Guest Forum

Request from the Laboratory in an Oil Refinery to Testing and Analyzing Equipment Manufacturers

Oil refineries are always required, as social duties, to strictly ensure “safety” and appropriately manage “environment, health and quality” and “stable supply” and, as economic duties, to seek and manage “productivity.” The mission of the laboratory of the oil refinery is to support good management, and it is essential for the laboratory to select and manage appropriate testing and analyzing equipments in order to fulfill the mission. This article explains from what viewpoints the laboratories select testing and analyzing equipments and contains some of my own experience. Since a typical laboratory owns quite a large variety of testing and analyzing equipments, the “sulphur analyzer (total sulphur content)” is taken up as an example for the purpose of this article.

Introduction

At oil refineries, as crude oil is run through the refining equipments, various kinds of petroleum products are manufactured and blended and then shipped, as shown in Figure 1. Reducing sulphur concentrations in fuel oil and oil products is one of the important efforts to reduce environmental loads. A typical oil refinery conducts testing and analysis in the production and blending processes according to the following procedures in order to obtain low-sulphur fuel oil and oil products:

- **Production process**
  The production processes are generally controlled by the sulphur regulation value for environmental management, the sulphur specification value for quality control and the operating procedures for operation management of refining equipments. Samples of crude oil and from each production process (on-site) are put to testing and analysis in the laboratory, and the measured sulphur concentrations are clarified. The test results are then fed back to each production process within a predetermined period of time so that necessary control for the operating conditions of the refining equipments can be made. This testing, feedback and control allows gas and oil in the production processes to maintain a sufficient quality level of low sulphur content and eventually supports environmental management and appropriate operation management of the oil refining equipments.

- **Blending process**
  Fuel oil going through the production process is controlled by the sulphur specification value set for each fuel oil and oil product so that it can be shipped as acceptable fuel oil and oil products. Samples are taken from the tanks (off-site) for testing and analysis in the laboratory, and the results of sulphur concentrations are identified. The test results are fed back to the blending process within a predetermined period of time so that fuel oil and oil products that comply with the sulphur specification value can be shipped. This procedure ensures sufficient quality for each fuel oil and oil product.

*1: A typical oil refinery is composed of the “production management section,” the “operating section that executes production,” the “maintenance section,” the “financial section,” and the “environment and safety section.”

*2: Crude oil is a mixture of hydrocarbons of a wide range of boiling points that contains sulphuric contents, nitrogen, oxygen and...
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Figure 1 Example of oil refining process
Parenthesized values show the general changes in sulphur concentration.
(1) to (8) correspond to the numbers in Table 1 and indicate total sulphur content testing methods appropriate for samples. In general, the underlined numbers are employed.
metals. Crude oil from the Middle East has a large sulphuric content.

\*3: Reduction in environmental impacts such as air pollution, water pollution, or waste.

\*4: In addition to the test results from the laboratory, process analyzing meters are installed at appropriate locations in the refining equipment.

\*5: It includes cost reduction, productivity enhancement or promotion of energy saving.

Other Testing and Analyzing Institutes

Unlike laboratories in oil refineries, typical testing and analyzing laboratories of research centers, public quality and environmental monitoring institutes, and private analyzing laboratories do not generally provide round-the-clock support for production operation nor have the capability to “provide test results within a short period of time” as necessary for quality inspection before shipment.

• Testing and analyzing laboratories of research centers
  They provide reports on the test results of sulphur concentration for samples for development of production technology or improvement and development of products within a predetermined period of time at the request. They may also be involved in development of testing and analyzing techniques.

• Public quality and environmental monitoring institutes and private analyzing laboratories
  They provide the clients with reports on test results of sulphur concentration using the samples given by the clients within a predetermined period of time.

Sulphur Analyzer (Total Sulphur Content) Required by the Laboratory

Requirements and Priorities

Table 1 lists various techniques for analysis for total sulphur content. In general, the technique that fits the type of sample to measure and its total sulphur content is selected for analysis. Laboratory staffs use a variety of testing and analyzing apparatuses in addition to the sulphur analyzer to conduct testing and analysis. This is the background of the requirements for a laboratory with respect to sulphur analyzer. The major requirements are listed below in order of priority:

• To have the performance that complies with the national standards and other officially certified testing methods and the ability to ensure traceability

• The after-sale service of the manufacturer should be flexible and responsive

• Operations such as start-up, preparation of analytical curves, measurement and shutdown should be simple and quick

• Should be excellent in safety, durability and stability
and have low running cost

Examples of Requirements

• Performance

Measurement range, precision (determination lower/higher limit, accuracy, repeatability, reproducibility), analytical curve (preparation accuracy, range, automatic/manual, degree, number, synthesis, long-term stability, standard sample), durability, measurement-suited sample (liquid, semi-solid, temperature), 24-hour continuous operation

• Functions

Automatic sample changer (continuous measurement, interruption, addition, deletion, possibility of thinned-out operation of samples), input of conditions and the number of inputs recordable, automatic correction, data output and recording, screen indication (brightness, clear picture), LAS communication

• Operation

Personal difference (maturity, suitability), workability (posture, movement, sight line, height, minuteness, degree of fatigue, dominant hand), ease of start-up/shutdown, time (assembly/disassembly), ease of measuring plane checking, working space, ease of change of measuring elements
Guest Forum Request from the Laboratory in an Oil Refinery to Testing and Analyzing Equipment Manufacturers

- Safety
  Discontinuation, startup indication lamp, earth-leakage breaker, protective circuit, alarm, prevention of erroneous setting, error message, indication of dangerous parts or warning parts, emergency (automatic shutdown, manual shutdown)

- Others
  Configuration (integrated type, composite type: measuring element and control element, PC, printer, interface), size (external dimension, weight, shape), material, standard accessories and quantities, price (main body, option and consumable), use environment (temperature, humidity, wind), utility (electricity), after-sale service, rating of sulphur analyzer (JIS-compliant item, traceability, sales records), supply system (main parts, option parts, consumables), inspection method (daily, periodic, manufacturer), instruction manual (ease of understanding, ease of user's preparation of operation sheet, DVD or floppy disk), installation work, labor, and explanatory contents associated with load-in, and disposal method (main body, option, consumables), sample container (quantity, heat resistant temperature), anti-earthquake measures (slip stop, fixing method), etc.

Negotiation between Purchasers and Manufacturers

These days, the laboratory staffs rarely negotiate with the manufacturer directly as the purchaser’s side. It is therefore very important for the laboratory staff to check the requirements (specifications) in detail and convey their request to the purchasing staff. But in reality, requirements are not fully examined in many cases. Coupled with the lack of information and knowledge on the users on the part of the manufacturers, purchasing contracts are often completed with no sufficient check of the requirements made by either side. Controversies that are later disclosed can only depend on the relationship of trust between the purchasers and the manufacturers. It is therefore essential to carefully examine the requirements and the information exchanged between the two parties to avoid such cases.

Conclusion

Whether the result of the negotiation between the purchaser and the manufacturer is good or not has a serious impact on the laboratory staff on the purchaser's side. It is also related to the level of trust on the manufacturer’s side. And negotiation let the manufacturer to know the selling point and the weak point. Such negotiations can also be used as valuable time for the manufacturer to think up better products. This is how I feel about those negotiations, and how about your idea? Whenever I have a chance, I intend to come up with better ways to select testing and analyzing equipment for the laboratory people. I hope that my article will be of help to the readers as much as possible.

/Publication members have responsibility for the translation