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Non-destructive elemental analysis for medical inheritances by muonic X-ray measurement

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Muon induced X-ray emission is a powerful technique for non-destructive elemental analysis for bulk material. This method have developed as practical quantitative analysis at J-PARC, and in present, this method have been applied for various samples, such as archeological artefacts, meteorite and so on.

In this paper, we report the results of applying this method to medical heritage in Japan. About 200 years ago, by introducing Western medicine, many formulations in glass bottles have been left since the late Edo period. The analysis for these bottles are important for studying the development of medicine in Japan, but some bottles can not be opened due to aging.

In this study, elemental analysis experiment using muons was conducted at J-PARC for a glass bottle that can not be open produced in the early 1900's stored at Osaka University. By adjusting the incident muon energy, the muons selectively stopped inside the glass bottle, and emitted muonic X-rays were measured by germanium semiconductor detectors. The X-ray peaks of muonic mercury and chlorine atoms were clearly observed, and we concluded the formulations was mainly composed of mercury chloride.

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