

Radio contamination of tea plants

Contamination level of tea

Tea is one of the most popular beverages. Besides drinking water, it is the most consumed drink worldwide. The tea plant, *Camelia Sinensis*, is cultivated in many countries, such as the People's Republic of China, India, Kenya, Sri Lanka, Turkey, Indonesia, Vietnam, Japan, Argentina and Iran. Worldwide, over three million tons of tea is produced yearly.

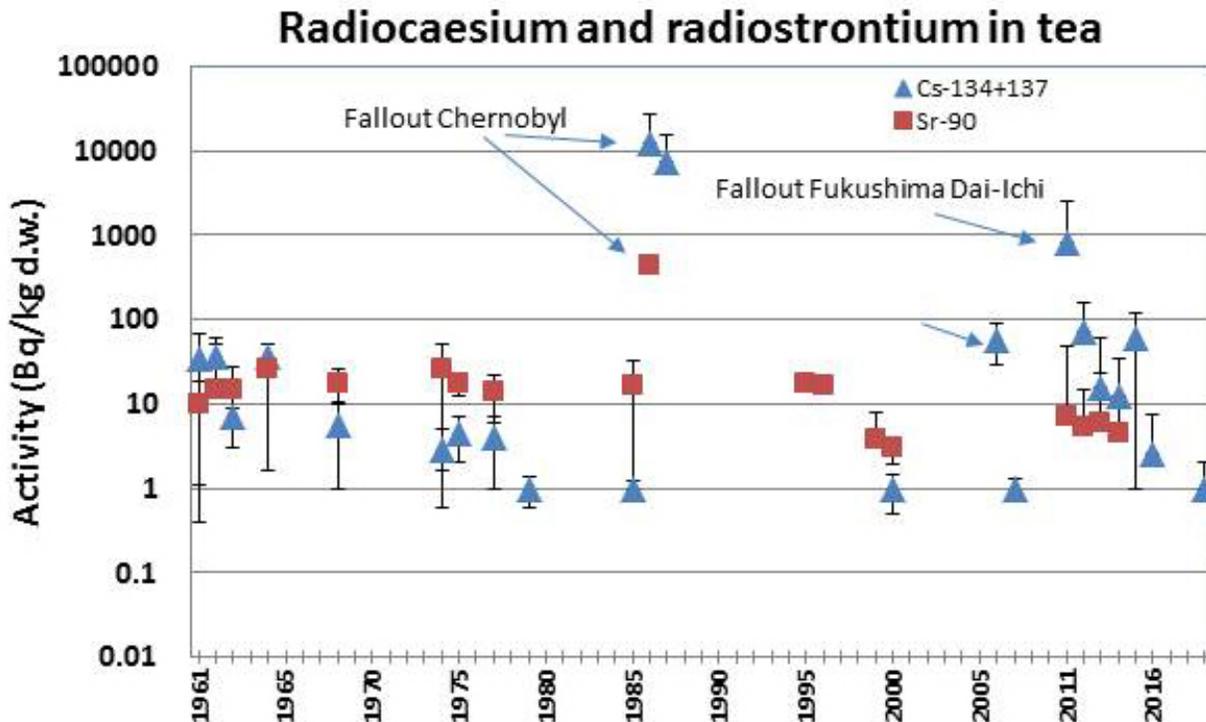


Fig. 1. World-wide radio contamination of tea. (d.w.: dry weight)

Tea plantations need large areas for production. The tea plant reaches a height of 1–5m and carries many leaves, therefore exposing a large surface at fallout. Consequently, tea is an ideal plant for the monitoring of radioactive fallout. When fallout is washed out on plantations, radionuclides are deposited on the surface of the leaves and on the soil. The tea plant takes up the radionuclides from the soil and translocates them quickly to the leaves.

Radioactive fallout has two main sources: Global fallout (fallout from over 900 atmospheric bomb tests starting in 1945) with a maximal fallout in the years 1962/63. The second source is fallout from nuclear accidents, such as the reactor fire at Chernobyl in 1986 and the multiple core melting at Fukushima Dai-Ichi in 2011. After a release of radio contamination, tea plantations will be

affected for several years. In 1986, tea plantations on the Turkish coast of the Black Sea were heavily contaminated by the fallout from the reactor fire at Chernobyl (^{137}Cs : $\sim 10\text{kBq/kg}$, ^{90}Sr : $\sim 400\text{Bq/kg}$). Two years later, the contamination level was reduced more than 90% (^{137}Cs : $\sim 1\text{Bq/kg}$, ^{90}Sr : $\sim 20\text{Bq/kg}$). The multiple core meltings at Fukushima Dai-Ichi resulted in a contamination level of $\sim 1\text{kBq/kg}$ of ^{137}Cs and $\sim 7\text{Bq/kg}$ for ^{90}Sr . While the elevated level of ^{137}Cs was reduced to $\sim 15\text{Bq/kg}$ in 2013, the ^{90}Sr -level was not raised by the fallout and remained at a level of $\sim 10\text{Bq/kg}$.

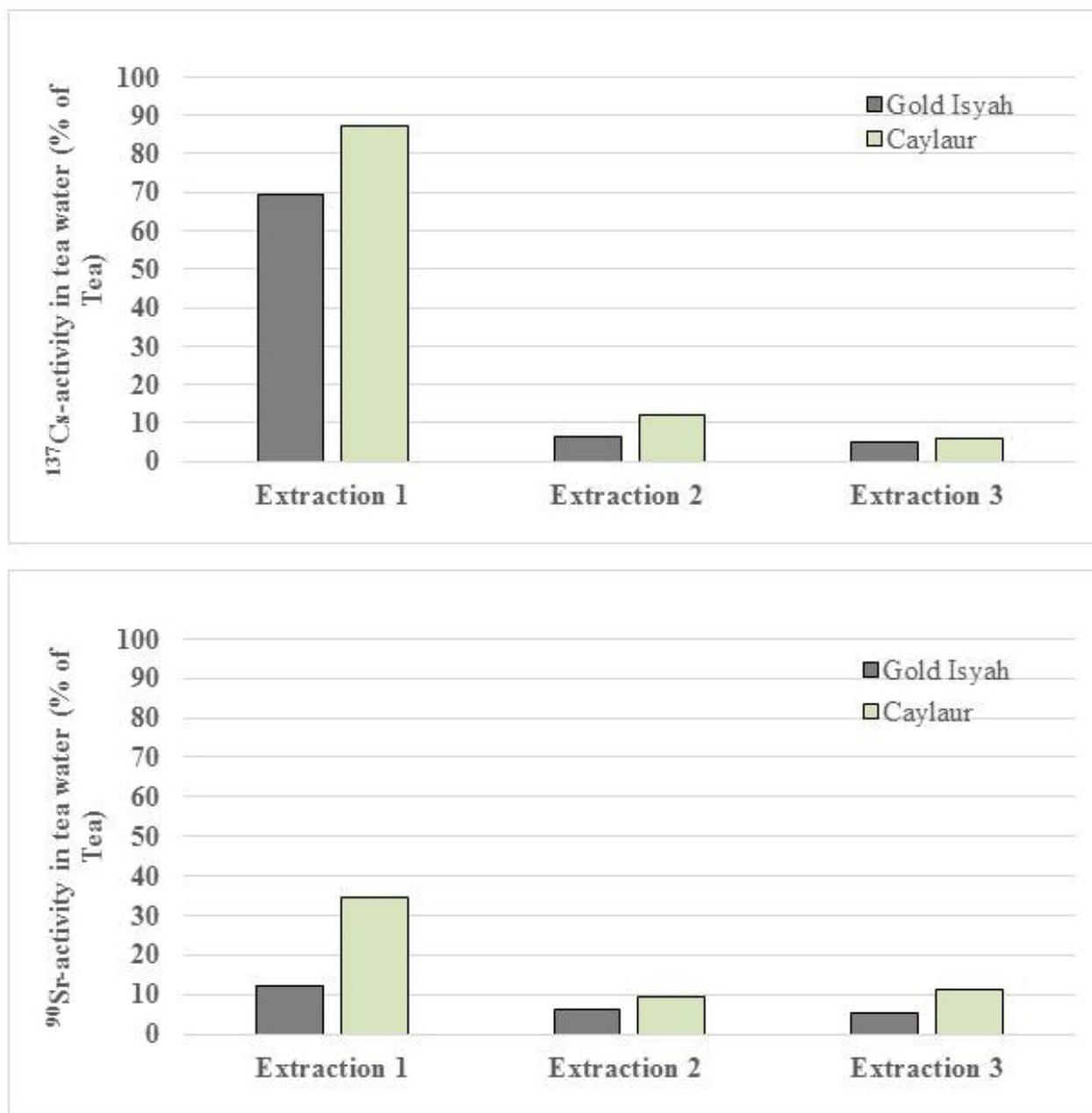


Fig. 2. Extraction behavior of radiocesium and radiostrontium in Turkish teas. 10g of Tea were each extracted with 1 L of water.

The tea brewing process

When tea is brewed, the original contamination in the tea leaves is more or less leached into the tea water (10g of two Turkish brands, Gold Isyah and Caylauer tea, were brewed with one litre of tap water. ~70–90% of the total ^{137}Cs in the dried tea powder was washed out by a unique brewing process. Whereas, only ~10-35% of the total ^{90}Sr could be extracted.

The preparation of tea water causes a remarkable reduction of ^{90}Sr uptake by tea consumption. On the other hand, ^{137}Cs is consumed almost quantitatively.

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Publication

[Radionuclides in tea and their behaviour in the brewing process.](#)

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