

Radioisotope Research Facility

Kunihiko Fukuda, *Professor and Director*

Yukio Yoshizawa, *Lecturer*

General Summary

The Radioisotope Research Facility was established to support medical and biological research with isotopes. We have supported researchers by suggesting methods and practical techniques for experiments. Lectures and training sessions were held for researchers and for medical students and graduate students who are starting to work with radioisotopes. In 2006, 62 researchers from 13 departments consulted this facility for 29 studies.

We have received authorization to use 21 nuclides, including a new nuclide, ^{109}Cd .

Research Activities

The second active site of teicoplanin

Glycopeptide antibiotics inhibit peptidoglycan synthesis by binding to the terminal D-Ala-D-Ala stem of peptidoglycan precursors. Despite the many similarities in chemical and microbiological properties, teicoplanin is more efficient than vancomycin when combined with beta-lactams. The strong synergistic activity of teicoplanin with beta-lactams against methicillin-resistant *Staphylococcus aureus* suggests an additional mechanism of action. We examined the possible second action point of teicoplanin that may appear when combined with beta-lactams. The minimum inhibitory concentrations (MICs) of teicoplanin and vancomycin against *S. aureus* TS670 were determined with Mueller-Hinton agar and a hypertonic medium CYLS agar. The MIC of teicoplanin was $0.125\ \mu\text{g}/\text{ml}$ both on Mueller-Hinton agar and on CYLS agar. In contrast, the MIC of vancomycin increased from $0.25\ \mu\text{g}/\text{ml}$ to $1\ \mu\text{g}/\text{ml}$. Although CYLS medium protects bacteria from osmotic pressure, the excellent properties of teicoplanin on CYLS agar may indicate that teicoplanin can act on the bacterial membrane.

Isolation of fibronectin binding protein-deficient mutants of S. aureus

Fibronectin binding proteins (FnBPs) are expressed on the cell surface of *S. aureus* and play important roles in colonization. We isolated FnBP-A-deficient mutants by inserting a tetracycline-resistance gene into the *fnb A* gene. The deficiency was confirmed with Western blotting as a lack of the FnBP A band. These mutant strains are useful for studying the roles of FnBPs in pathogenicity.

A study of radioactivity in consumer products

Some daily products are said to contain radioactive ores that have various effects on health. We have examined 8 wallpapers that are claimed to have so-called negative-ion effects to estimate external and internal radiation doses after exposure to them.

Gamma-ray spectrometry revealed that the wallpapers contain 0.03 to 0.35 Bq•g⁻¹ of Th-series nuclides (²⁰⁸Tl, ²¹²Pb, ²¹²Bi, and ²²⁸Ac) and of a U-series nuclide (²¹⁴Pb). Distribution of radioactive nuclides in the samples was measured with an imaging plate and a phosphoimage analyzer (FLA-2000, Fuji Photo Film Co., Ltd., Tokyo). The radiation doses from the printed side of the wallpapers were 5 to 15 times higher than those of the back side. The ²²²Rn concentrations emanating from the wallpapers in a 50-L sealed container were measured with Pico-Rad radon detectors (Accustar Labs, Medway, MA, USA). One wallpaper showed ²²²Rn concentrations 2 to 5 times higher than the background value.

Research on marine bacteria

The habitat distribution of several marine bacteria was surveyed during the *Tansei Maru* cruise KT-06-31 off Izu Peninsula. To study the metallic transport system of microbes, we focused on marine bacteria that produce siderophores in a low-iron environment. We are attempting to cultivate such bacteria from seawater and the sediment of the sea floor at a depth of 3,600 m.

Publications

Minowa H, Takeda M¹, Ebihara M¹ (¹Tokyo Metrop Univ). Sequential determination of ultra-trace highly siderophile elements and rare earth

elements by radiochemical neutron activation analysis: Application to pallasite meteorites. *J Radioanal Nuclear Chem* 2007; **272**: 321-5.