

Área: FIS _____

A Low-Cost Continuous-Flow System for Visible-Light Photoelectrocatalysis

Amanda Morais*(PG),¹ **Mauro C. Lopes**(PQ)¹, **Taiana G. M. Bonadio**(PQ)¹, **Mariana de Souza Sikora**(PQ)^{1,2}

am.morais534@gmail.com

¹Programa de Pós-Graduação em Química Aplicada, UNICENTRO, Campus Cedeteg; ²Departamento de Química, UTFPR, Campus Pato Branco

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Highlights

Compact continuous-flow photoelectrochemical system;
Accessible methodology;
Visible light Ag/Ag_xO/TiO₂-NTs reproducible photoanode response.

Abstract

Commercial photoelectrochemical cells are expensive and often inaccessible for low-resource laboratories. These high costs hinder research in photoelectrocatalysis (PEC), particularly under continuous-flow conditions which are known for their high efficiency [1]. A brief market survey reveals that commercial cells cost between \$180 for a 50 mL batch reactor and \$3,427 for a 10 mL flow reactor. While cheaper, lab-made alternatives using 3D-printing or low-cost materials have been reported [2, 3], there remains a need for simple, accessible designs. To address this, we developed a low-cost continuous-flow PEC system for experiments under visible light irradiation. The system (Figure 1A) components, include a photoanode of titanium nanotubes modified with silver/silver oxide (Ag/Ag_xO/TiO₂-NTs) and a platinum cathode, positioned 1 cm apart. An Ag wire was used as a pseudo-reference electrode. The reactor body is a 10 mL polystyrene container (R\$0.50) fitted with inflow and outflow ports. The container is surrounded by a 6000K LED light source (R\$15). A 220 L/h aquarium pump (R\$22) circulates the solution, with the flow rate controlled by a clamp and measured by recording the time required to collect 1 mL of effluent in a graduated cylinder. The measured photocurrent (Figure 1B) was comparable in magnitude to that achieved by UV-vis systems using Ag/Ag_xO/TiO₂-NTs [4], implying a significant potential for various applications, such as analytical chemistry or PEC water treatment studies. Furthermore, the system could be suitable for PEC inactivation of pathogens, as the plastic components can be sterilized to prevent biofilm formation or DNA contamination, as described in literature [5].

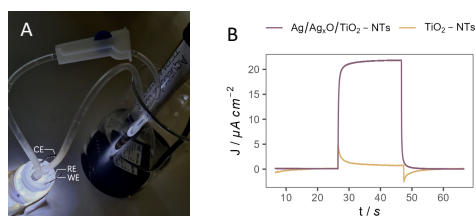


Figure 1 – A) continuous-flow photoelectrochemical system scheme. B) photocurrent of TiO₂-NTs and Ag/Ag_xO/TiO₂-NTs.

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