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Deliverable Report

D2.2 Diamond electrodes

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Lead beneficiary:	Fraunhofer IST
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1 Introduction to the project SERPIC

The project *Sustainable Electrochemical Reduction of contaminants of emerging concern and Pathogens in WWTP effluent for Irrigation of Crops – SERPIC* will develop an integral technology, based on a multi-barrier approach, to treat the effluents of wastewater treatment plants (WWTPs) to maximise the reduction of contaminants of emerging concern (CECs). The eight partners of the SERPIC consortium are funded by the European Commission and by six national funding agencies from Norway, Germany, Italy, Spain, Portugal and South Africa. The official starting date of the SERPIC project is 1. September 2021. The project has a duration of 36 months and will end 31. August 2024.

The overall aim of the SERPIC project is to investigate and minimise the spread of CECs and antimicrobial resistant bacteria/antibiotic resistance genes (ARB/ARG) within the water cycle from households and industries to WWTPs effluents, and afterwards via irrigation into the food chain, into soil and groundwater and into river basins, estuaries, coastal areas, and oceans with a focus on additional water sources for food production.

A membrane nanofiltration (NF) technology will be applied to reduce CECs in its permeate stream by at least 90 % while retaining the nutrients. A residual disinfection using chlorine dioxide produced electrochemically will be added to the stream used for crops irrigation (Route A). The CECs in the polluted concentrate (retentate) stream will be reduced by at least 80 % by light driven electro-chemical oxidation. When discharged into the aquatic system (route B), it will contribute to the quality improvement of the surface water body.

A prototype treatment plant will be set-up and evaluated for irrigation in long-term tests with the help of agricultural test pots. A review investigation of CECs spread will be performed at four regional showcases in Europe and Africa. It will include a detailed assessment of the individual situation and surrounding condition. Transfer concepts will be developed to transfer the results of the treatment technology to other regions, especially in low- and middle-income countries.

2 Deliverable description as stated in the Project Description

The diamond electrodes for the electrolysers, manufactured in **T2.3,** will be delivered to UCLM.

3 Introduction

The treatment process chain includes an electrolyser for the production of persulfate, developed by project partner University Castilla La Mancha (UCLM), Spain. The electrolyser is equipped with diamond electrodes, developed by Fraunhofer IST.

4 Results

Fraunhofer IST has delivered two diamond electrodes, manufactured via deposition of polycrystalline diamond coatings on Niobium plates in a hot-filament activated chemical vapor deposition (CVD) process (see Fig. 1). The diamond coatings were doped with boron to achieve the necessary conductivity. The electrodes will be used in the persulfate electrolyser of the prototype plant that will be set-up at UCLM.

- Dimension 100 mm × 100 mm × 2 mm, with terminal lugs
- Film thickness 11 µm

Figure 1: Delivered diamond coated electrodes.