

MicroXRF analysis of the leaves of fruit trees



XROS MF30 – laboratory x-ray microscope-microprobe for studies of the objects by the methods of the optical microscopy, radiography, local element XRF microanalysis with possibility of the element mapping. Using a microscope, a sample of up to 400 mm in size along the Y axis and of unlimited size along the X axis (max. scan area 150×150 mm; in the case of a larger area, the scanned areas can be stitched) and up to 105 mm high can be performed.

An overview video camera and two optical microscopes with magnification up to 200 times are using for accurate determination of the scanning area.

The central optical microscope with automated sharpness adjustment is combined with the axis of the microprobe (axis of the x-ray beam).

Local X-ray fluorescence microanalysis with the possibility of elemental mapping and X-ray studies can be carried out both separately and simultaneously.

Sample positioning accuracy is 10 microns.

The minimum diameter of the x-ray probe is 30 μm.

The range of simultaneously measured elements from ¹¹Na to ⁹²U.

Samples: dried leaves growing near the fruits of the mandarin.



Figure 1. The first sample

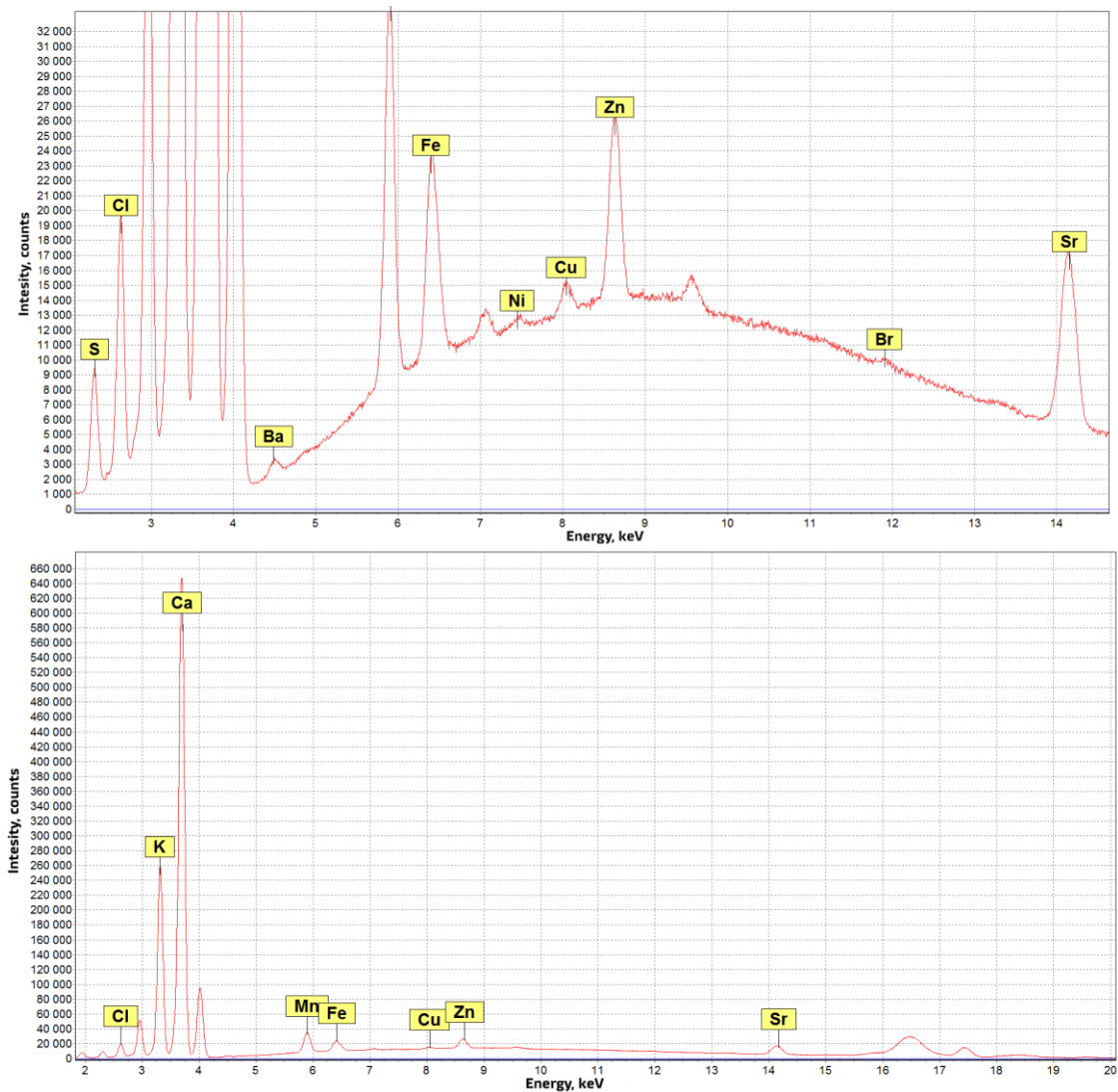
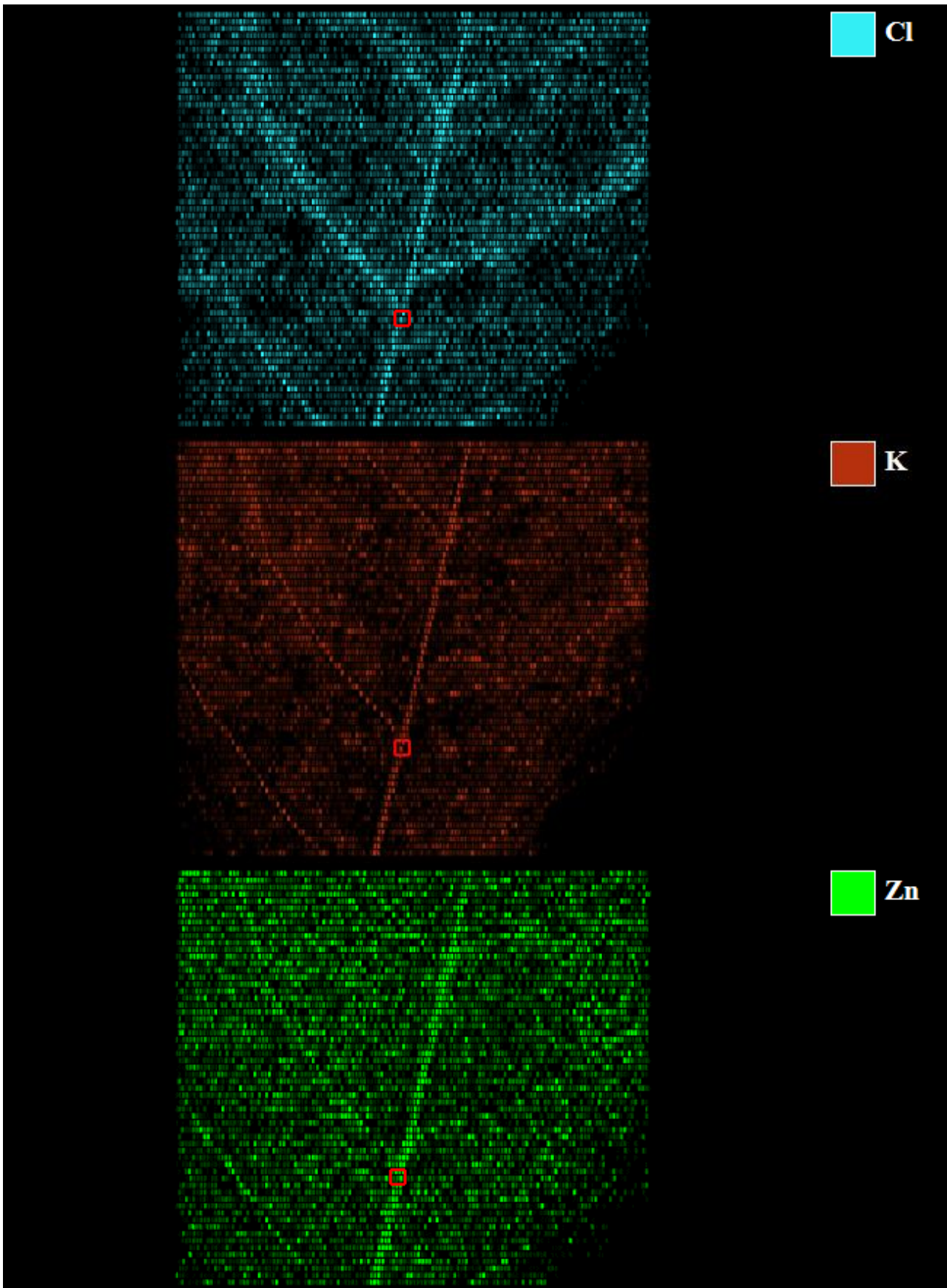



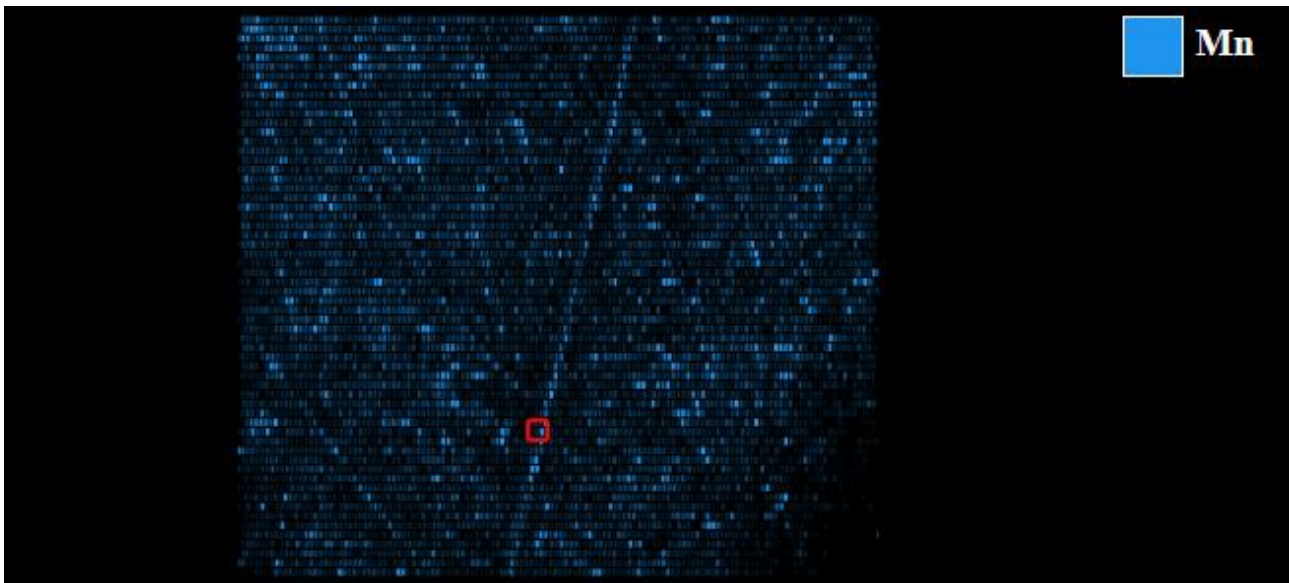
Figure 2. Total spectrum of the 1st sample



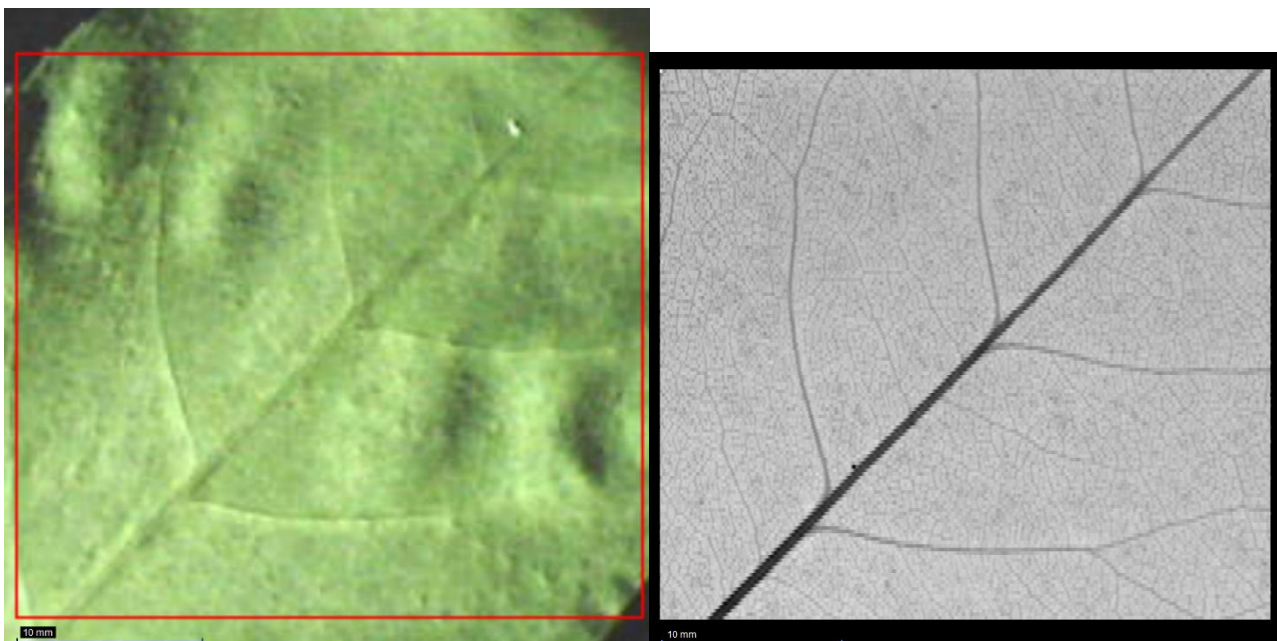
 Sr

 Ca

 Fe



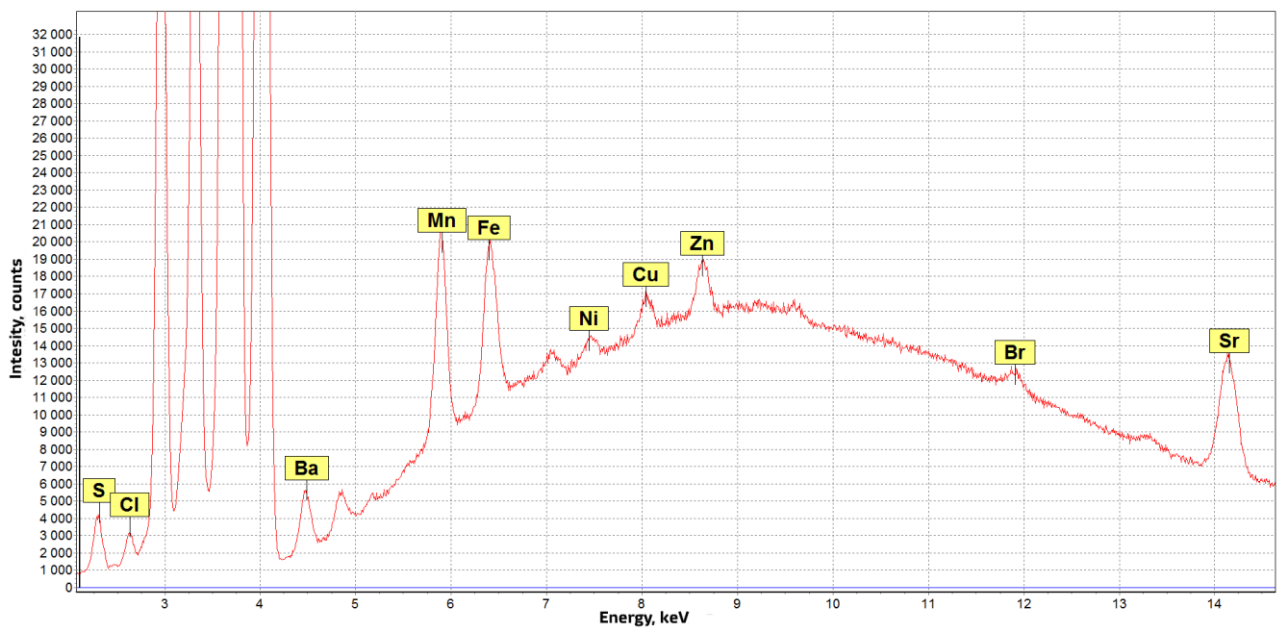
The main elements present in the leaves are potassium and calcium. Calcium, like strontium, is distributed mainly in stem. Potassium, as well as chlorine and zinc are distributed in stem and stipules (paired appendages on both sides of basal sheath). However, chlorine is less concentrated than potassium. Minor concentration of iron and manganese can also be observed there. These contaminant elements are located on the surface of the lamina. Shining inclusions can be observed on the surface of the sheet, which are probably caused by manganese contamination.



In the second leaf, there are much more copper and bromine. Nickel and barium are also present.



Figure 3. The second sample



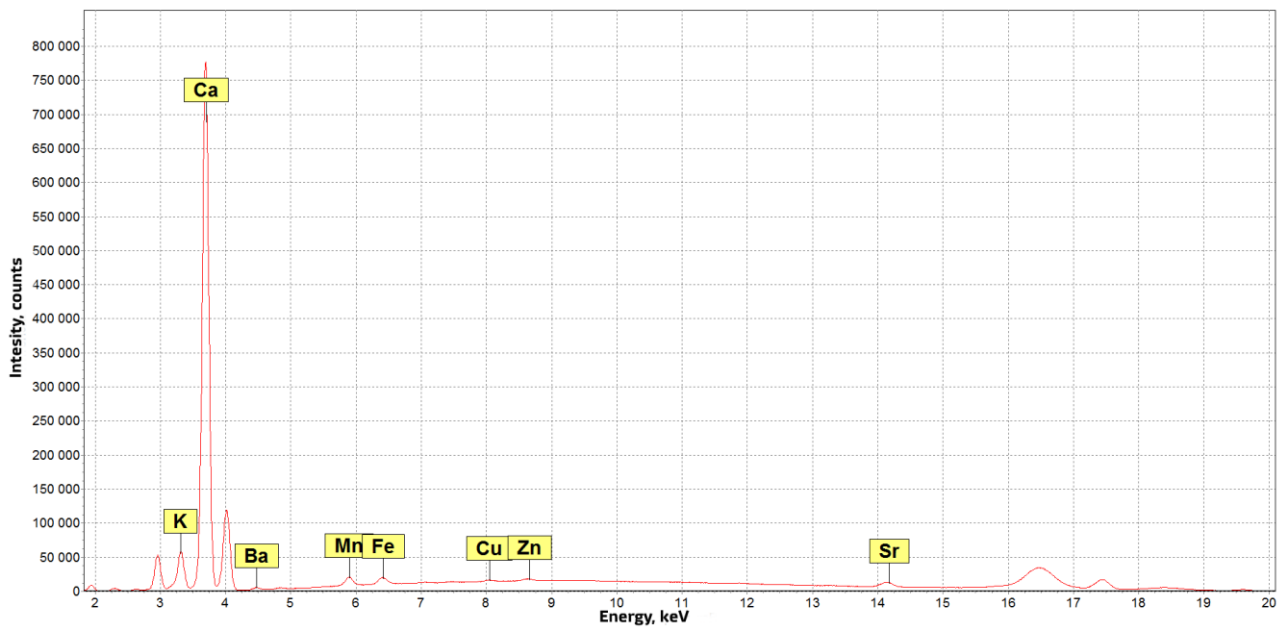
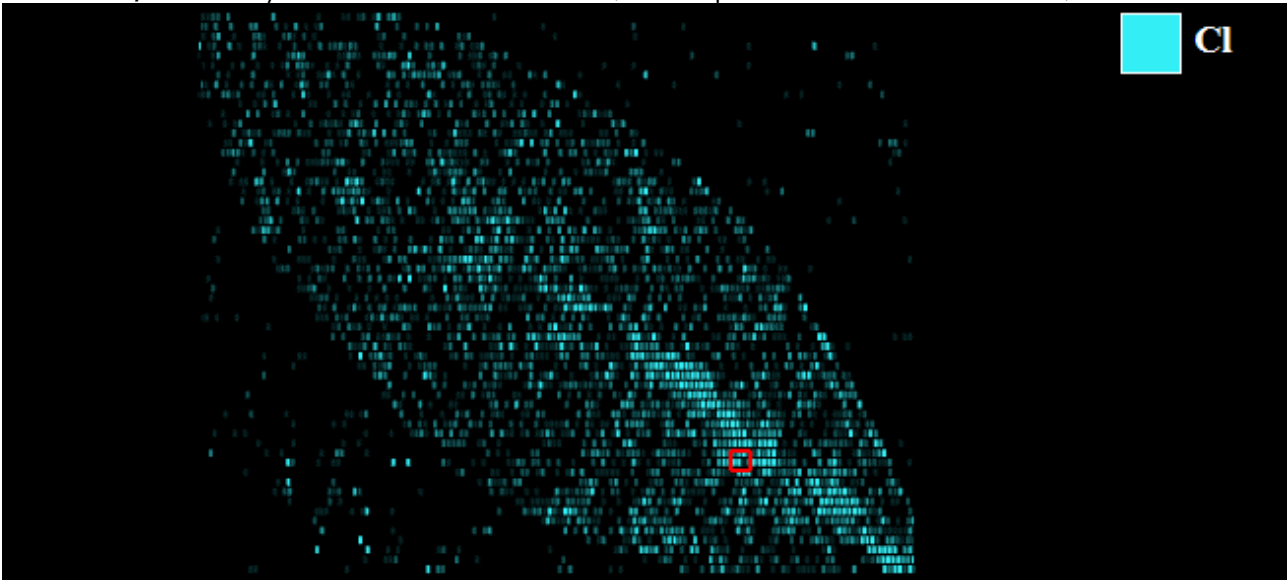
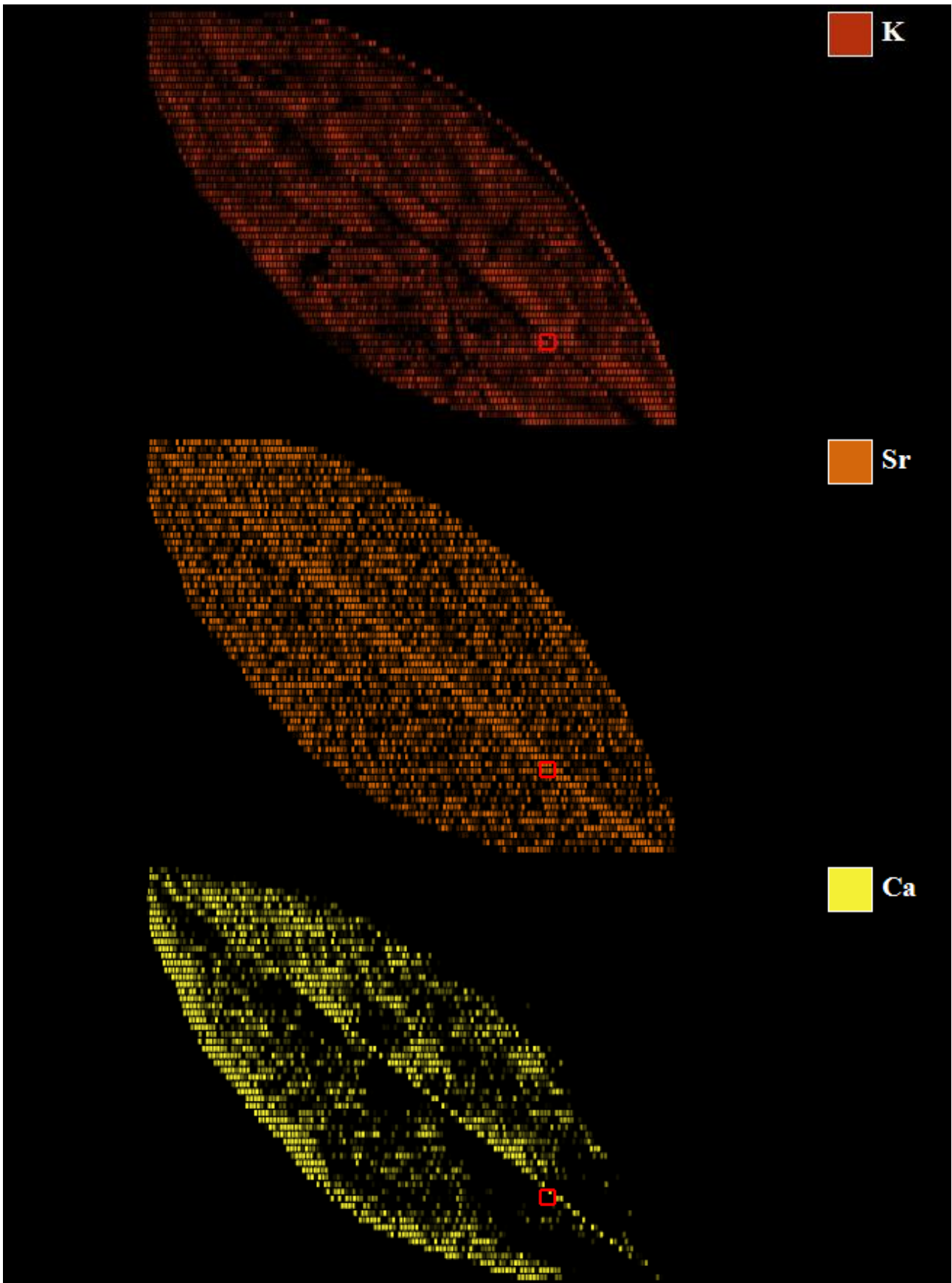
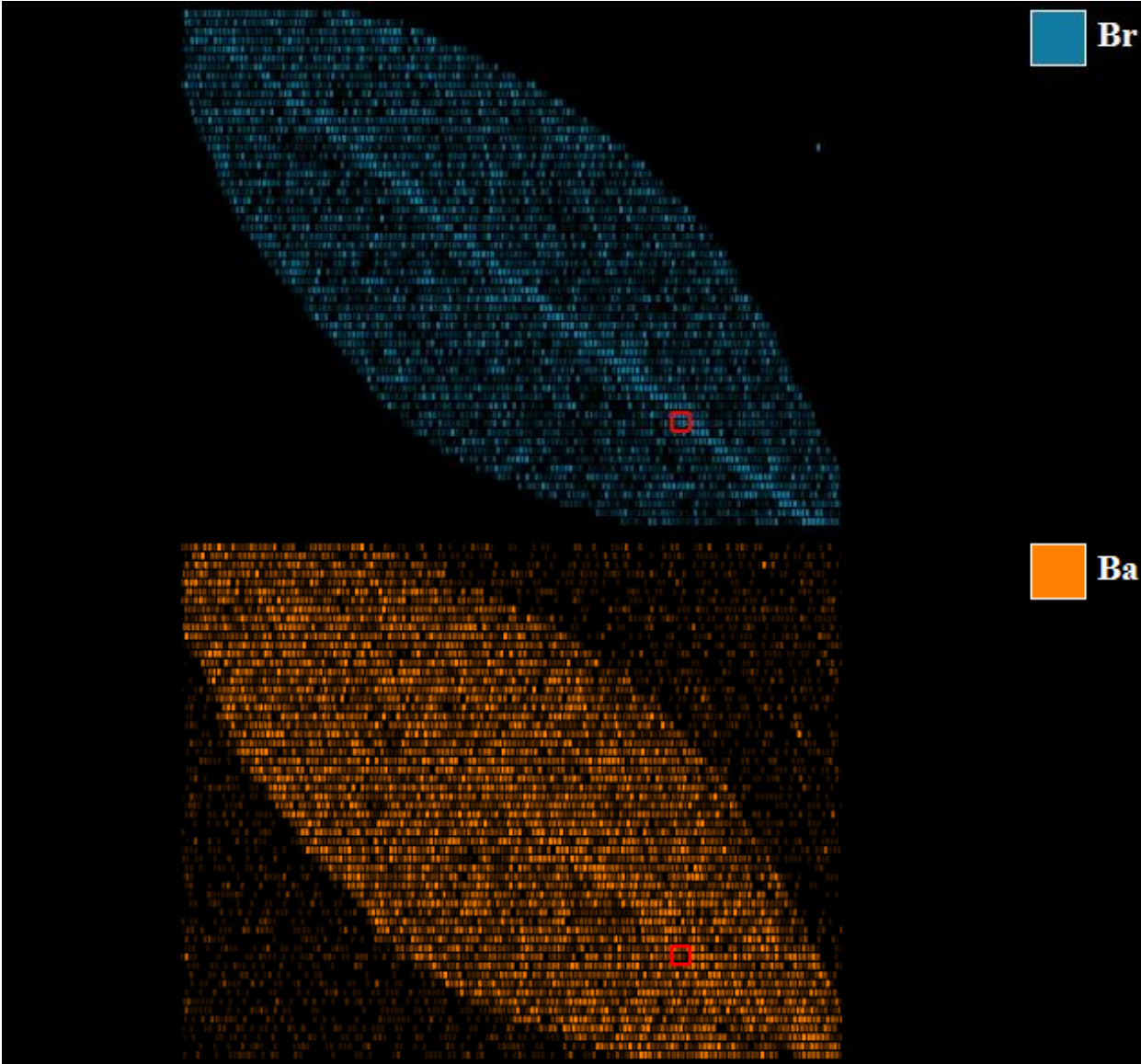


Figure 4. Total spectrum of the 2nd sample

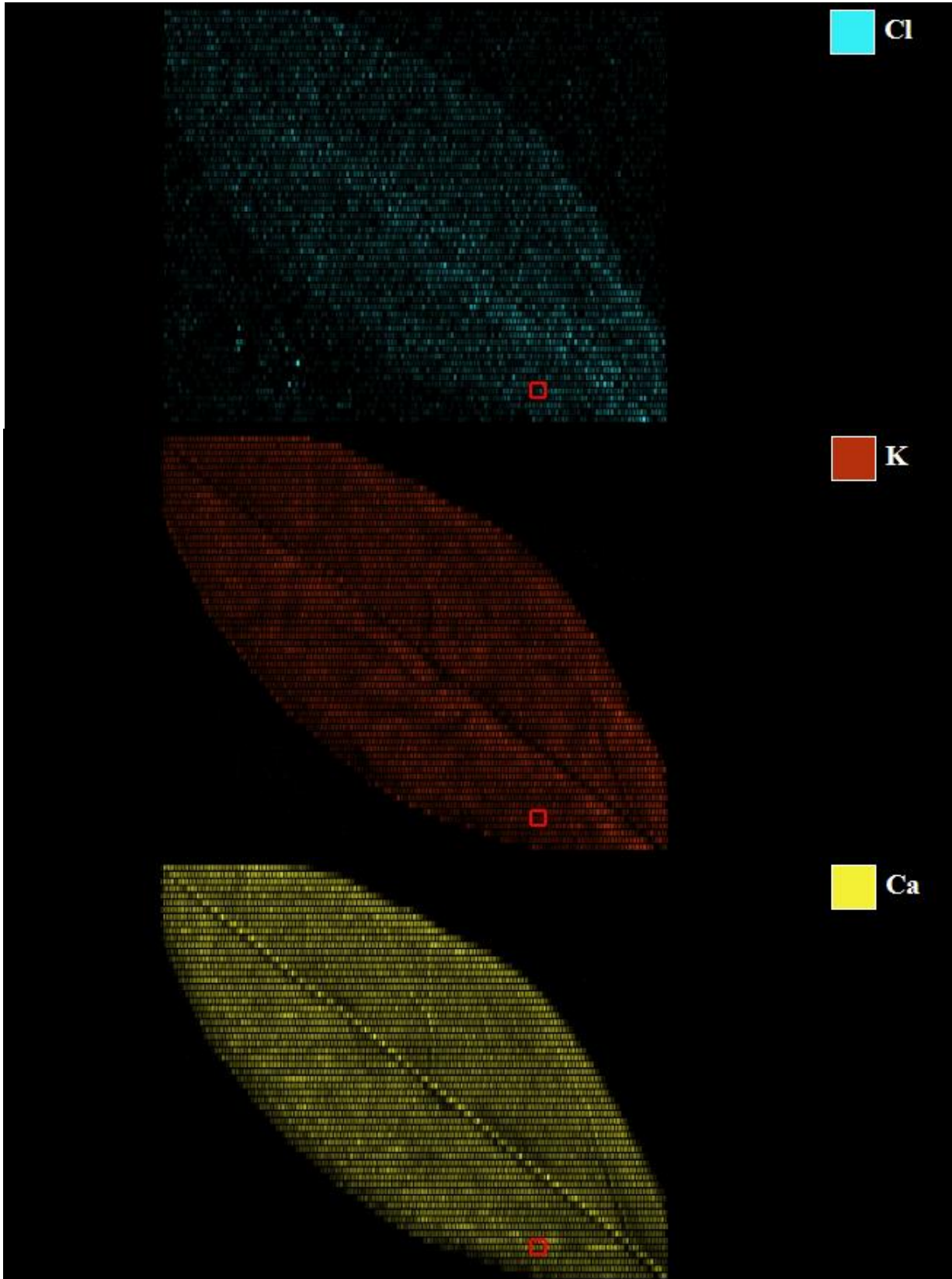
Chlorine is distributed near the stem (similar to the first leaf). Potassium and calcium are nonuniformly distributed, which may be associated with disease (brown spots are observed on the leaf).







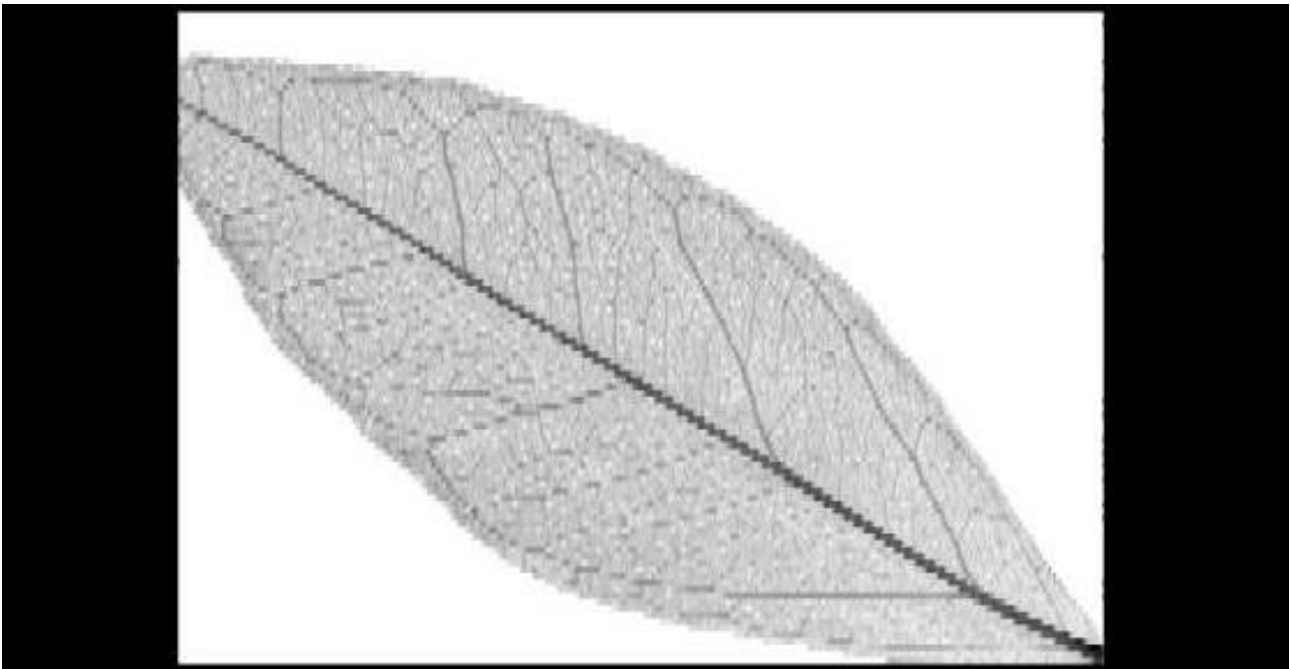
The other side of the second sample was investigated. The potassium content is less in areas with brown spots.



 Sr

 Ba

 Fe



Parameters of measurements:

Scan step	500 μm
Scan rate	500 $\mu\text{m/s}$
Measurement time	500 ms
Voltage	40 kV
Electric current	5000 μA
XRT	Mo anode
Atmosphere	Air