

# Design and Fabrication of Solar Sprayer Trolley

Aniket Jamdar<sup>1</sup>, Ankit Bhimt<sup>2</sup>, Atharva Upagade<sup>3</sup>, Parikshit Deshpande<sup>4</sup>, Kaustubham Khubalkar<sup>5</sup>, Prof. R. D. Gorle<sup>6</sup>

<sup>1,2,3,4,5</sup> Students of Department of Mechanical Engineering, Dr. Babasaheb Ambedkar college of Engineering and Research, Wanadongri – 441110, Maharashtra, India

<sup>6</sup> Assistant Professor in department of Mechanical Engineering, Dr. Babasaheb Ambedkar college of Engineering and Research, Wanadongri – 441110, Maharashtra, India

**Abstract-** India's major economy is determined by agriculture sector but it faces problems in technological advancements. The next problem faced not only by India but also by the whole world is the extinction of non-renewable source of energy. Solar operated pesticide sprayer focuses on to find the solution to these problems. A Solar Operated Pesticides Sprayer is a pump running on electricity generated by photovoltaic panels. The operation of solar is to charge the battery. The battery give the power to the pump. Solar are useful where the grid electricity is unavailable and alternative sources (in particular wind) do not provide sufficient energy. The solar sprayer has many advantages. Besides reducing the effort of spraying, there is saving on fuel. The solar sprayer maintenance is simple. There is less vibration as compared to the petrol sprayer. It also environmental friendly and do not produce pollution. The farmer can do the spraying operation by himself without engaging labour, thus increasing spraying efficiency.

**Index Terms-** Solar Panels, Diaphragm Pump, Sprayer, Photovoltaic Cell (PV), Electricity.

## INTRODUCTION

India is a country where nearly 70% of people lives in rural area and main source of their income is farming, directly or indirectly. 70% of people in India are connected with farming directly or indirectly, instead of that we are not producing the crop of which we having capacity to produce. Reason behind this is we farmers of our country are not using technology very well. So we have to make machines that can help them to save their time and money and to increase the production rate and their profit. We to make economic machineries so farmers can purchase it as per capita income of our country's farmers are low and our country per capita income is low that of

compared to other as our country is developing country.

Present scenario in agriculture field in India related to sprayer is that farmers are using hand operated sprayer or motorized sprayer. According to idea in our project we are making a 4 wheel trolley or vehicle which is runs on power source from battery. This battery is charge by solar panel using sunlight. We are using sunlight as power source and also using nozzle for fine spray this help to save the time and money.

Using a trolley for storage helps in reduction of danger of coming in contact with the pesticides. This would help in reduction of accidents caused while spraying pesticides on the farm. As the system uses renewable source of energy, the environmental hazards which are caused by non-renewable sources of energy is greatly reduced. The farmer can become self-dependent as the system does not depend on the electricity provided by the government. The maintenance and service cost is also cheap. The human effort is also reduced drastically. Furthermore, the system can also be used for various domestic purposes such as spray painting.

## LITERATURE REVIEW

Literature review is nothing but the work done before the present time on the same topic. So, we know that people doing farming from ancient time for food and other purpose. For better grown of crop they spray pesticides on them. There are many types of pesticides spraying technique available now that we can find as we move from east to west and also from north to south. It is difficult to mention all those technique here. But we tried to mention main

technique used and best known to us. People in India use backpack type sprayer which is carry on back of the person with 15 lit maximum capacities and one nozzles in one hand while other hand is used to pump the machine to create the pressure. Another machine which is developed and supplied in England was manufactured and patented by Holmes Farmsupplies Ltd. This machine is consisting of water tank on tractor. This water tank contains liquid pesticides. Also many such machines are manufactured by this company for large scale farming and large size crops. One another machine is made in India by Manusukhbhai Jagani. He attached spraying and cultivating equipment to his bike. So his bike was able to furrow opening, sowing, cultivate and spray pesticide on plants. This was proved as cost effective for small size farms.

### METHODOLOGY

Design and Fabrication of solar sprayer trolley has following steps

#### 1. Selection of Component

The Selection of component has done according to the requirement. Following are the list of the component

1. Tank
2. Solar Panel
3. Diaphragm Pump
4. DC Battery
5. Nozzle
6. Connecting Pipe

##### 1.1. Tank

Pesticides tank has capacity of 75 liters. In order to carry the more pesticides for spray.

##### 1.2 Solar Panel

Solar Panel is the main component of the system. It has the following specification

Maximum Power =10 watts

Maximum Voltage=17.03 volts

Maximum Current =0.59 Amp



#### 1.3 Diaphragm Pump

A diaphragm pump (also known as a Membrane pump) is a positive displacement pump that uses a combination of the reciprocating action of a rubber, thermoplastic or Teflon diaphragm and suitable valves on either side of the diaphragm (check valve, butterfly valves, flap valves, or any other form of shut-off valves) to pump fluid.



#### 1.4 DC Battery

DC battery is power source for this spray pump. This battery is charged by solar panel and removable. It has following specification

Current=8 Ah

Voltage=12 V

#### 1.5 Nozzle

Nozzle is the basic component of the spray pump which generate spray pattern. Nozzle is selected to operate on 3 bar pressure and obtained fine spray.

#### 1.6 Connecting Pipe

It supplies pesticide from tank to nozzle. As discussed above the pesticide will always flow through the pipe. So it should not wear fast. So material used for the pipe is stainless steel.

### 2. General Calculation

Calculation for size of the tank:

For 1 Acre cotton farm 180 lit of pesticide is required.

The traditional pesticide sprayer can carry 15 lit of pesticide at a time.

To reduce the human effort, the solar spray trolley must carry 60 lit (15x4).

Therefore the volume of the tank must be  $0.06 \text{ m}^3$  or above. ( $1000 \text{ lit} = 1 \text{ m}^3$ ).

Considering the human ergonomics, the average height of Indian male is 160 cm.

The height of his waist would be 80 cm ( $160/2$ ).

Therefore the overall height of the trolley must be 80 cm and the height of the tank must be within 40 cm.

Taking the height of the tank as 30 cm.

The distance between 2 plants of cotton is kept 100 cm approximate.

Therefore taking the overall width of trolley as 75cm and width of the tank 45 cm.

Considering the allowances for the tank capacity as 25%.

$$0.06 \times 1.25 = 0.075 \text{ m}^3$$

So the length for the above capacity would be

$$0.075 = 1 \times 0.45 \times 0.30$$

$$L = 0.55 \text{ m}$$

Therefore the size of the tank is, 0.55 x 0.45 x 0.30 m

Calculation for charging of the battery:

Power generated by solar panel=10 watts

Battery 12v, 8Ah current

Power =energy/sec

$$\text{Power} = V \times I$$

$$= 12 \times 8$$

$$= 96 \text{ WH}$$

Time required charging the battery

$$= (96/10)$$

$$= 9.6 \text{ hrs.}^*$$

\*Note-Time varies because of intensity of sun radiation at different days.

Backup time of sprayer

= (power stored in battery/power consumed by motor)

$$= 96 / (2.2 \times 12)$$

$$= 3.63 \text{ hrs.}$$

#### PRINCIPALE OF OPERATION

Sun radiation are incident on the solar panel. Solar panel consist of photovoltaic cells this photovoltaic cell convert the solar energy into electrical energy. The electrical energy generated by the solar are supplied to the battery via electrical wires. Controller is placed between the solar panel and battery. This controller control the current supplied to battery.

After charging battery is connected to diaphragm pump. The diaphragm pump is started after switching on the pump has two opening one inlet and one outlet. Pump develop the suction and lift the pesticides from tank and supplies to nozzle through the connecting pipe. Nozzle give the spray pattern and in this way the pesticide can be spray on the farm.

#### CONCLUSION

It is detect that, this model of solar spray trolley is reduced human effort and saving the time. It is more cost effective and gives the effective results in

spraying operation. As it is run on the conventional energy, it is widely available at free of cost. Now a day by day the world moving towards to find alternative energy source option to the non – conventional energy sources. In the finding of new ways for the conventional sprayer. As India is a developing country, this product can be become more popular in rural area. It has low cost and environment friendly.

#### FUTURE SCOPE

The future scope of the project would be such, it can also be used for domestic purpose like spraying painting vehicles, house walls, etc. with a variation in size and opting for a different capacity it can be used throughout different types of farms of different variety with reduction in cost.

Furthermore, the sprayer can be extended and the trolley can be fixed at one position, this could be possible by using high pressure pump. This can save time and effort tremendously.

#### REFERENCE

- [1] Pandurang Lad<sup>1</sup>, Virendra Patil<sup>2</sup>, Prashant Patil<sup>3</sup>, Tushar Pati<sup>4</sup>, Pravin Patil<sup>5</sup> “Solar Operated Pesticide Sprayer”, April-2015, ISSN-2319-8354(E).
- [2] Abhishek Jivrag, <sup>2</sup>Vinayak Chawre, <sup>3</sup>Aditya Bhagwat, Solar Operated Multiple Granulated Pesticide Duster WCE 2011, July6-8, 2011, London, U.K., Vol.3. ISBN: 978-988-19251-5-2.
- [3] Sarvesh Kulkarni<sup>1</sup>, Karan Hasurkar<sup>2</sup>, Ramdas Kumbhar<sup>3</sup>, Amol Gonde<sup>4</sup>, Raut A.S.<sup>5</sup> “Review Of Solar Powered Pesticide Sprayer.
- [4] Vector control – methods for use by individual and communities by Jan A. Rozendaal
- [5] Dhiraj Kumbhare ,Vishal Singh ,Prashik Waghmare,Altaf Ansari, Vikas Tiwari,”Fabrication Of Automatic Pesticides Spraying Machine”-IRJET
- [6] Solar ,Automatic And Manual Operated Diaphragm Pump By Krishnappa ,Venkatesh ,Vishaka Prasad, Yashwanth Kuri, Varum Kumar.(Asst. Professor, Department Of ME, Atria Institute Of Technology)
- [7] “Paper On Modelling Of Compressible Nozzle Flow”, Sanchi Varghrse, Dushyant Kalihari, Brijesh Patel-IRJET