

## **Dye-Sensitized Solar Cell (DSSC): effects on light quality, microclimate, and growth of *Orthosiphon stamineus* in tropical climatic condition**

### **ABSTRACT**

The main challenge facing greenhouse designers is to achieve environment-appropriate greenhouses, especially in tropical regions. The excess radiant energy transmitted into the greenhouse predisposes plants to photo-inhibition and consequently reduces crop production. Lately, photovoltaic (PV) modules are equipped as a greenhouse rooftop to minimize the level of irradiation and air temperature in the greenhouse, simultaneously improving its energy consumption. Nevertheless, due to the low level of irradiation, denser conventional PV internal shading would influence the cultivated crops' growth. Thus, Dye Sensitized Solar Cell (DSSC) possesses several attractive features such as transparent, sensitive to low light levels, and various color options that render DSSC a perfect choice able to serve substantially in energy buildings. This study assessed the microclimate conditions inside the greenhouse with semi-transparent DSSC mounted on top of it, describing the Photosynthetic Photon Flux Density (PPFD) ( $\mu\text{mol m}^{-2} \text{s}^{-1}$ ), Vapor Pressure Deficit VPD (kPa), relative humidity (%), and also temperature ( $^{\circ}\text{C}$ ). The Overall Thermal Transfer Value (OTTV), which indicates the average thermal energy transmission rate across the external layer of a structure envelope, is also presented. The effects of colored DSSC in altering the spectral of sunlight in reference to the *Orthosiphon stamineus* growth responses were determined. The information of the condition of DSSC greenhouse microclimate helps to identify the information for designing PV greenhouses and to produce income from both electric power and agronomic activity.

**Keyword:** PV greenhouse; DSSC; Microclimate; *Orthosiphon stamineus*; Tropical climate; Semi-transparent PV