

Advanced Medical Applications of Hydroxyapatite

Hideki AOKI, Ph.D., Professor
Tokyo Medical and Dental University
Director of the International Apatite Institute.

"Hydroxyapatite" is a member of the apatite group of minerals, and its chemical formula is $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$ with Ca/P ratio of 1.67. Hydroxyapatite is a fascinating and useful materials in dental, medical and industrial fields.

In the industrial field, the apatite has been used as fertilizers, fluorescent substances, catalysts, absorbents, humidity sensors, and materials for electrical parts. Moreover, in the future, it will also be of great promise as biotechnological materials as well as biomaterials. These features are derived from the unique composition and structure of hydroxyapatite.

In 1972, the author succeeded in the sintering of hydroxyapatite as a pioneer in the world. In 1974-75, the author and his colleagues found that the sintered hydroxyapatite has a good biocompatibility with bone tissue. Since then, they have developed many biomaterials based on hydroxyapatite ceramics including artificial bone, joint, blood vessel, trachea, percutaneous device, drug carrier in medical field, and toothpaste, cement, tooth root, in dental field.

Among them, it can be emphasized that various percutaneous devices with catheter, blood pressure transducer, lead wire and electrode, and optical materials have been developed. The percutaneous devices with catheters are practically used for CAPD (Continuous Ambulatory Peritoneal Dialysis) and IVH (Intravenous Hyperalimentation). Recently, the author developed a new biomaterial, so-called hydroxyapatite-sol. The hydroxyapatite-sol is composed of small hydroxyapatite crystals less than 0.1 μm dispersed into a physiological salt solution. From experimental results, it is concluded that it can be used as drug carriers for restriction of cancer cell and HIV growth.