Producing artificial bones from fish scales

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Credit: Tokyo Institute of Technology

Toshiyuki Ikoma and Junzo Tanaka have developed technology for producing artificial bones from fish scales and apatite.

"Our technology enables the formation of new bone tissues within three months," says Ikoma. "This is much faster than the six months required using collagen from porcine dermis." The use of fish collagen also mitigates the potential infection of humans with viruses from pigs. "This new material is very safe," emphasizes Ikoma.

Other features of artificial bones fabricated by fish collagen and apatite include the finding that (1) the bones have a much higher density and are thereby very strong; (2) the bones implanted into bone defects transform into bone tissue much faster than those using porcine dermis collagen.

"One of our major aims is to use fish collagen for the treatment of bone tumors in older people whose bones take longer to regenerate," explains Ikoma. "Fish collagen is a material that has the potential of becoming the key material for the development of artificial bones and bone therapy.

In addition to the regeneration of bones from fish collagen, the Tanaka and Ikoma Research group is pursuing projects on nanomedicine and diagnostics. Notably, the Tokyo Institute of Technology group conducts research on tissue engineering and implantable biomaterials in collaboration with medical doctors and biologists. "An interdisciplinary approach with researchers from the medical and engineering fields is very crucial for success" says Ikoma.

In the fish collagen experiments, the researchers have focused on type I collagen extracted from tilapia scales because the scale has little fat and is mainly composed of pure collagen. Intriguingly, Tilapia lives in warm fresh water and the scale collagen shows the highest denaturation (the change of collagen to gelatin) temperature at 36oC, and has no fishy odor.

The Tokyo Tech group has transferred the extraction technology of collagen from tilapia scale to a company. "Interestingly, the structure of collagen fibrils in fish scale is very similar to that of human corneal stroma," says Ikoma. "So the investigation of fish scale will be useful for the reconstruction of corneal stroma."

The unique characteristics of fish collagen show potential for the production of cosmetics. "We have already produced cosmetics including the fish collagen," says Ikoma. "Next, we would like to produce the other products such as cell culture substrates, scaffolds for tissue engineering, and implantable biomaterials."

More information: Effect of Glutaraldehyde on Properties of Membranes Prepared from Fish Scale Collagen (2012) *MRS Proceedings*. mrsf11-1418-mm06-04 (6 pages); DOI: dx.doi.org/10.1557/opl.2012.396

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