International Journal of Advanced Technology in Engineering and Science
Vol. No.5, Issue No. 03, March 2017
www.ijates.com
ijates
ISSN 2348 - 7550

DESIGN OF ALTERNATE ENERGY ORIENTED SOLAR SPRAYER FOR AGRICULTURAL APPLICATIONS

Binkam.Naga Murali[1] , Nandish V[2], T Surendra[3]

[1,2,3] *Sphoorthy Engg College/Mechanical, Hyderabad, (India)*

ABSTRACT

In Indian farms, hand operated spray pump is most popular but user can't use it for more than 5 to 6 hours continuously as he gets tired after some hours .Fuel operated spray pump requires fuel which is expensive and availability of fuel is not easy at rural places. It exhausts carbon dioxide as pollutant which is harmful to our environment . Then Solar energy would be one of the solutions i.e non-conventional energy.

This solar-powered spray pump system uses solar energy as source. Solar energy is first used to charge a storage battery and that energy stored in the battery is utilized to operate motor which functions as pump. As the name of the paper suggests, it deals with the constant discharge of pesticide, compressed air control system, solar power, battery charging and monitoring as well as timer and non-conventional power controlling techniques. In this paper it has been committed to do something unique and useful equipment with non-conventional source technique. Also it reduces the weight of unique solar spray jet as compare to diesel spray jet.

Keywords: Spray Pump, Pollutant, Conventional Energy, Storage Battery, Air Control System, Solar Power.

I INTRODUCTION

Manufacturer has received a lot of attention recently for very good economic reasons. This paper emphasizes on the spraying of pesticides using solar power as energy. It can be used as home lighting system as its battery can be used at night too

.

Fig 1.1: Hand Pump

Fig:1.2. Fuel Type Pump

Solar Energy: India has the fifth largest installed wind power capacity in the world .

Fig: 2.1 Solar Energy

Fig: 2.2.Wind Energy

Fig: 2.3. Tidal Energy

S.no	*Energies Used*	*Yearly Human Energy Consumption*
1	Solar	3,850,000 EJ
2	Wind	2,250 EJ
3	Biomass potential	100–300 EJ
4	Primary energy use (2010)	539 EJ
5	Electricity (2010)	66.5 EJ

II SCOPE OF WORK

For many agriculture needs, the alternative is solar energy. Modern, well-designed, simple-to-maintain solar systems can provide the energy wherever it is needed. Solar energy plays a vital role in drying agriculture products and for irrigation purpose for pumping the well water in remote villages without electricity. This technology on solar energy can be extended for spraying pesticides, fungicides and fertilizers etc., using solar sprayers.

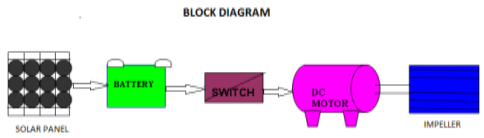

Fig.2.4 Model of Solar Panel

Specifications *:* **PANELS:**

Panel cell Size: 1 ¼ " x 1"

Cost of the Panel: Rs.1000 - Rs.1200/-

Weight of the Panel: 1kg.

Fig: 2.5

Power Rating: Capacity and discharge The higher the discharge rate, the lower the capacity. The relationship between current, discharge time and capacity for a lead acid battery is approximated (over a typical range of current values) by peukert's law .

$$t = \frac{Q_P}{I^k}$$

Where

Q_P is the capacity when discharged at a rate of 1 amp.

I is the current drawn from battery

t is the amount of time (in hours) that a battery can sustain.

k is a constant around 1.3.

` Fig: 3.1.Batteries

The presence of the internal electric field in the solar cell facilitates the separation of the photo generated electron-hole pairs. Formation of a space-charge region in the *p*-*n* junction. The presence of the internal electric field in the solar cell facilitates the separation of the photo generated electron-hole pairs. doping concentration is uniform both in the *p*-type and the *n*-type semiconductors. Concentrations profile of mobile charge carriers in a *p*-*n* junction under equilibrium.

Specification of Motor

Weight of the motor : 1kg

a) Operating power required : 82 watt

b) Operating Voltage : 12V

c) Operating current : 7 amp

d) Motor Speed: 1,600 rpm.

e) Motor Cost: Rs.600 – 800.

Fig:3.2 Dc Motor

III FABRICATION OF SOLAR SPRAYER

The design of solar agro sprayer consist of 3 main parts namely

1) Solar panel unit

2) Storage battery unit and

3) Rotating motor.

In the solar agro sprayer 2-stroke petrol engine, component of the power sprayer has been replaced with combination of storage battery and rotating motor. The action of the rotating motor could be controlled by a switch attached with in the assembly. Solar panel arrangement has been provided at the top of the unit to charge the storage battery.

The basic processes behind the photovoltaic effect are:

1.Generation of the charge carriers due to the absorption of photons in the materials that form a junction.

2. Subsequent separation of the photo-generated charge carriers in the junction.

3. Collection of the photo-generated charge carriers at the terminals of the junction.

Fig: 3.4 Nozzle

Requirement of good spray

According to enquiry from 20 different farmers about spraying capacity of spray, the middle range of delivery spraying capacity is 12 feet to 15 feet & discharge capacity of spray is 10 to 12 lit/min. According to requirement of spray, following motor is selected for this spray model .

Power Rating:

Voltage: 15 volt

Current: 5 Amp.

Power:15 x 5 = 75 watt.

Testing of Charging Time:

Instrument used to measure Sun Radiation:

Sun Meter

The Sun Radiation are measured in: mW/CM^2

Required voltage for charging Battery: 12 volt

IV OPERATING SYSTEM OF SOLAR PANEL

:

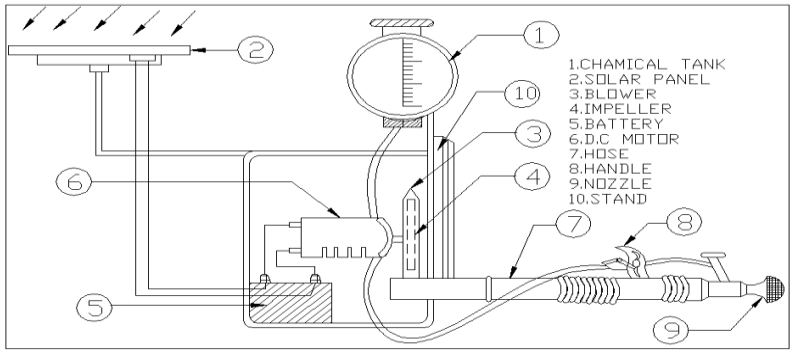

Fig: 3.5 Schematic Diagram

Charging can be done using a solar panel. Battery can be charged continuously during discharge itself, by attaching the panel on the sprayers. Without panel on the sprayers, discharge can be done for a minimum period of 4 to 5 hours. By changing the battery, discharge can be continued for further more hours. Charging can be done by separate Solar panel attachment.

Note: During Rainy Season charging can be done by electrical devices.

Battery charging time calculation:

Instrument used to measure sun radiation is sun meter.

Sno	Solar radiation	Charging time
1	200 to 300 mW/cm^2:	3 to 4 hrs.
2	300 to 400 mW/ cm^2	2 to 3 hrs.
3	400 to 600 mW/cm^2	1 hour.

Running period : 4 to 4 .5 hours.

Power Conversion Efficiency:

The solar cell power conversion efficiency can be calculated by using the relation, Where

P = Incident Solar radiation x Area of the Solar Cell in

= I x A T

The output power (P) = V x I out

It is the power delivered from the Generator.

Economic Analysis

The cost of the fuel increases day by day. It should be reduced by the modified model which works on the principle of solar energy. The operating cost of power sprayer for one hour operation is calculated and its value is compared with the operating cost of solar sprayer. Its seems that there is no need of operating cost but the initial investment towards the charging unit is a onetime investment with a life period of twenty years which is almost equal to the unit cost of the power sprayer with twist of petrol engine.

Merits

It is a good alternative for engine sprayer.

a) Maintenance cost is less.
b) The use will be most welcomed when the fuel resources are over.
c) It is noiseless.
d) It does not create any pollution.
e) There is no vibration comparing with petrol operated sprayers.
f) The construction is simple and not so difficult as other sprayers.
g) Simple to use and easy to manufacture.
h) Long durability and reliability.

V PRECAUTIONS AND SAFETY MEASURES

Before charging whether the input dc voltage is in accordance with charger input changing voltage or not is checked.

i. To avoid electric shock , non-professionals are not allowed to open the charger cover.

ii. Children are forbidden to use or play with the sprayer and accessories.

iii. When spraying, safety measures must be taken for example protective garments, respirator, gloves and so on. After spraying, sprayer and the person must get cleaned. It must be strictly prohibited to do spraying for anyone that is sick, skin wound, with skin disease, allergic to agriculture chemical or with weak constitution.

iv. One must keep away from the crowed and spray downwind. Spraying up wind is forbidden. All the crops, melon, fruit or drug ingredients which are sprayed must be picked only after the safety picking period.

v. Operate strictly abiding by the local legislation on agriculture chemical safety application and pesticide manufactures safety instruction. Treat the pesticide castoff well and protect the environment.

vi. Useless batteries should be returned to the dealer. No discard casually.

VI CONCLUSION

As we know 70% of population of our country lives in villages & their main occupation is agriculture. My prominent aim of this paper is to fulfill the tasks like hand spraying with I/C 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 save fuel up to large extent. At the same time environment pollution can be reduced. Thus saving is done for revenue of government & also most demanded fuel.

VII FUTURE SCOPE

For many agriculture needs, the alternative is solar energy. Modern well-designed, simple-to-maintain solar systems can provide the energy that is needed where it is needed and when it is needed. These systems that have been tested and proven around the world to be cost-effective, reliable and they are already raising levels of agricultural productivity worldwide.

Solar energy plays an important role in drying agriculture products and for irrigation purpose for pumping the well water in remote villages without electricity. This technology on solar energy can be extended in the future for spraying pesticides, fungicides and fertilizers etc., using solar sprayers.

PRODUCT IMAGES

Fig:7.1. Mobel battery

VRLA batteries immobilize the electrolyte. The two types are:

a) Get batteries (or "gel cell") / use a semi-solid electrolyte.

b) Absorbed glass mat (AGM) batteries absorb the electrolyte in special fiberglass matting.

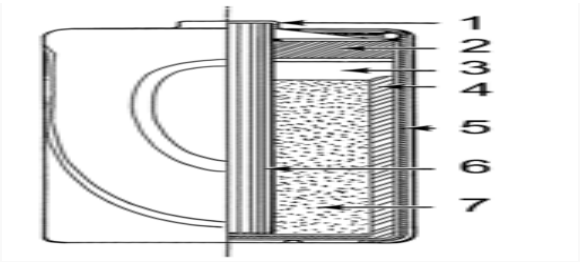

Fig: 7.2.Dry cell

REFERENCES

[1] Sootha,G.D. and Sk.Gupta, 1991.Jugal Kishore(Ed): solar Energy Center.

[2] Rao, G.D,Solar Energy , Solar photovoltaic: electric power generation.

[3] Rajesh, kumar and O.S.Sastry, 1998, Development of solar photovoltaic Lighting system in India.

[4] Sharma R.S,1996, Solar Thermal Power Generation (STPG) Technologies in India context.

[5] Sharma, R.S,1995. Environmental Economics and Design Consideration in mega watt range.

[6] Sastry,O.S, rasjeshkumar and P.C.Pant,199.Photovoltaic test fecility at Solar energy centre. Sootha,G.D. and Sk.Gupta, 1991.Jugal Kishore(Ed): solar Energy Centre.

[7] Rao, G.D,Solar Energy , Solar photovoltaic: electric power generation.

[8] Rajesh, kumar and O.S.Sastry, 1998, Development of solar photovoltaic Lighting system in india.

[9] Sharma, R.S,1995. Environmental Economics and Design Consideration in mega watt range.

[10] Sastry,O.S, rajesh kumar and P.C.Pant,199.Photovoltaic test facility at Solar energy centre..

ACKNOWLEDGMENT

First and foremost, I would like to express my profound and sincere gratitude and indebtedness to my esteemed colleagues and Mrs G.Parvathi for cooperation in the preparation of this thesis .My heartfelt thanks for having given me free hand in my research work and pin pointing to my observations at right time for Sphoorthy engg college premises ,Hyderabad. Plain“Thanks"cannot express my gratitude for dr G.Poshal,Dean & HOD ,Mech Dept SPHN ,Hyderabad,who supported me in real-time process.

I am deeply indebted to Mr.S.Jaganmohana Reddy ,Seretary,SPHN,Hyderabad for stimulating and untiring suggestions and constant encouragement. I could not have finished this work successfully without their help. Their doors were always opened to me for discussion. I am really touched upon by unconditional scientific inputs and humanity.

AUTHOR'S BIOGRAPHY

1. Mr.B.Naga Murali hails from prakasam dist .A.P, obtained B.Tech in Mechanical engg from JNTUA campus,Anantapur,A.P,Iindia & M.Tech in CAD/CAM from JNTUH,Hyderabad.

He has 7 years industrial and 12 years teaching experience and published six international journals and working as an Associate professor in SPHN ,Hyderabad ,India.

2.Mr.Nandish V working as Assistant professor in Sphoorthy Engg College and he got his B-Tech and M Tech degree from VTU , KARNATAKA.

3. Mr.T Surendra working as Assistant professor in Sphoorthy Engg College and he got his B-Tech and M Tech degree from JNTU Anantapur , AP