The Enhanced Growth of Biodiesel Crops Using a Photovoltaic-Powered Drip Irrigation System for the Efficient Production of Fuel

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This project presents a cost-effective, efficient way to grow non-food crops for biodiesel production through the implementation of a photovoltaic-powered drip irrigation (PVDI) system on unused, arid lands using groundwater. Initially, the goal was to design a simple PVDI system and observe the growth of the plants. However, additional data on seed yield, oil yield, power and energy needs, efficiency, and costs were necessary. This, in turn, led to the extraction of oil from the seeds of the plants to produce biodiesel to measure yield and efficiency. The PVDI system was modeled and assembled to observe water, power, and current usage to determine optimal conditions. One gallon of water was pumped within 14 seconds, using 0.1 V of power. The system produced the most power and current in direct sunlight at an angle. Two biodiesel crops were chosen: camelina and coriander. The experimental group was grown using the PVDI system, and the control group was grown separately with only rainfall and manual watering, if necessary. The experimental group grew at a healthier rate than the control group (for both plants). Oil was extracted from the seeds using two methods: dichloromethane and ethyl acetate. The oils were run through a transesterification process and converted into biodiesel. A GCMS was performed on the samples to confirm their makeup. The costs of the PVDI system were calculated. The efficiency and costs of biodiesel was compared to that of traditional ethanol and other fuels. Overall, an optimal PVDI system was determined and could be successful in growing biodiesel crops on arid lands using groundwater efficiently.

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