

DT11

## Fabrication and Characteristics of Alkali Mineral Water Sensor Using GMR-SV Biosensor

Ju-Hee Lee<sup>1</sup>, Da-Woon Kim<sup>1</sup>, Min-Ji Kim<sup>1</sup>, Joon-Ho Kang<sup>2</sup>, and Sang-Suk Lee<sup>3\*</sup>

<sup>1</sup>Kangwon Science High School, Wonju-City, Gangwon-do, KOREA

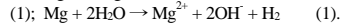
<sup>2</sup>Dept. of Physics, Columbia University, 2960 Broadway, New York, USA

<sup>3</sup>Dept. of Oriental Biomedical Engineering, Sangji University, Wonju-City, Gangwon-do, KOREA

\*Corresponding author: Author1 Sang-Suk Lee, e-mail: sslee@sangji.ac.kr

A fertilized egg in the first time to form a human body is composed of 99 % of water. While growing into a human, the content of water in the body decreases to 70 % because of the growth of bones and increase of mineral amount. As time goes by, the minimum percent of water at one's natural death is decreased to 50%. Since human has been lived in status of water from the cradle to the grave, therefore, the water is namely life. On the other hand, the active oxygen is produced by the stress, the excessive drinking, and the intake of processed foods. The active oxygen is affected by the greasy cell of human body and subjected to an obstinate disease which leads to cancer or circulatory complaint. Also it is known to remove the vitamin C and E by supplying into the body to form foodstuffs [1]. But there is the important thing to prevent the incurrance the active oxygen, that is, the edible water is changed to the alkali reduced water by adding Mg mineral.

The Mg melting in the water emits electrons and dissolves hydrogen molecule and hydroxide as follow as chemical eq.



This produced OH radical (OH<sup>-</sup>) is the edible water changed to the alkali one. At the same time, the oxide restoration peak (ORP) decreases to the lower value as a result of H<sub>2</sub> and active hydrogen, giving water the power of removing the active oxygen.

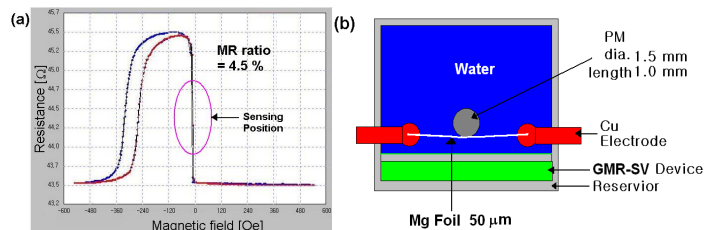


Fig. 1. (a) MR characteristics of GMR-SV device and (b) schematic of alkali mineral sensor system.

In this study, the alkali mineral water biosensor using a highly sensitive giant magnetoresistive-spin valve (GMR-SV) device [2,3] with high linearity and very low hysteresis was fabricated. The characteristics of GMR-SV device and the schematic of sensor system are shown in Fig. 1(a) and 1(b). The detection of the Mg-dissolving ratio for the three different kinds of water, which were a tap water, commercial edible water, and distilled water, was also investigated. Here, Mg foil with a thickness of 50 μm and the permanent magnet with a magnetic field of 30 Oe in the distance of 5 mm from the center of it were used. From the previous experimental result [Fig. 2] for the dissolving time of Mg thin film in three waters respectively, we can apply the alkali mineral water sensor, which is found to be suitable enough for detecting and analyzing their signals clearly.

This work is supported by Science High School R&E Project of KOSEF (2008).

### REFERENCES

- [1] S. Shirahata *et al.*, Biochem. Biophys. Res. Commun., 234, 269 (1997).
- [2] D.L. Graham, *et al.*, Sens. Actuators B: Chem. 107, 936 (2005).
- [3] S. H. Park, K. S. Soh, D. G. Hwang, J. R. Rhee, and S. S. Lee, J. Mag. 13, 30 (2008).

DT12

## Hyperthermia Application in Cancer cell Extermination

N.C. Thuan<sup>1</sup>, P.V. Thach<sup>1</sup>, P.H. Linh<sup>1</sup>, N. X. Phuc<sup>1</sup>, L. V. Hong<sup>1</sup>, H. Th. M. Nhung<sup>2</sup>, N. Th. Xuyen<sup>2</sup>,  
N. Th. Quy<sup>2</sup>, and T. C. Yen<sup>2</sup>

<sup>1</sup>Institute of Materials Science, VAST Vietnam 18 Hoang Quoc Viet Road, Cau-Giai, Hanoi, Vietnam

<sup>2</sup>Faculty of Biology, Hanoi National University Nguyen Trai Street, Thanh Xuan, Hanoi

An *in vitro* toxicity test with using Fe<sub>3</sub>O<sub>4</sub>-based magnetic fluid was performed on several cancer cell lines, Sarcoma 180, HeLa and H358. It shows that the fluid with a concentration of Fe<sub>3</sub>O<sub>4</sub> below 1.2ng/cell is completely non-toxic for these cell lines and appropriated in cancer extermination application. In aim of searching possibility of the cancer extermination, an *ex vivo* study of Sarcoma 180 extermination by magnetic heating with an AC field of 80 Oe and 184 KHz was carried out. The result shows that the extermination ratio depends on Fe<sub>3</sub>O<sub>4</sub> concentration and increases with prolonging the heating time. A heat treatment for 60 min killed about 50% of Sarcoma 180 cells and reached over 95% cell extermination after keeping for 2 hours.

Keywords: Magnetic nanoparticles, Magnetic fluid, Hyperthermia applications, Cancer treatment.

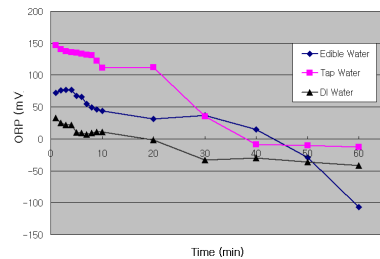


Fig. 2. ORP variation vs time in Mg shots in three waters.