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RESEARCH ARTICLE

DEVELOPMENT OF SOLAR SPRAYER WITH THE INCLUSION OF ELECTRICAL STIRRER MECHANISM

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ABSTRACT

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 do not provide sufficient energy. Also this provides a modification from the conventional system, mixing the fertilizer thoroughly by using Electro mechanical Stirrer (Proposed). There by the toxic inhalation of the pesticides will be reduced. The battery will be charged during the day time and this power which is stored and used in night and cloudy weather condition.

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INTRODUCTION

Agriculture is the back bone of our country. India is set to be an agricultural based country approximately 75% of population of India is dependent on farming directly or indirectly. Our farmers are using the same methods and equipment for the ages. Spraying pesticide is an important process in farming. Nowadays, there are many types of pesticide sprayer already in market. For the different types of pesticide sprayer there are have a different shapes, sizes, method to carry it but the function are same. Solar sprayer are the ultimate cost effective solution at the locations where spraying is required. This solar-powered spray pump system uses solar energy as source. Solar energy is first used to charge a storage battery. The solar energy stored in the battery is utilized to operate motor which functions as pump. As the name suggests, it deals with the constant discharge of pesticide. The pesticide been uniformly mixed with water by using the mixing mechanism. Thus the solar sprayer will become an alternative to the available conventional system. Joshua *et.al* (2010) explained technology on solar energy can be extended for spraying pesticides, Fungicides and Fertilizers etc., using Solar Sprayers.

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This paper deals how a 'Power Sprayer' which is already in use and works with fossil fuel can be converted into solar sprayers works without any fossil fuel. Zoeb khan (2013) formulated the main drawback of hand operated spray pump is that the user can't use it for more than 5-6 hours continuously as he gets tired after some hours where as fuel operated spray pump requires fuel which is expensive and availability of fuel is not easy at rural places.

At the same time it exhausts carbon dioxide as pollutant which is harmful to our environment. Sagar P. Yadav *et al.* (2009) 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, 12Ah by practically is 14.45 hours and hours. Pandurang lad *et al.* (2015) formulated a Solar Operated 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). Abishek Jivrag *et al*. (2002) illustrates invention and operation of multiple granulated pesticides duster with the use of solar energy. The concoction is accomplished by the use of solar

panel, impeller type centrifugal blower, gear reduction mechanism, dispensers, D.C motors and batteries. The operator controls the rate and discharge of different pesticides by means of push buttons and toggle switches. Bart van campen *et al*. (2000) formulated that solar photovoltaic systems have shown their potential in rural electrification projects around the world, especially concerning Solar Home Systems. With continuing price decreases of PV systems, other applications are becoming economically attractive and experience is gained with the use of PV in such areas as social and communal services, agriculture and other productive activities, which can have a significant impact on rural development.

Robson Shigueaki Sasaki *et al*. (2014) Developed and evaluated a solar photovoltaic backpack sprayer. An electric backpack sprayer MTS brand, model Spritz 18, was used. An aluminium structure was designed and built for fixing two photovoltaic cells, Kyocera brand, model KS5. At the end it was verified that the average of the instantaneous power generated was of 1.4 and 2.18 W, for in movement and in static respectively. Laukik p. Raut (August, 2013) tells about the farmers who are using the same methods and equipment for the ages. In our country farming is done by traditional way, besides that there is large development of industrial and service sector as compared to that of agriculture. The spraying is traditionally done by labour carrying backpack type sprayer which requires more human effort. Varikutivasantha Rao (April, 2013) explained the design and implementation of multiple power supplied fertilizer sprayer has been presented. The developed system is the modified model of the two stroke petrol engine powered sprayer which minimizes the difficulties of the existing power sprayer such as operating cost, changing of fuel etc. Sarvesh Kulkarni (April, 2015) tells about the solar energy which is widely available in nature throughout the year. So it can be utilized in miscellaneous application like spraying, drying and cooking etc. In agricultural areas spraying is one of the essential tasks. This paper gives the information about solar powered pesticide sprayer as in cost effective manner. Mohan badiger *et al*. (Aug 2014) derived a project, which 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.

Modeling of solar sprayer

Photovoltaic panels, used to generate renewable electricity directly from sunlight. This electrical energy is also been used to run a mechanical stirrer , For this purpose a stirrer is connected to a D.C motor 1A,12v,max 1000 rpm. This D.C motor can be switched on or off by using the control switch. The empty tank is first filled with the required amount of water and pesticide. By switching it on the motor will make the stirrer to rotate and through mixing of the water and pesticide will be made. Then the pump is switched on to suck and pump out the mixed pesticide through the nozzle to the crops. The complete model is created with the Pro-E Wild software as shown in Figure 1. Storage tank are used to enhance the effectiveness of pesticides such as herbicides, insecticides, fungicides and other agents that control or eliminate unwanted pests. As with medical adjuvants, agricultural spray adjuvants are not themselves active in controlling or killing pests.

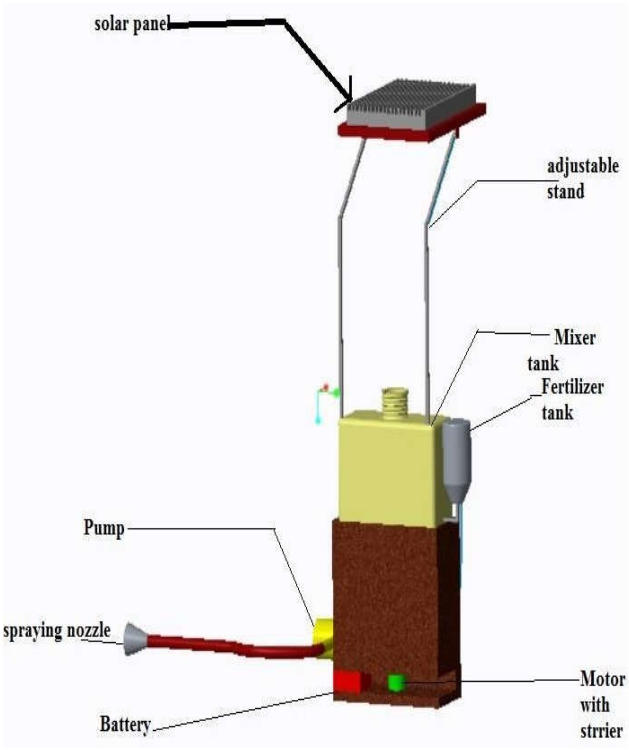

Fig. 1.

Instead, these additives modify some property of the spray solution, which improves the ability of the pesticide to penetrate, target or protect the target organism. Among the typical types of ingredients used are surfactants, emulsifiers, oils and salts. Each of these ingredients, and others, modifies the spray solution itself to improve such properties as spreading, penetration, droplet size or other characteristics. Aspee is one of the supplier of the storage tank which has different capacity based on our need and suggestion from farmers the tank of 16 liter capacity is chosen the tank is purchased for our experiment as shown in Figure 2.

Fig. 2. Mixer tank

The Table 1. Provides the details of components and its specification for project

Bill of materials

Table 1. Bill of materials

S.No.	Component	Specification	Material	Quanity
1	Solar panel	12V,10w,(340*280*2 5mm)	Silicon based pv cell	1
2	Dc pump	12V,40PSI,3.5LPM	Self-priming	1
3	Motor	12V,1.7 amps	DC Power	1
4	Mixiertank	16 Litre	Plastic	1
5	Fertilizer tank	500 mL	Plastic	1
6	Stirrer	80mmSpan	Mild steel	1
7	Battery	12V,4.5 amps	Lead acid battery	1
8	Nozzle	12 holes, 4 holes, 2 holes	Plastic	3
9	Stand	L- Frame 2m	Mild steel	1

Pesticide Tank

The system consist of a pesticide tank which is been separately held and used to inject the required amount of pesticides in to the mixer tank. This pesticide tank will consist of level reading to specify the amount of pesticide. This pesticide tank is a pressure type tank, when the bottle is pressed the required amount of pesticide will be injected. In the case of different kinds of pesticide the main opening of the mixer tank can be used as shown in Fig. 3.

Fig. 3. Pesticide tank

The mixing of the pesticide with the water is thoroughly mixed by using the mechanical stirrer. This stirrer agitates the pesticide and water uniformly. The stirrer is made of mild steel and its dimension will less in diameter. So the outer diameter is 80mm is preferred for product development as shown in Fig. 4.

Fig. 4. Stirrer

Conclusion and scope for future advancement

The developed model is most suitable for Energy Alternate Device for power sprayers. The farming community is more dynamic and they were accepted the proved technology for implementation. Moreover the same technique and technology can be extended for all types of power sprayers. 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 environment pollution. Thus saving revenue of government and also most demanded fuel. The equipment is purposely design for the farmers having small farming land say 2-3 acre. The initial cost of the proposed system is little more as compared to conventional sprayer but the running cost of the system is very less. It is found that the solar panel could be given the desired inclination of $15^0 18^0$ N-S so as to maximize the catch of incident sun rays, depending on the direction of travel of the operator. The solar operated sprayer can be operated 10-12 hrs a day without any charging of fuel, Charging of fuel is the main drawback of fuel operated and battery operated systems**.** This enhanced system is used to mix the water and pesticide, there by mixing time get reduced for each refill of water. Weight and cost of the system is lower than the petrol operated sprayer.

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