is available at:
https://www.cell.com/trends/chemistry/fulltext/S2589-5974(19)30002-4

About the New York University Tandon School of Engineering
The NYU Tandon School of Engineering dates to 1854, the founding date for both the New York University School of Civil Engineering and Architecture and the Brooklyn Collegiate and Polytechnic Institute (widely known as Brooklyn Poly). A January 2014 merger created a comprehensive school of education and research in engineering and applied sciences, rooted in a tradition of invention and entrepreneurship and dedicated to furthering technology in service to society. In addition to its main location in Brooklyn, NYU Tandon collaborates with other schools within NYU, one of the country’s

foremost private research universities, and is closely connected to engineering programs at NYU Abu Dhabi and NYU Shanghai. It operates Future Labs focused on start-up businesses in downtown Manhattan and Brooklyn and an award-winning online graduate program. For more information, visit http://engineering.nyu.edu.

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