RENEWABLE ENERGY SOURCES FOR BIOMEDICAL APPLICATIONS

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I.ABSTRACT

In this chapter the brief discussion about different types of medical devices which uses renewable resources has been discussed. In our current scenario medical devices plays an very important role in a variety of medical aspects such as diagnosis and treatment. But the main challenge the hospital industry faces the power consumption because in order to maintain specific environmental conditions for safe handling end equipment's and delicate lab equipment require uninterrupted energy flow and hence Pharma Industry are now looking for renewable energy resources. In this review we will discuss the applications of harvesters into implantable devices and evaluate the different materials and methods and examine how new and improved circuits will help in assisting the generators to sustain the function of medical devices.

Key Words- *Renewable Resource; Medical Devices; Uninterrupted Energy Flow.*

II.INTRODUCTION

Environmental bio-energy harvesting (EEH) is a means of powering biomedical devices by scavenging many low grade ambient energy sources such as infrared, solar and wireless energy transmission, and their conversion into useable electrical energy to power the implanted devices. EEH devices are therefore potentially attractive as replacements for implanted batteries. They also hold the promise of one day enabling the powering of a range of implantable and wearable medical devices.

In the current world scenario renewable energy resources based medical equipment's plays an very important role to provide clean energy. For example solar based technologies can be applied in healthcare facilities. But the main advantage of using these kinds of systems provide low carbon di oxide emission. the various forms of renewable energy sources includes solar, geothermal and wind

III. METHODS

A) Solar based autoclave

Autoclave is used to sterilize medical instruments and equipment's .in the autoclave process the medium is exposed to saturated steam at higher temperature. But the main constraint is that limited/non-existent access to source of electricity sufficient to power such systems.

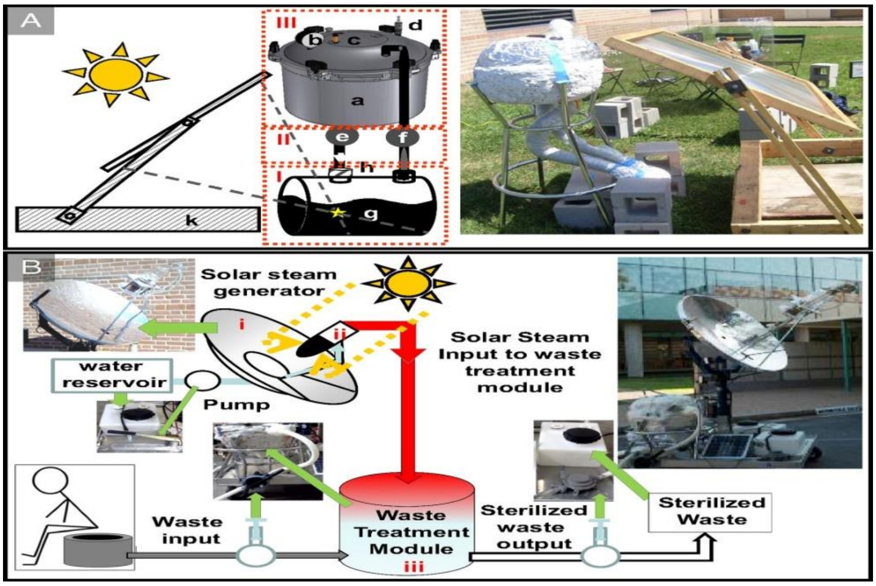

Figure 1: Solar Autoclave

In this method we uses light absorbing particle as the source of heat generated for example.,carbon, nanoshell ,metallic nano shell converts solar energy to steam. the advantage of using nanoparticles are neither dispersed into the vapour phase or degraded by the steam generation process.in one method strong localized photo thermal process creates a nucleation sites with increase in temperature,non another method sustained illumination bulk fluid heating occur because of prolonged exposure to sunlight the combination of these two process results in solar steam production.

B) Solar based Blood Pressure Monitor

The solar energy eliminates the need for expensive rechargeable batteries in remote areas where the availability of electricity and batteries are very less. The main decision parameter for BP measurement is the systolic blood pressure measurement hence this solar based BP monitor measures the systolic pressure accurately. the main advantage of using this device is that it eliminates the use of mercury which is hazardous to the environment.it uses rechargeable sunlight powered batteries making it ideal for rural areas .the battery provides more than

C) Solar Based Thermometer

Temperature measurement with solar energy works completely without batteries and has small solar cells that take over the power supply of the thermometer once it has charged fully it can be used continuously for 3 days. the main component present inside the thermometer is the gold cap condenser which can take upto 25 readings with one energy transactions. The additional advantage of using this thermometer is that they can also be installed in any appliances and can able to sense the temperature of the equipment.

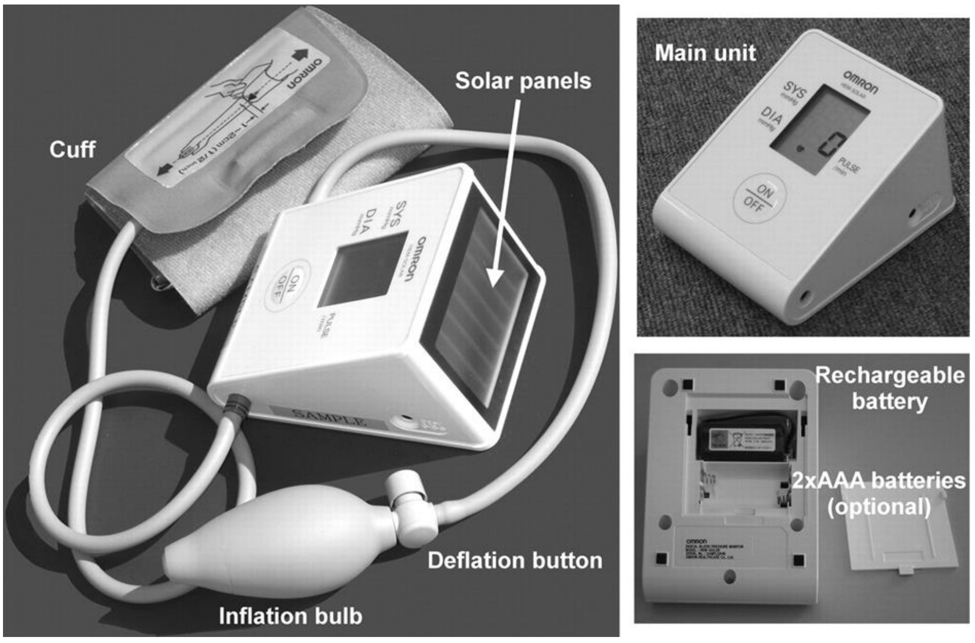

Figure 2: Solar Powered Blood Pressure Monitor

In the solar microscope a lightening device with a solar power supply is used. The solar power supply consists of a solar cell panel, a connecting bolt ,a switch, and LED. The LED are arranged in outer shell ,a battery ,a boosting device, a switch ,and LED. The LED are arranged in outer shell and they have connected with solar cell panel which is arranged at the bottom surface .The main objective of using the solar microscope that it replaces the use of reflector of a microscope so as to realize bright light source and two modes will be present like the daytime and light time so that the observation is clearer.

Two parameter have to be considered while designing power generation:

Module Power Conversion Efficiency :
It is the % of electrical energy converted from 1KW of light energy per/m2 (10.76 ft2) of solar module.

Module power conversion efficiency (%)=Maximum output of the module(W)X100/Area of the module (m2)x100(W/M2)

Cell Power Efficiency:

It indicates the power conversion efficiency (%)=output of electrical energy/incident light energy

D) Solar powered pacemaker

A pacemaker is a device which uses electrical impulses to control abnormal heart rhythms .The pacemaker will have a battery with long life period and it should be replaceable when depleted .There are so many risk and complications involved that added stress for the patient .In this method near IR light is used because it aids good skin penetration .Thus in this method an implant is irradiated yet implanted under the skin and the penetrating light could be converted into electrical energy by solar cells.

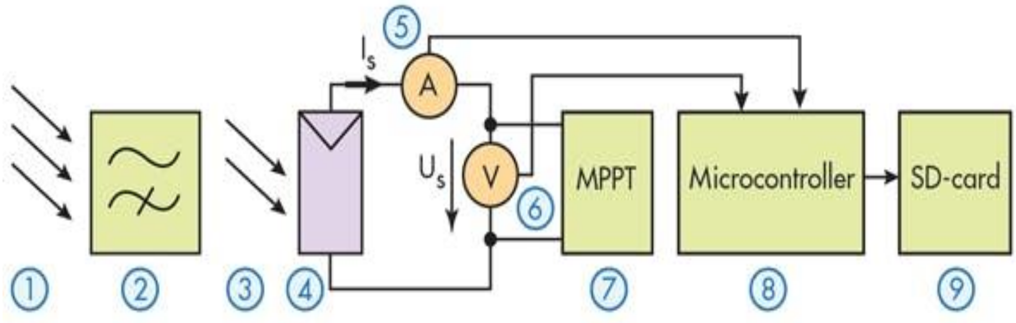

Figure 3: Solar powered pacemaker

1-it is the ambient light
2-optical fiber attenuated by light
3-solar cells gets radiated
4-maximum power point tracker
5-the solar cell output power is monitored by current and voltage measurement circuit.

Another method of solar pacemaker uses the tiny solar cells and the laser light principles. In this it has a flexible mesh out of silicon that when activated by flash less of light creates a tiny electrochemical effect that encourages the heat to beat.

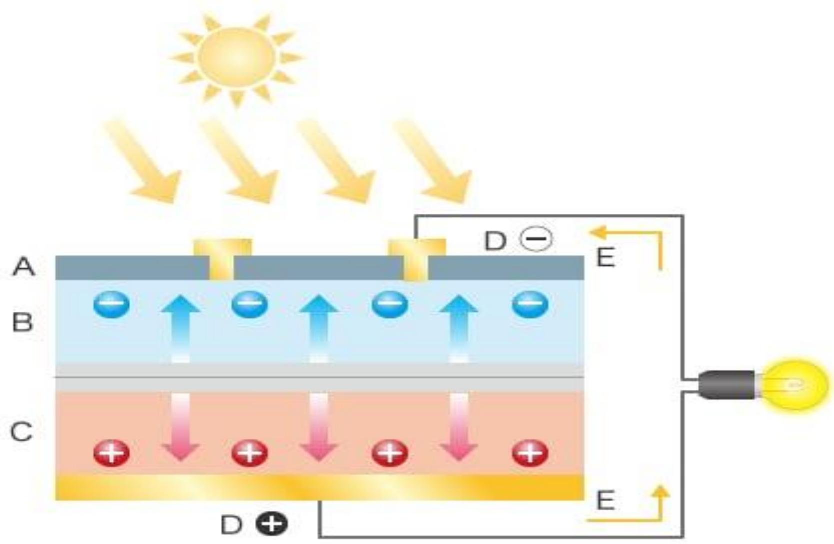

Figure 4: Solar Powered Pacemaker Using Laser Principle

E) Energy Harvesting For Implantable Biomedical Devices

Energy harvesting devices generate electric energy from their surroundings through direct energy conversion . To date, implantable biomedical devices are powered using a couple of wires; this setting may cause skin infections, discomfort, and other hazards to patients. Currently, implanted batteries provide the energy for implantable biomedical devices. However, batteries have fixed energy density, limited lifetime, chemical side effects, and large size. Thus, researchers have developed several methods to harvest energy for implantable devices. Devices powered by harvested energy have longer lifetime and provide more comfort and safety than conventional devices. A good solution to energy problems in wireless sensors is to scavenge energy from the ambient environment. Energies that may be scavenged include infrared radiant energy, thermal energy (solar–thermal, geothermal gradients of temperature, combustion), kinetic energy (wind, waves, gravity, vibration, and body motion), wireless transfer energy, and RF radiation energy (inductive and capacitive coupling).

Implantable biomedical devices may be classified into two types. The first type includes devices powered by energy harvested from the human body and covered by secondary forest. The second method includes those powered by energy harvested from the environment and covered by secondary forest.

Implantable battery have lots of side effects having fixed energy density, limited lifetime, chemical side effects and large size. So researchers are working on energy efficient, longer lifetime ,comfort and safety conventional devices .The sources from which we can trap or harvest energy such as infrared radiant energy, thermal energy ,kinetic energy, wireless transfer energy and radio frequency radiation energy.

Electrical energy can be trapped from kinetic energy including pieze electric, magnetic induction generator and electrostatic transduction methods. The piezoelectric effect make use of the mechanical strain which produces an electrical polarization.in Massachusetts institute of technology they have illustrated a concept in which human motion into energy which can be used to operate wearable electronic applications. This kind of prototypes will have an piezeoelectric elements on toes and shoes and they will generate electricity of about 8.3MmW and 1.3mW and in another method the sensor is compressed and placed on the heel of a boot. Sieko kinetic approach, In this method the heart beat of the patient is used to charge the implanted pacemaker battery

Figure 5: Magnetic generator adapted in a shoe

F) Thermal energy based devices

Using See back Effect (i.e) temperature difference minimal power generations can be done. The various applications such as implanted nerve and stimulators, cochlear hearing replacements and for wireless patient diagnostics. This concept implies the fact that hot and cold junctions when created causes the voltage generation across the thermocouple.

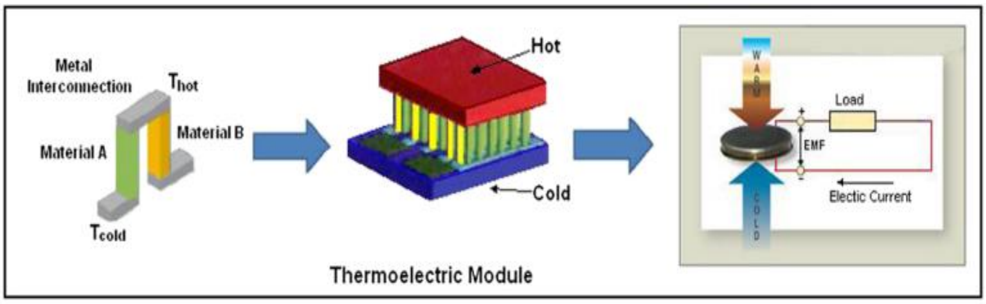

Figure 6: Thermoelectric Module

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