Testing the safety of transplanting cells using cell culture supernatants

Improve the safety of regenerative medicine

We have developed a noninvasive and quantitative method to detect tumorigenic human pluripotent stem cells using cell culture supernatants. We established a sandwich assay system to detect the soluble hyperglycosylated podocalyxin secreted specifically from human pluripotent stem cells into cell culture supernatants. The sandwich assay utilizes two lectins by focusing on characteristic glycan structures displayed on the soluble podocalyxin: a recombinant rBC2LCN (*N*-terminal domain of BC2-L lectin derived from *Burkholderia cenocepacia*) highly specific to human pluripotent stem cells is used as a "discriminator" to capture the soluble hyperglycosylated podocalyxin. rABA (recombinant *Agaricus bisporus* lectin), an *O*-glycan-binding lectin, is used as a "signal enhancer", which detects *O*-glycans heavily displayed on podocalyxin. The developed system allows rapid diagnosis (<3 h) of a large number of samples using only a drop (50 µL) of cell culture supernatants. The developed method should increase the safety of human pluripotent stem cell-based cell therapies.

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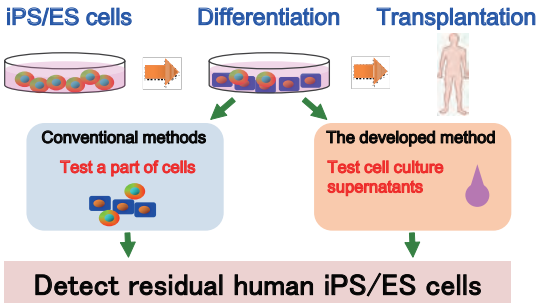

Detect residual human iPS/ES cells using cell culture supernatants

Development of high-performance lead-free piezoelectric ceramic

A step toward the practical use of lead-free piezoelectric sensors

Piezoelectric materials are unique in that they can convert mechanical energy to electrical energy and vice versa. They can be used as sensors and actuators. Their applications range widely, from leading-edge electronic devices (fine-movement stages of semiconductor exposure apparatus, precise adjustment mechanism for scanning-type probe microscopes, etc.) to general-purpose electronic devices (inkjet printer heads, image stabilization elements of digital cameras, etc.). As such, piezoelectric materials have become essential to our lives. Presently, lead-based piezoelectric ceramics $Pb(Zr,Ti)O_3$(PZT), which is harmful to human health and the environment, has been used for electronic devices because of lack of lead-free piezoelectric ceramics that can substitute it. Thus, the development of lead-free piezoelectric ceramics has become a global issue. We have succeeded in developing lead-free piezoelectric ceramics with properties comparable to PZT. Their usability has been confirmed via prototyped devices (e.g. AE sensor, ultrasonic distance sensor).

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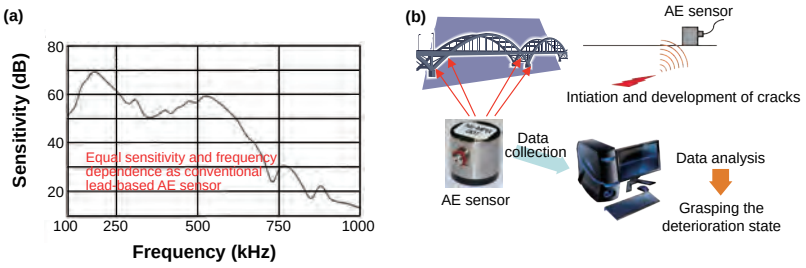

(a) Sensitivity of lead-free AE sensor to the frequency of mechanical vibration
(b) Image of structural health monitoring with AE sensors
The developed lead-free AE sensor was designed to have maximum sensitivity to a frequency of approximately 150 kHz.