PHOTOELECTROCATALYTIC/SOLAR CELL PROTOTYPE DEVELOPMENT FOR ORGANIC DYE DEGRADATION

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Abstract - This research focuses on developing a photoelectrocatalytic (PEC) cell coupled with a solar cell to degrade organic dyes in wastewater with high efficiency, a simple process and an energy-saving method. The layer-by-layer dip coating method was used to develop the FTO/WO_3/$BiVO_4$ photoanode fabrication, allowing for future production scaling. High porosity, excellent visible light absorption, and the ability to completely cover the FTO substrate are all properties of WO_3/$BiVO_4$. The developed FTO/WO_3/$BiVO_4$ electrode was applied in the PEC cell prototype to degrade organic dyes, showing high oxidation activity and durability. PEC cells that incorporate a solar cell to convert light into electrical energy to supply the controlling system have been developed. The original small PEC cell prototype with a capacity of 5 liters can degrade methylene blue and rhodamine B dyes by up to 94% and 93% in 3 hours, respectively, without needing external power.Significantly, the design of large-scale 60-litre PEC prototype cells could eliminate 100 % of the organic dye within five minutes. This innovative large-scale PEC cell prototype is highly effective for removing various organic dye substances, is a simple method, and offers an energy-saving process suitable for further application for dye wastewater treatment systems on a large scale.

Keywords - Photoelectrocatalytic Cell, Solar Cell, Organic Dye Degradation, WO_3/$BiVO_4$ Thin Film, Dip Coating Method.