

Evaluation of cleanliness of aluminum foil surface using the Shimadzu Total Carbon Analyzer

Nowadays, with the spread of mobile phones and other mobile communications, there is an increasing demand for high purity aluminum electrolytic capacitors. The material for the electrodes in aluminum electrolytic capacitors is aluminum foil, and it is one important part that affects quality. When the aluminum foil is rolled during processing it is coated with lubricating oil, but if residues of this oil remain on the aluminum foil the characteristics of the final product are deteriorated. Therefore, in order to manufacture high-quality products, there is a demand for high sensitivity control of oil residues on aluminum foil surfaces.

Purpose

In order to prevent loss of characteristics of the aluminum foil by the presence of oil residues on its surface, there is a need for reliable detection of organic residues. Here we present a method for evaluating oil residues using the Shimadzu Total Carbon Analyzer. The system consists of TOC-VCSH + SSM-5000A. TOC-VCSH is the successor of TOC-5000A.

Comparisons with Conventional Methods

In conventional methods, the oil residues on metal surfaces are extracted using water or alcohol, and analyzed using an oil analyzer or infrared analyzer. However, using these methods has disadvantages, including the following:

1. Oils not soluble in the extract are not analyzed;
2. Organic contaminants other than oils are not detected;
3. The procedure is time consuming because an extraction step is required.

Measuring Conditions

1. As an imitation sample of oil residue a x 100 dilution of industrial oil (white, TC: 145g-C/L) in ethanol is prepared.
2. 200mg of this solution is placed on a 4cm x 5cm square of household aluminum foil and dried, and then the sample including the foil is placed in the SSM-5000A sample port and analyzed for TC.
3. A 200mg sample of the same solution is also placed directly in the sample port and the value obtained is used as the base value for evaluating recovery rates.
4. Using the same method, a small sample (30mg) is also analyzed and evaluated for effect on analysis accuracy and recovery rates.



Shimadzu Total Carbon Analyzer

Results

Sample volume [mg]	Sample placed on aluminum foil [μg-C]	Sample only [μg-C]	Recovery rate [%]
200	284.3 (c.v.0.48%)	289.9 (c.v.0.76%)	98.1
30	41.59 (c.v.4.26%)	40.99 (c.v.5.06%)	101.5

It was found that for any sample volume a recovery rate of approximately 100% was achieved. Also, for small samples such as 30mg the measurement of the small peak was less accurately repeatable but on a practical level an adequate accuracy of measurement was achieved. From these results, it can be seen that the total carbon analyzer can be used for controlling oil residues on aluminum foil surfaces. Analysis data of 200mg samples placed and dried on aluminum foil are shown in Fig. 1, and those for 30mg are shown in Fig. 2.

Applications in Other Fields

Problems and faults with materials for electronic parts caused by organic residues have been reported in the areas of metals and inorganic materials, such as aluminum and copper foils, sheets, wires as well as glass fabrics, and in all cases there is a need for accurate detection of such residues in order to prevent deterioration of the characteristics of the final product. The Shimadzu Total Carbon Analyzer can be used in order to prevent product problems like these. In addition to the examples presented here, it can be used in a wide range of fields such as controlling oil residues on the surface of beverage cans and managing metal coatings, and we have received comments that it has made analyses extremely easy and has made the processing of large numbers of samples possible.

Please discuss with us any other potential applications.

Benefits

Using the Shimadzu Total Carbon Analyzer,

1. Insoluble oils can be detected,
2. The total contaminants, even unforeseen ones, can be measured,
3. Analysis is extremely easy because no extraction step is required,
4. Measurements are fast and simple so a large number of samples can be processed, and the detection of oil residues can be done more easily, rapidly and more reliably than by conventional methods.

Features of the Shimadzu Total Carbon Analyzer

- ¥ Measurements are fast (approx. 3 minutes/sample) because the samples can be introduced as they are. (There is no need for pre-treatment steps such as extraction.)
- ¥ Samples are analyzed directly, allowing the analysis of residues insoluble in water or other solvents.
- ¥ Operation and analysis condition settings are easy, and the results can be read directly as absolute carbon values per sample.
- ¥ It has high sensitivity with almost no interference from other components.
- ¥ With the TOC-5000A and SSM-5000A (TOC-VCSH and SSM-5000A) combined, not only solid samples but also aqueous samples can be analyzed.

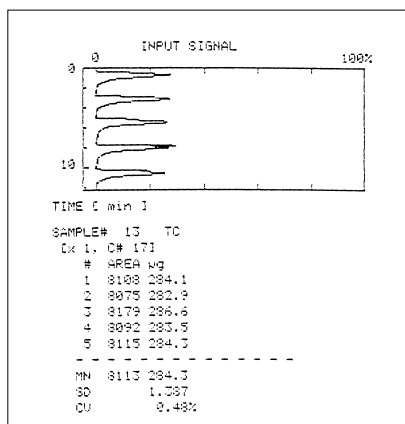


Fig.1 200mg industrial oil placed and dried on aluminum foil

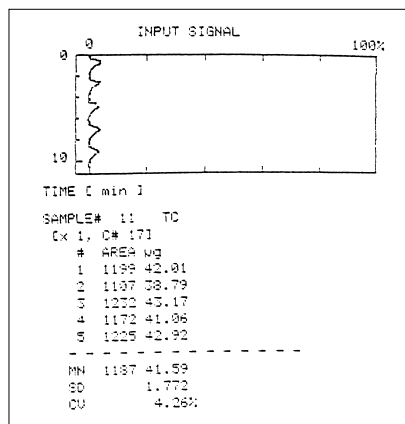


Fig.2 30mg industrial oil placed and dried on aluminum foil



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