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XRF

# Elemental distribution imaging of inorganic minerals on a multivitamin supplement tablet using micro-XRF

Application Note

Pharmaceutical XGT29

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**Abstract:** We introduced a fast and non-destructive imaging method for inorganic minerals on a multivitamin supplement tablet containing various essential minerals to body functions. We used the HORIBA XGT-9000 X-ray Analytical Microscope for the imaging, and we could visualize the distribution of the key inorganic elements on the tablet less than 20 minutes even though the concentration of the elements are tens of mg or less per tablet.

**Keywords:** Pharmaceutical, tablet, distribution imaging, micro-XRF

## Introduction

The spatial distribution of ingredients is crucial in pharmaceutical or supplement tablets. However, the packages of such tablets often show only the individual total amount of the ingredients, in spite of the fact that the spatial distribution of the pharmaceutical materials in tablet formulations is critical to product performance, such as tablet hardness, robustness, tablet lifetime, component bioavailability, and bodily uptake.[1]

Raman spectroscopies and IR spectroscopies are mainly used for molecular characterization imaging on tablets.[2]-[4] However, elemental imaging techniques are also important to understand inorganic element distribution for complementary information to molecular distribution. SEM-EDX is a suitable tool for elemental imaging in the sub-micron scale, but it requires sample pretreatment to avoid sample damage and any charging-up issue. LIBS can also offer elemental distribution information, but it is destructive as it creates a crater on the sample surface during each analysis.

In this application note, we will introduce micro-XRF as a fast and non-destructive elemental imaging tool to get inorganic elemental distribution on whole a tablet non-destructively.

## The XGT-9000 X-ray analytical microscope

The XGT-9000 X-ray Analytical Microscope (Figure 1) is an energy dispersive X-ray fluorescence microscope (micro-XRF) with micro-probes and a motorized XYZ stage, which enables users to acquire elemental imaging, as well as to target a small foreign matter on a sample.[5]

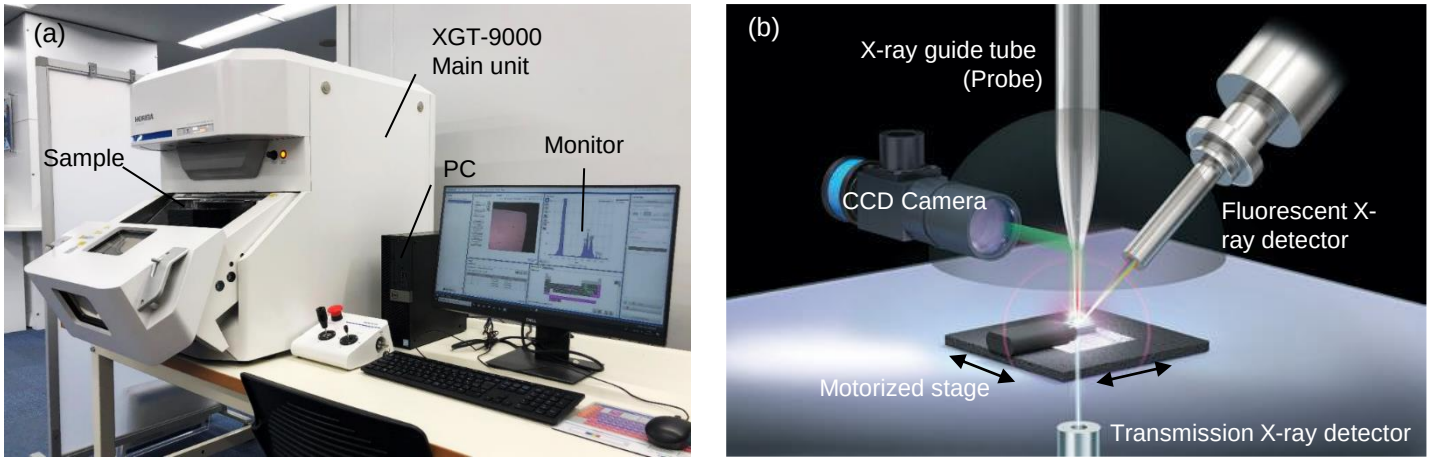


Figure 1. (a) The installation setup of XGT-9000 X-ray analytical microscope (b) schematic diagram of the optics of the XGT-9000.

## Sample information

We purchased a commercial multivitamin supplement including multiple minerals from a pharmaceutical shop. We selected one of the tablets for this analysis (Figure 2). The individual amounts of the key minerals are shown in Figure 3.

## Measurement condition

We placed the tablet on the sample holder and set the holder into the chamber of XGT-9000 under whole vacuum condition. We carried out elemental imaging on the tablet using 100 µm ultra-high intensity probe. The remaining conditions are shown in Figure3. We didn't perform any sample pre-treatment on the tablet.

## Result

Figure 3 shows the elemental distribution imaging results obtained using XGT-9000 C (with a light element detector). We could visualize the distribution of the key inorganic elements contained on the tablet in just 20 minutes even though the concentration of these elements are tens of mg or less per tablet.

Mapping area (Montaged optical image)

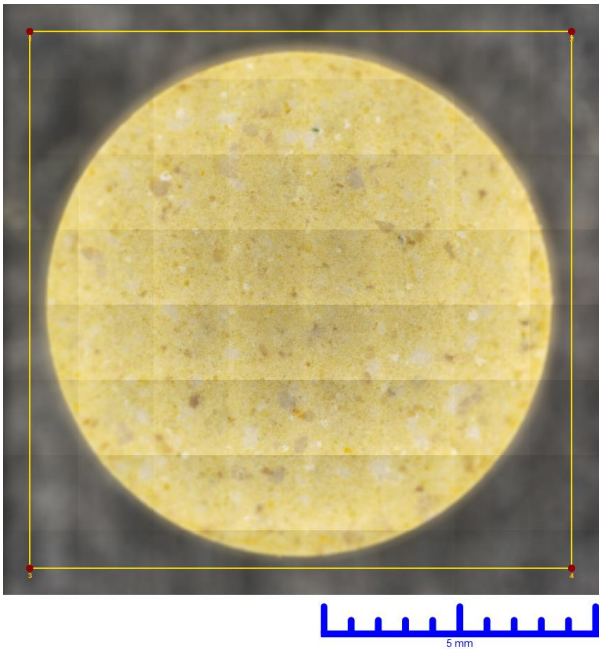


Figure 2: The optical image of the tablet analyzed in this application note. We obtained the image using the XGT-9000 (Montage image)

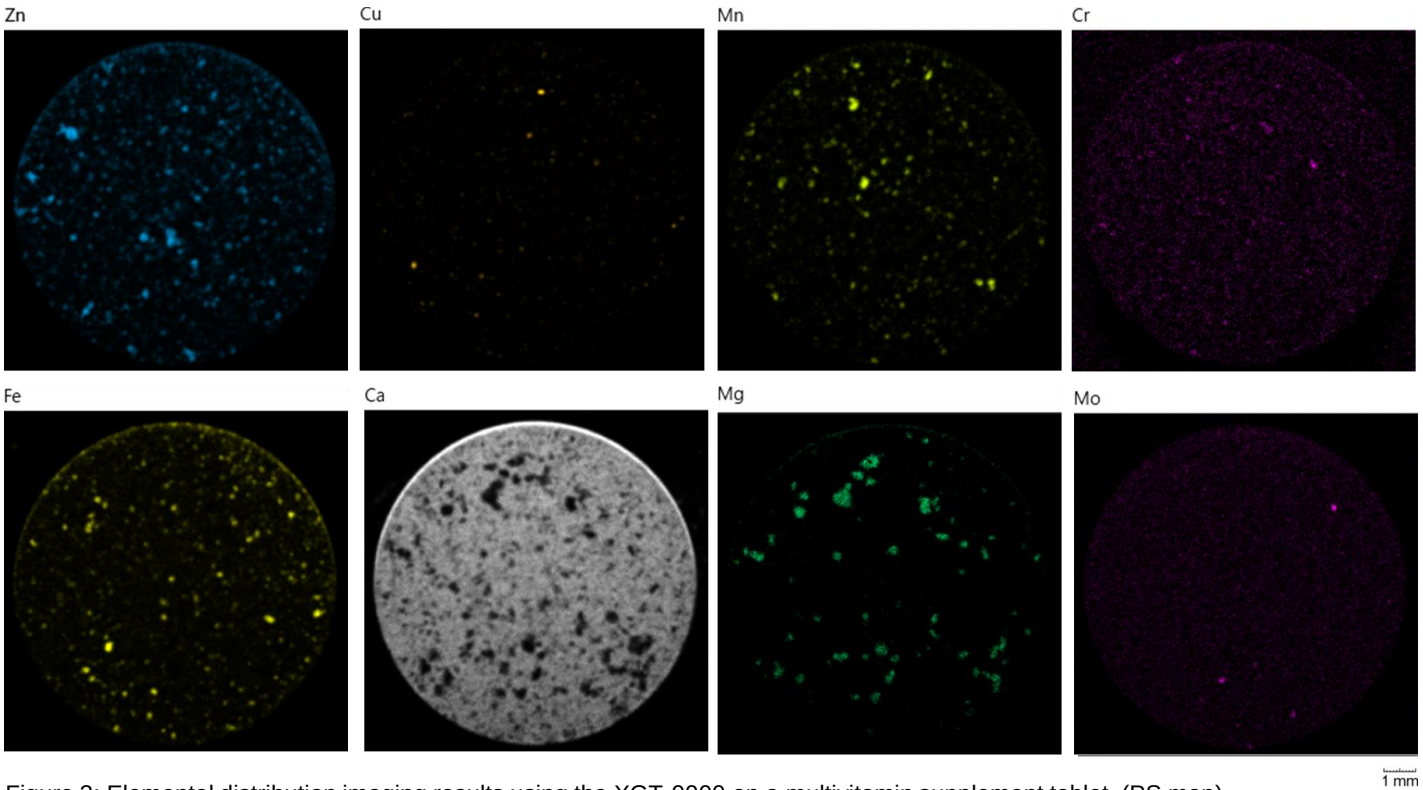


Figure 3: Elemental distribution imaging results using the XGT-9000 on a multivitamin supplement tablet. (PS map)
[Sample] Zn: 1mg, Cu 0.1 mg, Mn 0.25 mg, Cr 4.72 µg, Fe 1.25 mg, Ca; 41.67 mg, Mg: 20.83 mg, Mo: 1.75 µg (per tablet)
[Condition] Configuration: XGT-9000 C (with a light element detector),:Voltage: 50 kV, Current: 1000 µA, Pixel Time:10 ms
Processing time: Process 3,Capillary:100 µm ultra-high intensity probe, DT Correction :20, Vacuum : Whole Vacuumed
Mapping area: 9.728 mm x 9.652 mm (256 x 254 pixels), Mapping time: 20 min

## Conclusion

We carried out elemental imaging on a multivitamin tablet using HORIBA XGT-9000 X-ray analytical microscope. Normally, such a multivitamin supplement tablet shows only the individual total amount of ingredients on the package. However, as shown in our result, these ingredients exist in the form of aggregation in a tablet. We could visualize it less than 20 minutes, non-destructively. Thus, we could show the value of elemental imaging using micro-XRF.

## References


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