

Solar Powered Sprayer for Agricultural and Domestic Purpose

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ABSTRACT: Nowadays there is a great need for “conservation of energy “. Continuous use of traditional energy resources will have high risk of rising in price and energy depletion. This paper focuses on green energy utilization for agricultural and domestic purpose. The conventional energy sources uses non-renewable energy resources and they are in the form of backpack which is only useful for the agricultural purposes. This made us to think of designing a multipurpose product that is basically trolley based solar powered sprayer which involves a minimum intervention of man power and operates with the no pollution for agricultural pesticide spraying and washing of vehicles. Our design mainly eliminates the back mounting of sprayer setup which causes back pain, use of fossil power which is non-renewable and hazardous and extensive use of manpower. Thus we proved to be more efficient when compared to conventional sprayer.

Keywords: Solar, DC Pump, Renewable energy, Pesticide sprayer, Vehicle Washer, Multi tasking, Non-Conventional.

I INTRODUCTION

Sprayers are very much important in the application of agricultural practices like spraying pesticides to get uniform distribution of chemicals throughout the crop foliage and also in some domestic application like washing of vehicles ,machine etc. Sprayers not only ensures uniform distribution but also limits use of it. We are particularly using a sprayer which is empowered by a renewable resource i.e. solar energy. This signifies the green energy utilization which creates no harm to the environment. The existing products for pesticide sprayers are either hand operated (manpowered) or fuel operated (fossil power) which requires high human effort and needs regular maintenance like refilling of fuel which are quite expensive. Traditional agricultural sprayers are in the form of backpack which on continuous usage creates back pain or becomes stressful for the users and also can only carry maximum of 10 liters. Our product which is basically a trolley based that eliminates these problems and restrictions. It can be easily movable with very less human effort and can carry sufficient amount of pesticide. The solar panel mounted on the top can be tilted to required angle according to the sunlight. This panel consisting of photovoltaic cells which converts solar energy into electrical energy which is supplied to the battery via controller. The battery intern runs DC motor with sufficient speed for effective spraying through nozzle. Various types of nozzles can be used according to the required work like for spraying the pesticide , spraying of water to the plants, and single point nozzle for washing of vehicles and machine parts etc. The designed product is multitasking, user friendly and eco friendly with high efficiency when compared to existing products and In affordable range.



Fig 1: CAD modal of solar powered sprayer.

Components Used

Components are selected according to get maximum output of the product. These are the following components which are used as follows

- a. Tank
- b. Solar panel
- c. DC battery
- d. DC motor

2.1 Tank

The selection of tank is done considering the weight, quantity and quality of the liquid it can hold. Plastic tank is preferred which is inert to pesticides.

Specifications

Material : plastic

Capacity : 20 liters

2.2 Solar Panel

The Key part of the product. Solar panel is a connected assembly of photovoltaic cells. Photovoltaic modules constitute photovoltaic system that generates and supplies solar electricity. It grabs sunlight and converts solar energy into electrical energy.

Specifications

Capacity : 20W

Size : 530*350 mm

Voltage : 18V

Current : 1.1 Ah

No of cells : 36

Material : Silicone

Weight : 2.3 kg

2.3 DC Battery

DC battery is power house of the system composed of electrochemical cells charged by solar panel. It stores energy through electrochemical reactions. A controller is provided between solar panel and battery to control the current flow.

Specification

Voltage : 12V DC

Rated current : 7.5 Ah

Weight : 2.4 kg

2.4 DC MOTOR

DC Motors are the electrical machines that converts electrical energy to mechanical energy. DC motor helps to lift liquid from tank and delivers it to spray gun with sufficient discharge speed.

Specifications

Voltage : 12V

Discharge : 5 lit/min

Current : 2.5 Ah

Size : 163*50 mm (H * Dia)

Material : plastic and metal

Pressure : 0.6Mpa

II DESIGN CALCULATION

Solar panel

Power = 20w

Voltage = 18v

Then current produced by the panel is given as

$$I = P/V \quad I = 20/18 = 1.11\text{Ah}$$

Battery

Voltage = 12v

Current = 7.5Ah

Then power of battery is given as

$$P = VI \quad P = 12 * 7.5 = 90\text{W}$$

Pump

Power = 30w

Voltage = 12v

Flow rate =5 lit/min

Then current required for the pump is given as

$$I = P/V \quad I = 30/12 = 2.5\text{Ah}$$

Charging time for battery

T=(battery rating in ampere hour)/ (total current consumed by the solar panel)

$$T=7.5/1.11= 6.5\text{hrs (during mean time).}$$

Discharging time

T=(battery rating in ampere hour)/ (total current required for the pump)

$$T=7.5/2.5 = 3\text{hrs}$$

When battery is discharging for 3hrs simultaneously it will charge that can work for 1.5 more hrs.

Total discharging time

$$T= 3+1.5 = 4.5\text{hrs}$$

III ADVANTAGES

- The pesticide sprayer operates with minimal pollution.
- No conventional power consumption.
- Low operating cost.
- Easy to operate.
- User friendly.
- It is portable.
- Maintenance cost is low.
- Easy to assemble and disassemble.
- Effective spraying
- Product uses renewable energy resources.
- Product is easily movable.
- It is also used for washing of vehicle.
- Multipurpose device.
- Reduces human efforts.

IV RESULTS

From the collected data, It is observed that 18V , 1.11Ah solar panel can charge 12V ,7.5Ah battery fully in 6 and half hours assuming normal sunlight in daytime and it takes complete three hours to discharge. During 3 hours of discharge simultaneously battery will be charged, that is sufficient to work for 1 and half hours more when operating in mean time. Therefore continuously we can spray for 4 and half hours without rest.

V CONCLUSION

The fabricated model satisfies all the requirements of the user and It is designed according to the parameters. It involves minimum intervention of manpower . It completely eliminates use of fossil fuels and uses renewable resource i.e. solar energy . The trolley based system also relief user from back mounting which would cause back pain . The designed model is compact, affordable, user friendly and produces no bad impact on environment. Hence the designed model is cost effective and compatible with other models available commercially.



Fig 2: Final modal of solar powered sprayer.

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