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# XRF1090 - Semi-Quantitative Analysis Of Recycled Solid Fuel With Benchtop WDXRF Supermini200

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## Introduction

Recycling has become a term that cannot be ignored in the industrial world. Recycling is roughly classified into (1) "re-use", utilizing something again for the same purpose, (2) "material recycling", returning something into the original material for subsequent use, (3) "chemical recycling", changing something into another material for subsequent use, and (4) "thermal recycling", using something for thermal energy. New technologies utilizing fly ash of urban refuse as cement material (chemical recycling) and converting urban refuse into solid fuel (thermal recycling) have attracted a lot of attention.

In X-ray fluorescence (XRF) analysis, it is possible to perform qualitative and quantitative analysis with easy sample preparation, without dissolving samples. Therefore, XRF is widely used for industrial process and quality control. In addition, evolution of the fundamental parameter method (FP method) has improved performance of the semi-quantitative analysis program ("SQX" analysis), where it is possible to calculate quantitative values based on the results of qualitative analysis without calibration standards. This application note demonstrates analysis results of refuse derived fuel (RDF) by the semi-quantitative analysis program "SQX" with the benchtop wavelength dispersive (WD) XRF spectrometer, Supermini200.

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## Instrument

The Supermini200 is a benchtop sequential WDXRF spectrometer designed specifically to deliver excellent performance while eliminating typical installation requirements, such as cooling water, special power supply and large floor space.

Equipped with a unique air-cooled 200 W X-ray tube, two detectors and three analyzing crystals, the Supermini200 is capable of measuring elements from oxygen (O) to curium (Cm). A standardless semi-quantitative analysis program is available, allowing quick and simple characterization of a large variety of samples.

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## Sample preparation and measurement

Recycled solid fuel can be classified into RDF (refuse derived fuel) and RPF (refuse plastic and paper fuel). In this application note, actual RDF samples were analyzed to demonstrate that the Supermini200 is suitable for quality control of RDF.

RDF samples were pressed at 200 kN into aluminum rings to make pressed briquettes.

Semi-quantitative (SQX) analysis was carried out with the Supermini200. The semi-quantitative FP calculation to obtain the analysis results is executed automatically based on the X-ray intensities of the detected elements in the completed sequential scan.

## Analysis Results

The semi-quantitative analysis (SQX) results are shown in Table 1.

**Table 1:** SQX result of RDF samples. (mass%)

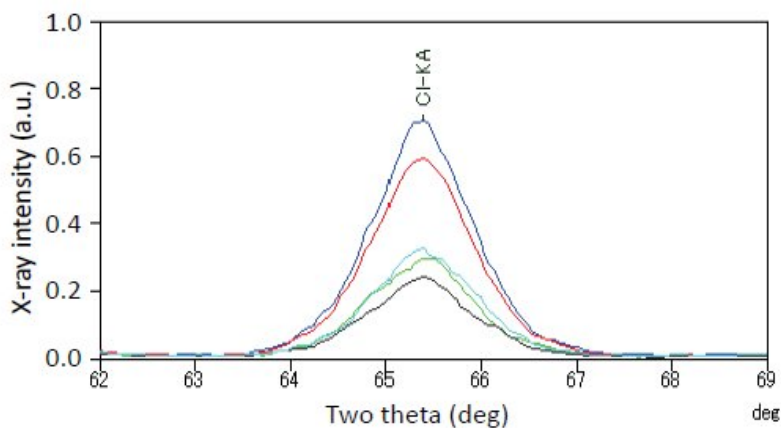
Element	Sample number				
	1	2	3	4	5
Al	0.080	0.11	0.30	0.17	0.19
Si	0.19	0.31	0.10	0.33	0.26
P	0.005	-	-	-	-
S	0.009	0.018	0.011	0.021	0.030
Cl	0.14	0.30	0.24	0.16	0.12

- : "not detected"

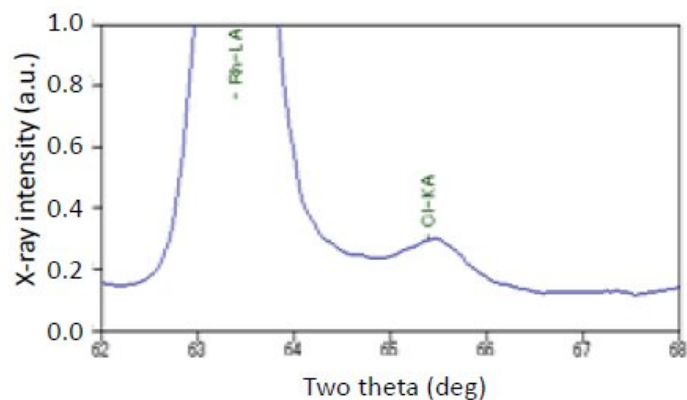
In the SQX calculation, an organic compound was specified as the balance component.

In particular, Cl, Al and S are carefully monitored because they cause corrosion and damage to furnaces.

The qualitative chart of Cl-K $\alpha$  is shown in Figure 1, where it is found that no Rh-L line is observed owing to the Pd target of the 200 W X-ray tube mounted on the Supermini200. For comparison, a typical qualitative chart of Cl-K $\alpha$  for an X-ray tube with a Rh target is shown in Figure 2. Here, the Cl-K $\alpha$  peak sits on the slope of the Rh-La line. This implies that it is difficult to detect a small amount of Cl with a Rh-target tube.



**Figure 1:** Cl-K $\alpha$  chart on Supermini200 with a Pd target X-ray tube.



**Figure 2:** Cl-K $\alpha$  chart with a Rh target X-ray tube.

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## Conclusions

This application note demonstrates that semi-quantitative analysis with Supermini200, a benchtop sequential WDXRF, can be applied to RDF (refuse derived fuel), a recycled solid fuel.

Excellent analysis results were obtained with the Supermini200 equipped with an air-cooled 200 W X-ray tube by simply pressing RFD samples.

The Supermini200 has a small footprint and does not require special utilities, so that this model can be used in a small analysis room for quality control of recycled solid fuel.

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## Related products



### Supermini200

Benchtop tube below sequential WDXRF spectrometer analyzes O through U in solids, liquids and powders