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Bacterial and moisture- a renewable source of clean energy

On the globe, there are several renewable energy sources of natural origin. It is the light of the sun, wind, geothermal energy and the evaporation of water of the world ocean. Some of the following sources are already mastered but others have not even touched because of the complexity of its use.

The first steps towards the use of moisture in the air as an energy source made by researchers from the Institute of Weiss, Columbia University, and Loyola University, Chicago. This group of researchers managed to create an experimental model of the generator, which produces electrical energy by means of rubber sheets. Dr. Ozgur Sahin believes that the evaporation of water is the largest natural source of energy. Trying to demonstrate the capabilities of this unknown source, Sahin and other researchers have created a prototype of an electric generator with rubber layers, which are set in motion in response to changes in humidity by coating of bacterial spores. In his study in 2012 , published in the magazine *Journal of the Royal Society Interface*, a team of researchers consisting of Sahin, doctors L. Mahadevan, a member of the interdisciplinary faculty Wyss Institute (USA), and Ph.D. Adam Driks , Professor of Microbiology and Immunology, school of Medicine, Loyola University of Chicago (USA). Scientists have found that harmless bacteria species *Bacillus subtilis*, hitting in adverse environmental conditions, which include the absence of moisture, reduced in size and become hard wrinkled disputes. But when in contact with these spores re-enters the moisture they immediately return to their original shape, increasing in size.

The ability of bacteria to contract disputes and to restore the original shape led scientists to believe that they can be used as energy storage devices. Ozgur Sahin, Ph.D. from the Institute of Weiss took a thin flint plate and covered it with a solution containing a colony of bacteria *Bacillus subtilis*. This step was taken in order to make

it possible to measure the deformation forces, which is the source of the bacteria that respond to changes in ambient humidity. To the surprise of researchers, in order to see the action of bacteria, they do not have to use any high-precision atomic force microscope, or even an ordinary optical microscope. Deformation of the flint plate, which arise in response to changes in humidity from the breath of the person, can be seen with the naked eye.

Having conducted further experiments and calculations, the scientists found that the bacteria *Bacillus subtilis* are incredibly strong. Thin plastic plate covered with spores of bacteria could produce a force of 1000 times superior force that can produce human muscles similar size and weight , and this result was obtained in the transition from dry to wet sunny day to wet foggy evening. The receiving experimental data together with the theoretical calculations showed that 1 pound (0.45 kg) of dry bacteria *Bacillus subtilis* spores by changing humidity can produce a force capable to raise the average car to a height of one meter.

After this, scientists have made experiments using silicon, rubber, various plastics, and other materials as the substrate onto which the film of bacteria spores pile up. Ironically, the best results showed ordinary rubber, which the researchers used an experimental design "bacterial" generator. This generator is made of Lego blocks and there is a miniature fan, magnet and rubber stripes covered scrapped bacterial spores *Bacillus subtilis*. In response to changes in ambient humidity rubber stripes are reduced, causing rotating magnet field which excites the electric current in the coils located near the coils.

Created by an experienced generator has a very low efficiency. But scientists are already working on further improvement of technology, the debate created by genetic engineering strain of *Bacillus subtilis* bacteria can accumulate already twice as much energy than the original bacteria spores, and later, scientists plan to achieve an even greater number of values stored energy. Increasing the efficiency of micro-organisms in the near future will be used to generate energy in the regions where there are large daily fluctuations have humidity in coastal seas, oceans and near artificial reservoirs. "The sun and wind are highly segmented. There are moments when the sun is not

shining and the wind is not blowing. Under these conditions can be used only humidity changes that by using special generators have a chance to become another source of clean energy".

Literature:

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