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 <b>MLF Experimental Report</b>	提出日 Date of Report
課題番号 Project No. 2014A0010 実験課題名 Title of experiment <b>Analysis of cosmetics and Chinese medicines with TOF and PGA information by ANNRI</b> 実験責任者名 Name of principal investigator Etsuko Furuta 所属 Affiliation Ochanomizu University	装置責任者 Name of responsible person Yosuke Toh 装置名 Name of Instrument/(BL No.) BL-04, ANNRI 実施日 Date of Experiment 26, April, 2014, 23, May, 2014, 12, June, 2014

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。(適宜、図表添付のこと)  
 Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

<p>1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.</p> <p>1. Cosmetics; several kinds of cosmetics claiming Au inclusion were purchased in Japan and Korea. Also, Au sheets which include some known percentage of Au were irradiated as standard samples. The types of cosmetics were jell, cream, powder, face masks and nail polish. A few kinds nail polish were irradiated which were not claiming any ingredients, but included some lame in them.</p> <p>2. Pigments; several kinds of pigments named cadmium were irradiated; yellow, red, orange and green.</p> <p>3 Chinese medicines; the famous Chinese medicines, which is famous to include As, and some other medicines with same name, which ingredients were unknown, were irradiated.</p>
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<p>2. 実験方法及び結果 (実験がうまくいかなかった場合、その理由を記述してください。)                  Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.</p> <p>Experimental</p> <p>1. Cosmetics; some of the samples were dried under an infrared lamp. Two kinds of face mask samples were large (approx.2×3cm<sup>2</sup>), however other samples were approx. 1×1 cm<sup>2</sup> and they were put in the center of the neutron beam.</p> <p>2. Pigments; some of the samples were powder and others were paste which were dried under an infrared lamp.</p> <p>3. Chinese medicines; solid samples were crushed into powder. A capsule sample and powder samples were just enclosed.</p> <p>All the samples; powder and dried samples were enclosed two folds in a FEP film of 2.5 μm in thickness. Furthermore, the samples were put in the FEP film, which was made like a container, and irradiated among a suitable time of each sample.</p>
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## 2. 実験方法及び結果(つづき) Experimental method and results (continued)

### Results

Now, only TOF spectra were analyzed for almost all the samples. We can get information by the TOF spectra as follows:

1. Cosmetics; by comparing cosmetics with Au sheets as standards, some of which includes a little of Ag, one of cosmetics clearly found inclusion of Au and Ag by TOF spectrum. Also, some of others were detected of Au inclusion, however, others were not detected of Au, which claims Au inclusion. So, cosmetics samples are divided into three groups; 1) pure Au inclusion, 2) impure Au inclusion, so Ag was included because Ag coexisted with Au in mineral, 3) no Au detected because the included amounts were under detection limits. In the case of 1), Au could be detected in a few min. On the other hand, Au was not detected in a few hours in the case of 3). The analysis of nail polish has not finished yet.
2. Pigments; every pigments named cadmium were detected with Cd and Ba. On the other hand, yellow pigment named "Chalk yellow" could not detect any elements. Also, Hg was not detected in the pigments of cadmium red and/or cadmium orange. Both of the pigments were analyzed by INAA and Hg was detected in them. The amounts of Hg was one-tenth of Cd, so the sensitivity of Hg is estimated lower than that of Cd.
3. Chinese medicines; Chinese medicine named Niuhuang Jiedu Pian is well known to the inclusion of As as an ingredient, and As was detected in a few seconds by ANNRI. Niuhuang Jiedu Pian by the other maker was also inclusion of almost same amounts of As. However, Niuhuang Jiedu Pian, the third sample of the same name, was approx. 1/13 inclusion of As. So we knew the same named Chinese medicines are not included same ingredients.  
Also, Liushen Wan is well known to the inclusion of As and Hg. And both of the elements were detected by ANNRI and the amounts of As was estimated to be approx 3 times higher than that of Niuhuang Jiedu Pian. The results of ANNRI did not agree well with those of INAA, so there is a possibility that the TOF spectra overlapped some other elements. The Liushen Wan for child made in Japan was analyzed and no As was detected, but Ag was detected.

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We need to analyze the prompt gamma-ray spectra for all samples. Information hidden in the TOF spectra will be analyzed.

These results were related with the detection efficiencies of the ANNRI and they will change by the improvement of the S/N ratio of the neutron beam line.

For many applications, an easy and useful software is necessary.