STRUCTURE AND CHARACTER OF ARTIFICIAL MUSCLE MODEL CONSTRUCTED OF FIBROUS HYDROGEL

Lijiang Mao,[1] Yuanjie Hu,[1] Yinshi Piao,[2] Wenshu Xian[1] and Dongxu Piao*[1]
[1]China Rehabilitation Research Center, Beijing, 100068, China
[2]Jiangnan University, Wuxi, 214036, China
***PIAORN@public3.bta.net.cn**

Among the various artificial muscle models, hydrogel type one with chemomechanical character is very important. Most of such artificial muscle are usually constructed from a film-like hydrogel, and their chemomechanical performance are not very satisfied [1-2]. The authors advanced a novel muscle model constructed of fibrous hydrogel (FHM)[3]. Its structure and character is discussed in the present article.

Anionic hydrogel layers were formed onto the cellulose fiber surface by means of AN-grafting and subsequent hydrolysis[4]. The obtained hydrogel fibers were dispersed in water and formed homogeneous slurry. An fiber assembly with layer-like arrays (FHM) was obtained from the slurry by natural sedimentation pulping method. The FHM shows unidirectional reversible transformation under a stimulating of surrounding medium. The FHM in water expands to 5~8 times in 10 sec and in methanol it contracts to original size in 30 sec. Long-term storage in ordinary condition hardly affects that performances of the FHM.

That chemomechanical character of the FHM should be ascribed to its structural features: There is an anionic polymer layer with the thickness of 1~3 μ m on the cellulose fiber surfaces. The main compositions of that anionic polymer chain are polyacrylate sodium and polyacrylic acid [4].
When the surrounding medium is alternately changed, the thickness of the fibers remarkedly changes, but the length of that remains unchanged. In the meantime, an internal stress is relevantly produced inside the fibers. The fibers in its assembly are arranged into multiplayer plane texture.

The chemomechanical system (FHM) with unidirectional reversible transformation was established by use of fibrous hydrogels. Such artificial muscle model should satisfy the following essential requirements: The elemental fibers have to possess both hydrogel feature and enough mechanical strength. The interface between the hydrogel layer and the frame fibers must firmly be bound e.g. covalently. The regular texture of the FHM must be parmanently retained during the repeated use. It is deduced that more excellent models of the artificial muscle can be obtained, provided any more fine (superfine or nano-scale) hydrogel fibers are adopted.

REFERENCES

1. Y. Osada, M. Nishino (1998) *Artificial Organ*, **27**(3):614-619.
2. D. Piao, W. Xian (1993) *Biomedical Materials Research in the Far Est* (ed. H.Feng), 14-16.
3. K. Ogino et.al (1991) *Basis and Application of Soft Materials*(Sangyoutosho),130-141.
4. Y. Piao, L. Mao, R. Sun (2000) *J.Wuxi University of Light Industry*,**19**(3):276-278.