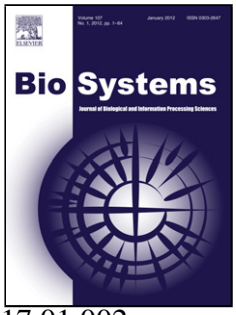

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What if houses were powered by milk?

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Abstract

Living architectures and green energy are hot topics of the applied sciences. They aim to develop buildings that co-live with their environment and co-habit with people they house. An ultimate goal would be to make every block in a building capable of producing energy. We present results of scoping, and somewhat illustrative, experiments on generating electrical energy in modified aerated concrete blocks. These blocks are commonly used in modern building industry and therefore make an ideal candidate for 'inbuilt' microbial bio-reactors. We fill the blocks with milk to evaluate electro-generation potential of a pasteurised milk and to study power generating potential of the medium nutrient rich for micro-organisms. We assess the practicality of using bio-reactors which become colonised by local micro-flora.

Keywords: bio-reactor, milk, microbial fuel cells

> So the girl ran further until she came to a river of milk flowing in banks of pudding. River of milk, banks of pudding, where did the swan-geese fly to?
> "The Magic Swan-Geese" by A.N. Tolstoy

1. Introduction

Production of green and renewable energy is amongst top priorities of the world governments [1, 2, 3]. Microbial fuel cell technology is so far most perspective a par with solar and green energy productions [4, 5, 6, 7]. Microbial bioelectricity is considered to be a low-carbon, low-cost, sustainable potential energy solution for both developed and developing nations [8, 9]. Bio-reactors are based on the operational principles of microbial communities. The self-governing nature of microbial communities means they are able to adapt to conditions to maintain system efficiencies by adjusting consortia. Despite having many functions, bio-reactors have recently been realised as a potential source of electricity generation: micro-organisms are cultivated in a chamber (anodic) containing aqueous media and an electrode. A second, abiotic (cathodic) electrode-containing chamber is connected to the first via a semi-permeable membrane which permits the flow of hydrogen ions ($[H^+]$). Microbes in the anodic chamber catabolise a supplied food source, which may be any readily-oxidised organic substrate, which liberates electrons and $[H^+]$. If the anodic chamber is anaerobic, the anode becomes an electron acceptor, generating a small electrical current, creating an electrochemical gradient which drives the transport of $[H^+]$ through the semi-permeable membrane [4, 5, 10].