ELECTRICITY FROM NANOMEMBRANE

by

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Short paper
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Tulachan et al. found that silk cocoon membrane can generate electrical current due to ionic conduction. We argue that the current is produced by osmosis as that in a commercial osmotic plant.

Key words: *nanomembrane, bubble-electrospinning, nanofiber*

Introduction

Tulachan *et al.* [1] conducted an interesting experiment on silk cocoon membrane (SCM) and found that a moisture SCM can generate electrical current, which can be enhanced by salt solution. The phenomenon has theoretical importance and practical applications. However, the phenomenon can be explained in an alternative way, instead of ionic conduction as given by Tulachan *et al.* [1], to answer the question: can artificial membranes generate electrical current?

To answer this question, we begin with some findings on the silk cocoon, which exhibits a superb oxygen and water vapor diffusion performance [2]. Wild cocoon at seaside should have also been evolved into protection to seawater. All these properties can be explained by osmosis theory [3].

Osmosis is ionic movement through a nano/micro membrane due to solution concentration difference [3]. Silk cocoon of the silkworm, Bombyx mori, has special hierarchical microstructures, which enable the cocoon to have almost same property of a nanomembrane [2]. When the cocoon is exposed to water vapor, the Na, Cl, and K ion concentrations through SCM changes, this is the reason for generation of the electronic current. The world's first osmotic power station was opened in Norway in 2009, where the power is produced by osmosis.

Experiment

Our experiment shows that nanomembranes have similar electric property. The nanomembrane was fabricated by Nantong Bubbfil Nanotechnology company limited using bubble-electrospinning (bubbfil spinning) [4], we use NaCl solution in the osmosis experiment, and experimental set-up is illustrated in fig. 1. We observed 0.026 mA and 26.4 mV in our simple experiment, showing the solution concentration difference through the nanomembrane is the main factor for producing electronic current.

Discussions and conclusions

The current flowing across the nanomembrane is due to the change of ionic concentrations through the nanomebrane. The electronic property of nanomembrane can be used for

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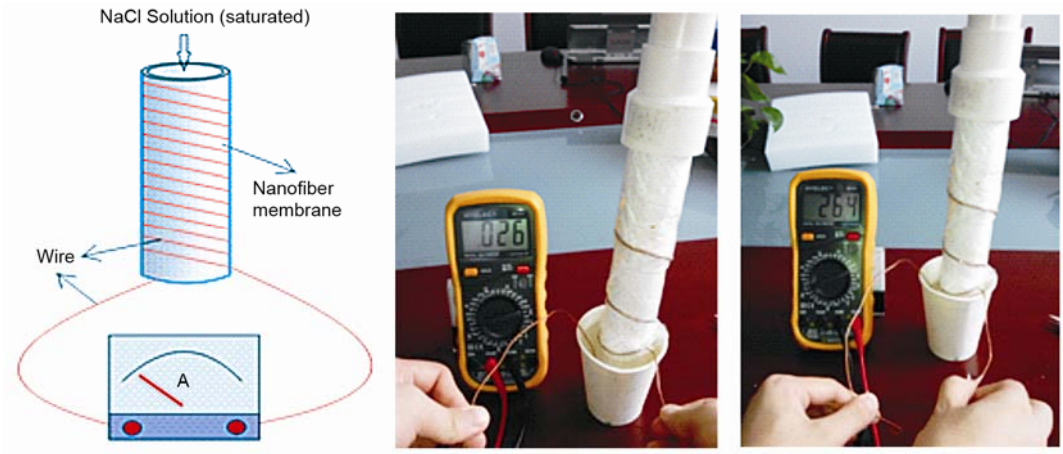

Figure 1 Simple device prepared by physically connecting two electrodes to the nanomembrane surfaces

development of energy harvesting devices, which could find wide applications in various field, especially this technology can be used to produce power from seawater filtration.

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