Effective Use of Krypton and Argon Pumping Model KAP in Controlling Temperature in Plant Greenhouse

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The world's food chain is under pressure due to the increasing demand for food: arable land shrinkage and the threat of adverse climate change. Recently, greenhouses have been increasingly used for agriculture applications. The temperature inside greenhouses is a major constraint to increasing crop yield in greenhouses. Therefore, this study aims to reduce the greenhouse's cost by replacing the elements that provide the required temperature in it with a cheaper and more suitable system. This innovative system uses a low emissivity glass combined with krypton and argon gas pumps (KAP). Practical experimentation was conducted using the KAP model and setting the temperature at 22°C. This model used a temperature sensor to detect any temperature change. KAP system tested, the temperature was raised above 22°C by a thermal heater, thus, valve A opened to allow the gases to pump by 8.081*10^-3mol/s between the glass panels. Pumping stopped when the observed temperature equalized with the required temperature. By using the gases, the temperature decreased below 22; thus, valve B opened to let the gases spread out to a collected cylinder. The results showed a positive indication for tomato and mung beans plant growth under the KAP system to those grown under other conditions. KAP system maintained the set temperature by decreasing or increasing it to an average of 0.23°C/10s or 0.25°C/10s, respectively. Moreover, greenhouse cost reduction was calculated at 55.6% in comparison to an existing greenhouse type. The findings of the study suggest using this system for sustainable agriculture in the future.

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