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Electrical energy from foods

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Presenting new sources of safe energy sources is not only an urgent need but also a vital input for social and economic development. In this work, we present a novel technology to produce electric energy from food; in particular from commercial potatoes. The food has been sandwiched between two metals; for example, Zn/potatoes/Cu and the open circuit electric potentials V_{oc} have been measured. It has been found that V_{oc} lay in the range V_{oc} $0.32\,V < V_{oc} < 1.39\,V$ and decays exponentially by time. The open circuit potential varies from food to another and depends also on the metallic contacts and food thickness. It has been found that V_{oc} is a function of the potatoes thickness, which has a maximum at 1.05 V and the corresponding maximum short circuit current is about 1.7 mA. The internal resistivity for the potatoes battery is about 1.4×10^4 Ω cm and the metallic electrodes resistance is about 57.4 Ω × area for Zn/Cu electrodes. The short circuit current depends on the nature of the metallic electrodes and the food itself. This current is very sensitive to the food thickness. At a critical thickness when the potato slice is about 0.18 cm, the maximum short circuit current density of the potatoes battery is about 15.7 $\mu A/cm^2$. The maximum electric power, generated at 0.18 cm, equals155 $\mu W/cm^2$. The Zn/potatoes/Cu battery has electric capacity 2.57 times more efficient than an AA/LR6 1.5 V alkaline Energizer® battery. Also, cost analysis has showed that potatoes-cells generate electric energy 26 fold cheaper than commercially available Energizer® battery. This work presents a new energy source: Safe, economic, durable, and renewable; also it can fit most applications. [doi:10.1063/1.3659289]

I. INTRODUCTION

Energy is the motive power that keeps all wheels moving and, consequently, keeps our life in dynamic state. So, developing a simple, durable, non-abandoning materials, and cheap biological energy will improve the bases and infra structures of the economy of many countries and in particular the developed ones all over the world. Generating energy from the environment and driving electric devices is real goal for human being.

The origin of the biological energy (sometimes called green energy) is solar energy. This energy could be stored and transported in plants and animals as chemical energy in the bonds between atoms in the molecules; also, some biological energy is stored in phosphate bonds in the Adenosine-5′-triphosphate (ATP) molecule.[1] Then, the human can use this stored energy in several metabolic processes. In fact, the first steps have been made to discover bio-electricity was due to Galvani,[2] who has reported the presence of electrolysis in living tissue. One decade later, Volta[3] has invented the first electrolyte battery made of two electrodes connected by a salt bridge. Modern developments in bio-sensing, micro-robotics, implantable devices, bioengineering, and micro-sensors have stimulated the interest of scientists and their curiosity in batteries which are self-powered of electricity from removable sources. In the present study, the electric current generation from some sort of foods is considered. In general, food contains many water soluble chemicals (positive and negative ions) that react with one electrode or them both leading to the electricity generation. Another more important advantage for the food

