

## SOLAR OPERATED PESTICIDE SPRAYER

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### Abstract

Day by Day the population of India is increasing and to fulfill the need of food modernization of agricultural sectors are important. Due to chemical fertilizers the fertility of soil is decreasing. Hence farmers are attracted towards organic farming. By mechanization in spraying devices fertilizers and pesticides are distributed equally on the farm and reduce the quantity of waste, which results in prevention of losses and wastage of input applied to farm. It will reduce the cost of production. Mechanization gives higher productivity in minimum input. Farmers are using same traditional methods for spraying fertilizers and pesticides. Equipment is also the same for ages. In India there is a large development in industrial sectors compared to agricultural sectors. Conventionally the spraying is done by labors carrying backpack sprayer and fertilizers are sprayed manually. The efforts required are more and beneficial by farmers having small farming land. We know that today's world faces a huge "energy crisis" problem. To meet the future "energy demands", the use of non-conventional energy as an alternate solution is inescapable.

A Solar Operated Pesticide Sprayer is a pump running on electricity generated by photovoltaic panels or the thermal energy available from collected sunlight as opposed to grid electricity or diesel run water pumps. The operation of solar powered pumps is more economical mainly due to the lower operation and maintenance costs and has less environmental impact than pumps powered by an internal combustion engine (ICE). Solar pumps are useful where grid electricity is unavailable and alternative sources. The solar sprayer has many advantages. Besides reducing the cost of spraying, there is a saving on fuel/petrol. Also, the transportation cost for buying petrol is saved. The solar sprayer maintenance is simple. There is less vibrations compared to the petrol sprayer. The farmer can do the spraying operation by himself without engaging labour, thus increasing spraying efficiency.

**Keywords:** Solar Panels, Solar Pump, Sprayer, Photovoltaic Cell (PV), Recharable battery.

### I. INTRODUCTION

In India about 73% of population is directly or indirectly depends upon the farming. Hence it is said that India is an agricultural based country. But till now our farmers are doing farming in same traditional ways. They are doing seed sowing, fertilizers and pesticides spraying, cultivating by conventional methods. There is need of development in this sector and most commonly on

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fertilizers pesticides spraying technique, because it requires more efforts and time to spray by traditional way.

Most of Asian nations are at developing stage and they are facing the problem of high population and as compared to that agricultural productivity is much lower as compared to developed nations. India is one of the nations who is facing the same problem. This is caused due to low level farms, insufficient power availability to farms and poor level of farm mechanization.

Most of the increase in the area of irrigated land in the world has been through the increasing use of engine-driven pumps. However, the increasing price of oil-based fuel has reduced the margin to be gained by farmers from irrigation, since food prices have generally been prevented from rising in line with energy costs. Despite present short-term fluctuations in oil prices, conventional oil-based engine-driven power sources and mains electricity are expected to continue to increase in the longer term. If we are to decrease our dependence on imported oil, we have to find methods for energizing irrigation pumps that are independent of imported oil or centralized electricity.

Renewable energy resources are the most preferable resources for generation of electrical energy because of environmentally friendly. Of all the renewable energy resources, solar power is the most resource mainly because it is free, unlimited and free from pollution. The solar energy is usually harvested through solar panels that are made up of photovoltaic cells. Approximately 80% of all photovoltaic systems are mended into a stand alone system.

The advent of photovoltaic modules and arrays or simply solar panel corroborates this progress. The photovoltaic (PV) or solar cells crafted from silicon semiconductor are configured to trap and convert the sun's energy into the useful energy which is then used to perform work such as Dehydration of Agriculture products, irrigation pump, pesticide Duster etc.

Solar radiation as a source of energy is Of course, the epitome of the clean. Sustainable energy technology except for residues possibly arising out of the manufacture of solar component (e.g. semiconductors), solar technology has very low environmental impacts. The environmental impacts of solar system in operation are very low and the source is, for us inexhaustible.



**SOLAR OPERATED PESTICIDE SPRAYER**

## II. BACKGROUND INFORMATION

In agriculture, a sprayer is a type of equipment that is used to apply pesticides & fertilizers on crops. There were many evolutions in sprayers, some of them are

1. Hand operated sprayers.
2. Petrol/Diesel Agricultural sprayers.
3. Aerial Sprayer
4. Lite-Trac sprayer

### 1. HAND OPERATED SPRAYERS

Hand driven pumps consist of a flexible diaphragm made of synthetic rubber connected to the pump handle by a crankshaft mechanism, a rigid diaphragm chamber and either flat or ball-type inlet and outlet valves. The outlet valve is connected to a pressure chamber, which in many hand driven pump sprayers has a variable pressure setting valve. These pumps typically operate between pressures of 1 and 3 bar (15-44 psi) and it is suitable for herbicide application where large droplets are required to minimize spray-drift.



**FIG.1 HAND OPERATED SPRAYER  
SPRAYER**



**FIG.2 PETROL/DIESEL OPERATED  
SPRAYER**

### 2. PETROL/DIESEL OPERATED SPRAYER

The power sprayer consists of an integrated or external spray tank; a high pressure piston pump usually powered by a petrol engine a pressure regulating valve and a hose of up to 50 m of length. Spray tanks are too big to be carried as a knapsack. The power sprayer is produced in a number of versions. Most simple and common is an engine driven pump mounted on a frame without wheels, a 200 l drum and hose and lance. Flow regulation is to be done via a pressure regulating valve and/or by restrictors (basic power sprayer) and the size of the nozzle. At the other end of sprayers mounted on wheels, equipped with pressure regulators. Technically, the power sprayer

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has a lot in common with the motorized knapsack-sprayer. The unit is generally set for high volume spraying, transporting the droplets with high pressure.

### 3. AERIAL SPRAYER

Aerial sprayer is another type of spraying; it is beneficial for the farmers having large farms. This technique is not affordable by farmers having small and medium farm. It is modern technique in agricultural field. In aerial spraying the spraying is done with the help of small helicopter controlled by remote. On that sprayer is attached having multiple nozzles and sprayed it on the farm from some altitude. It is less time consuming and less human effort required to spray fertilizers.



**FIG.3 AERIAL SPRAYER**

### 4. LITE-TRAC SPRAYER

Lite-Trac is a trading name of Holme Farm Supplies Ltd, a manufacturer of agricultural machinery registered in England and based in Peterborough. The Lite-Trac name comes from "lite tractor", due to the patented chassis design enabling the inherently very heavy machines manufactured by the company to have a light footprint for minimum soil compaction.



**FIG.4 LITE-TRAC SPRAYER**

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**III. DESIGN.**

Design and fabrication of solar powered pesticide sprayer has following steps,

**Selection of components:**

The selection of component has been done according to the requirements. Following are the list of components,

1. Tank
2. Solar panel
3. DC water pump
4. DC Battery
5. Nozzle type
6. Connecting pipe/boom
7. Control unit



1. Tank



2. Solar panel



3. DC water pump



4. DC Battery



5. Nozzle types



6. Connecting pipe/boom



7. Control unit

1). Tank :-

Pesticide tank has capacity of 16 liters. PVC material tank is use for it.

2). Solar Panel: -

Solar panel is the main component of the system. A solar panel is a packaged, connected assembly of photovoltaic cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications. It has the following specifications,

20W PV Solar panel,

Dimension :49×35×3 cm,

Weight :2 kg,

Max voltage: 17 V,

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Max current: 1.18 A,  
Open circuit volt: 21 V,  
Short circuit current: 1.2 A.

3). DC water pump.

DC water pump is used to lift the pesticide from tank and delivers to the spray gun. DC water pump has following specifications,  
Voltage : 12V,  
Current : 0.5 AMP to 1.5 AMP (max),  
Flow rate : >3.68 liter / min,  
Fluid pressure : 1.6kgf/cm<sup>2</sup>.

4). DC Battery: -

Capacity : 12V, 7Ah,  
Constant voltage charge with voltage,  
Standby use : 13.6V -13.8V,  
Cycle use : 14.1V-14.4V,  
Type =lead acid battery,  
Max initial current : 1.4A.

5). Nozzles: -

Different types of nozzles are used to spray depending upon the requirement.

Types:

- Double fixed nozzle
- Splitter nozzle
- 4-hole nozzle
- 8-hole nozzle

6) Connecting Pipe / boom :- It is a connection between tank to spray gun that helps to regulate required pressure from tank to spray gun.

7). Control Unit: -

It consists of switch and pressure regulator. The switch is used for ON/OFF the pump and the pressure regulator is used to increase or decrease the pressure of spraying

#### **IV. CONSTRUCTION (OR)ALINGMENT**

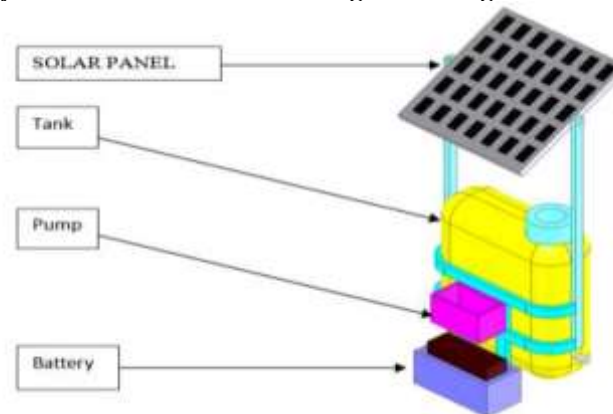
In this project a frame is constructed. In this frame a retractable link is fixed to the top end of which a solar photovoltaic panel is fixed that converts solar power into electricity. This electricity is then provided to battery via a charging circuit and is used for charging the battery. Electric power from this battery is given to an electric dc water pump via control switches, by controlling which entire device can be operated. The blower blows high speed air into the blower pipe. The blower pipe is held with hand by the device operator and is directed into the area where we wish to spray the pesticides/insecticides. The insecticide reservoir is connected to the blower pipe. By continuously

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feeding the insecticide to the blower pipe the same is spread or sprinkled where we wished. Liquid insecticide is sprayed on the crops using spray pipe which receives liquid from a reservoir with the help of a pump. This pump is driven by another DC water pump that receives power from the same battery. Thus insecticide in liquid form is sprayed where we wished.

**V. WORKING PRINCIPLE**

This project operation on solar energy. The concoction is accomplished by the use of solar panel, a centrifugal pump which runs on dc supply is attached to the solar panel the solar panel generates the power that power is dc power its positive and negative charges are connected to a battery in order to save the power and use it when the sun rays are not present by using this device we can spray pesticides to the herbs and plants and any agriculture spraying it is economical as compared to the other means used like petrol/diesel pesticide sprayers. There is no much maintenance cost and no operating cost as it is using solar energy it is free of cost and there is no pollution its working principal is very simple and the it is economical to the farmers as it has one more advantage that it can also generate power that power is saved in the battery and it can be used for both for spraying and well as to light in the house when there is no current supply. And where as in rainy season when the sun rays are not there that time we can charge the battery and use it to spray pesticides to the herbs and plants as compared to petrol/ diesel it is economical no efforts to human just he has to carry the device the device is light in weight so it is much feasible.



**VI. RESULTSAND DISCUSSION**

The proposed system was tested with AC charging as well as solar charging. From the results it was found that the current and time required for charging the full battery capacity of 12V, 8Ah by Solar energy is 5-7 hours. The fully charged battery can be used to spray 580 liters of fertilizer, which approximately spray 3-4 acers of land. The initial cost of the proposed system is little more as compare to conventional sprayer but the running cost of the system is veryless. The developed system used for occupation is agriculture. The prominent aim of this project is to fulfill the tasks like hand spraying, IC engine spraying, and leg pump spraying etc. using non-conventional energy sources. Thus solar operated spray pump will help the farmers of those remote areas of country where fuel is not available easily. They can perform their regular work as well as saves fuel up to large extent. At the same time they reduces effect on environment.



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**VII. MERITS**

- More economical
- Easy to clean and maintain
- It is a renewable energy source
- It does not create air pollutant & noise
- Easy to handle
- Do not required fuel hence cost reduce for spraying

**VIII. CONCLUSION**

It does not compromise the performance of a petrol based pesticide sprayer. In addition, the model is designed to be eco friendly and lower cost, and thus will prove to be more efficient when compared to petrol based pesticide sprayer. A minor modification to the form factor, the module can be brought out as a commercial product.

In order to verify the performance we mounted an attachment on the frame and carried out the testing. We are happy to find that 8Ah battery can run the pump for 5-7 hours one fully charged battery can be used to spray 3-4 Acres, while 1litre of petrol can cover 1Acre. Thus, cost of 1litre petrol is Rs.80 and cost for charging the battery is negligible. So no operating cost is required in solar based pesticide sprayer.

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