Small Zeolite Column Test Equipment

Background

During the first phase of the Fukushima Daiichi Nuclear Power Station accident, it was a high-priority issue to establish a cooling water recycling system, through which contaminated water of about 0.2 million cubic meters, accumulated in the reactor or turbine buildings, can be decontaminated and desalted, and then with the resulting pure water used for reactor cooling once again.

It was thus necessary to understand the effect of the sea salt and oil content in the contaminated water on the Cs adsorption properties of zeolite. Further, this system had to have a high throughput capacity of around 1,200 m^3/d. It was our urgent task to stably operate the Cs adsorption apparatus (KURION system).

Hence, in order to support the design and operation of the decontamination system, functional small-scale zeolite column testing equipment in which the several kinds of zeolites can be tested was installed in CRIEPI.

The dynamic characteristic of the system such as the breakthrough curve* is estimated using this equipment. Using these results, a simulation code is developed that can predict the Cs removal performance of the actual system.

Outline

○Single-column/series-columns test: Both the single-column test for the verification of the developed calculation code and the series test consisting of four columns modeled after the actual system can be conducted.

○Merry-go-round system: The column-changing system applied to the actual system can be simulated by changing valve operation. (After the top column adsorbs an adequate amount of Cs, the top column is dismantled from the system and the second column is moved to the top position, and the new column is installed at the third position.)

○Long-term operation: As breakthrough is attained after more 24 hours in some cases of Cs concentration in the contaminated solution, an auto feeder and sampling system are introduced for the long-term operation.

Specifications

(1) Column
Transparent column made of acrylic resin (two kinds of diameters: 3 cm and 5 cm), with easy de-installation functionality
(2) Measuring system
At the feed inlet, a flow meter (Aichi Tokei Denki Co., OF05ZZWIN) and a pressure gauge (Yokokawa Electric Co., FP201) are equipped.
(3) Sampling system
At the outlet of the column, the sample solution is collected at certain intervals through the open and close of the solenoid valve, and the collected solution is transported to the auto sampler (EYELA DC-1500) by tube pump (EYELA SMP-23) and finally collected in the 15 cm^3 sample tube.
These systems are equipped at each of the three lines, and four series-column tests can be conducted.

[Installed location and date]

Komae area/May 2011

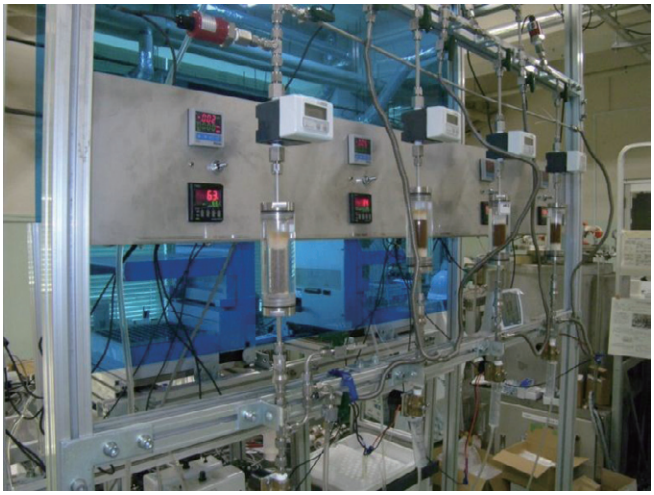

Photo: Small zeolite column test equipment

* "Breakthrough" refers to the fact that the outlet concentration of Cs was the same as the inlet concentration of Cs through the saturation adsorption capacity of the column. A breakthrough curve can show the relationship between the time and the ratio of outlet concentration to inlet concentration.