Semi-Transparent Dye-Sensitized Solar Modules for Greenhouse Application

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Our world is facing an environmental crisis that is driving scientists to research green and smart solutions in terms of the use of renewable energy sources and low polluting technologies. In this framework, photovoltaic (PV) technology is one of the most worthy of interest. Dye-sensitized solar cells (DSSCs) are innovative PV devices known for their encouraging features of low cost and easy fabrication, good response to diffuse light and colour tunability. In recent works, the feasibility of DSSC applications in greenhouses and its suitability in comparison to other PV technologies has also been discussed. With the energy crisis that humanity is facing and the urgent need for use of sustainable energy from renewable sources, 'agrovoltaic' is the coined term to indicate the optimization of land use combining solar PV panels and food crops. For healthy crop growth inside greenhouses there are many controlling systems with different functions, such as regulating temperature, lighting, fans and monitoring devices. DSSC technology, with its unique peculiarities, is considered for greenhouse application not only for supporting energy needs but also with the role of selective control of light. Indeed, DSSC transparency allow the incident light to be filtered, dividing the spectrum between plant growth and electricity production. We carried out panel measurements in outdoor and greenhouse environments in both sunny and cloudy conditions to find clear trends in efficiency behaviour. A maximum panel efficiency in outdoor conditions of 3.83% was obtained in clear and sunny sky conditions.