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**Enrique Rodríguez-Castellón**, DNI: 02195082P. Full Professor of Inorganic Chemistry of the Departamento de Química Inorgánica, Cristalografía y Mineralogía of the Universidad de Málaga, Málaga, Spain, informs about the Doctoral Thesis entitled “Nanoengineering of Thin Layers Of Semiconductor Photocatalysts In A Microreactor Environment For Lignin Based Model Compounds Valorization” submitted by Ms. Sci. **Swaraj Rashmi Pradhan** to the Institute of Physical Chemistry (IPC), Polish Academy of Sciences (PAS), Warsaw, Poland, and supervised by **Prof. Juan Carlos Colmenares Quintero**.

The Thesis memory is composed of five chapters that are analysed as follows:

### **Chapter 1**

The introduction section is straightforward, concise, and contains a clear statement of the state of the art. The description of the Flow Chemistry is very useful to understand the objectives of the Thesis. But also the explanation of the advantages of this process in comparison with other more classical ones is very relevant. The environmental considerations give a clear prospective. There are many updated references that can help to follow with more detail the subject of the Ph.D. Thesis. Another relevant aspect is the introduction with details of the sonication as a method to functionalize the polymeric reactor to support the photocatalysts. Perhaps, some information about scale up processes with these systems is lacking.

### **Chapter 2**

This chapter includes the review entitled “Designing Microflowreactors for Photocatalysis Using Sonochemistry: A Systematic Review Article” and published in

the journal *Molecules*. This review analyses the use of sonication for designing and fabricating reactors, where the deposition of catalysts inside polymeric reactor is studied in depth. In addition, the use of functionalized microreactors for photocatalytic reactions is also reviewed, explaining the advantages in terms of higher spatial illumination and homogeneity. This review also include a study of the use of ultrasound for the efficient synthesis of materials, and for many different applications such as the mineralization of organic compounds and fuel production. This review has 26 citations in spite of its recent publication.

### **Chapter 3**

This chapter entitled “Design and Development of TiO<sub>2</sub> coated microflow reactor for photocatalytic partial oxidation of benzyl alcohol” was published in *Molecular Catalysis* in 2020. This is relevant chapter of the Ph.D. Thesis because the main challenge of this study is to modified the polymeric reactor for the internal coating with the photocatalyst. In fact, the ultrasound-assisted TiO<sub>2</sub> deposition on the inner walls of a polymeric microtube under mild conditions is introduced and the further characterization by SEM, XRD, nitrogen adsorption at 77 K and UV-Vis Diffuse Reflectance spectroscopy. Finally, the photocatalytic activities of the TiO<sub>2</sub> nano-engineered transparent polymer based microreactors were examined in the oxidation of benzyl alcohol, a model molecule of very relevant importance in Green Chemistry in the valorization of lignin.

This paper has 25 citations. A very high number taking into account the date of publication.

### **Chapter 4**

This chapter entitled “Flow photomicroreactor coated with monometal containing TiO<sub>2</sub> using sonication: a versatile tool for visible light oxidation” has been recently published in 2022 in the journal *Catalysis Communications*. The research of this chapter is a continuation of that carried out in the previous chapter. Now different active transition metals have been incorporated, the new catalytic system were also characterized and then tested in the photocatalytic conversion of benzyl alcohol under UV and visible light irradiation. The incorporation of these active metal enhanced the catalytic properties and the Fe- containing catalyst was the more active. However, a clear

explanation of the different observed catalytic properties is lacking and requires a further study. But a Ph.D. work cannot cover all points and new investigations will be carry out in a near future.

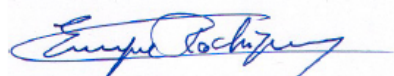
## Chapter 5

This last chapter entitled “Bimetallic TiO<sub>2</sub> Nanoparticles for Lignin Based Model Compounds Valorization by Integrating Photocatalytic Flow-Microreactor” has been recently published in *Molecules* in 2022, and the effect of the addition of other metal, Au in this case, is studied. Now, different aromatic alcohols as model molecules, such as vanillyl alcohol, coniferyl alcohol, cinnamyl alcohol and benzyl alcohol were studied. It was observed the alcohols containing hydroxy and methoxy groups (coniferyl and vanillin alcohol) showed high conversions and selectivities. The selection of these alcohols is very relevant to promote green chemistry since these molecules derived from lignin. In this case, some mechanistic studies were performed.

In summary, the candidate has published four papers in Q2 journals, a national patent was submitted and several oral and posters presentations in national and international meetings were presented. This indicate that the Ph.D. work has been positively considered in international journals and meetings. More important, in my opinion is the new investigation lines opened thanks to this work for a new promising future.

Finally, considering the scientific relevance and the quality of the results included in this Thesis and the publications derived of this Thesis, I informs very **positive** to this Ph.D. Thesis and propose the presentation of the candidature of Ms. Sci. **Swaraj Rashmi Pradhan** as Ph.D. in Chemical Sciences. The doctoral dissertation meets the conditions specified in Article 187 of the Act of July 20, 2018 Law on Higher Education and Science (Journal of Laws of 2018, item 1668, as amended).

Málaga, August 18<sup>th</sup>, 2023



Prof. Dr. Enrique Rodríguez Castellón