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General Principles for Sampling Chemical Products

化工产品采样总则

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General Principles for Sampling Chemical Products

1 Scope

This Standard specifies the terms and definitions of chemical product sampling, sampling purposes, basic principles of sampling, sampling plans, sampling techniques, sampling safety, sampling records and sampling reports, sample containers and storage, and metering one-time sampling inspection.

This Standard applies to the sampling of chemical products.

2 Normative References

The provisions in following documents become the provisions of this Standard through reference in this Standard. For dated references, the subsequent amendments (excluding corrigendum) or revisions do not apply to this Standard; however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB/T 3723 Sampling of Chemical Products for Industrial Use - Safety in Sampling (GB/T 3723-1999, idt ISO 3165:1976)

GB/T 4650 Chemical Products for Industrial Use – Sampling – Vocabulary (GB/T 4650-1998, idt ISO 6206:1979)

GB/T 6679 General Rules for Sampling Solid Chemical Products

GB/T 6680 General Rules for Sampling Liquid Chemical Products

GB/T 6681 General Rules for Sampling Gaseous Chemical Products

3 Terms and Definitions

For the purposes of this Standard, the terms and definitions given in GB/T 4650 apply.

4 Purposes of Sampling

The basic purpose of sampling is to obtain a representative sample from the overall material to be tested, and to obtain data within the allowable error through the detection of the sample, so

4.4.3 To classify materials by hazard, etc.

5 Basic Principle of Sampling

The basic principle of sampling is to make the collected samples fully representative.

When the cost of sampling (such as material cost, operation cost, etc.) is high, the sampling error and cost can be properly considered when designing the sampling plan, but the requirements for sampling error shall be met.

6 Sampling Plan

6.1 Factors influencing the sampling plan

6.1.1 The nature, physical state and range of the overall material to be collected. The range can be a certain delivery batch agreed by the purchaser and supplier, or a certain production batch produced intermittently; and in the case of continuous production, it can be the material produced within a certain time interval;

6.1.2 The possibility of contamination or deterioration of the overall material during or after production;

6.1.3 Acceptable sampling error;

6.1.4 Specifications of inspected materials;

6.1.5 Characteristic definition of material judgment standard;

6.1.6 Precision of the detection method;

6.1.7 Value of the material;

6.1.8 Possibility to simplify sampling operations.

6.2 Basic content of sampling plan

6.2.1 Determine the range of the overall material;

6.2.2 Determine the sampling unit and the secondary sampling unit;

6.2.3 Determine the number of samples, the quantity of samples and sampling location;

6.2.4 Specify sampling operation methods and sampling tools;

6.2.5 Specify the processing method of the sample;

The variability of the overall material characteristic values and their types are the basis for designing a sampling plan. They exist objectively, but it is expensive and difficult to operate to estimate them through the detected data. Therefore, the actual measurement is generally not carried out when designing the sampling plan, but inferences and assumptions are made based on experience and the material information that has been mastered.

7.4 Sampling of uniform material

7.4.1 The uniformity of uniform materials may vary with the size of the specified unit to be investigated. For example, 10 t of material packed in 50 kg barrels has no significant difference in the average value of characteristics between barrels. Therefore, this batch of materials are uniform materials for the barrel unit. If the materials in the barrel are segregated during processing, there will be differences in the average characteristic values between 500 g portions of materials taken from different parts of the barrel. Therefore, for the 500 g material as the inspection unit, the material is non-uniform.

7.4.2 Sampling of uniform materials can, in principle, be carried out at any part of the materials. But beware:

7.4.2.1 Impurities shall not be brought into during the sampling process.

7.4.2.2 Avoid material changes (such as water absorption, oxidation, etc.) during the sampling process.

7.5 Sampling of non-uniform materials

For the sampling of non-uniform materials, in addition to paying attention to the same two points as uniform materials, random sampling is generally adopted. The obtained samples are measured separately; and the results of all samples are aggregated to obtain an estimate of the average and variability of the characteristics of the overall material. If several equal samples (or unequal samples taken in proportion to the amount of represented material) are randomly selected from the overall materials, combined into a large sample, and then reduced into the final sample; then the estimate quantitative error of the average value of the characteristics obtained from it is large, meanwhile, the information about the variability of the characteristic value cannot be obtained.

Designing the sampling plan according to the variability types of the acquired characteristic values can make the collected samples better represent the overall materials and save the cost.

7.5.1 Sampling of random non-uniform materials

A random non-uniform material refers to a material in which the average value of the characteristics of any part of the overall material is independent of the average value of the characteristics of the adjacent parts. The sampling can be randomly selected or non-randomly selected.

7.5.2 Sampling of oriented non-random non-unform materials

Oriented non-random non-uniform materials refer to materials in which the characteristic values of the overall material change along a certain direction. For example, when the solid granular material is conveyed, the material that is separated vertically and horizontally due to the difference in particle size and weight. Another example is that after filling at high temperature, it gradually solidifies from the near wall to the center, and the materials that the impurities content must form a gradient with the solidification sequence. Such materials shall be sampled in layers, and samples that can represent the layer of materials shall be taken from each layer with different characteristic values as far as possible.

7.5.3 Sampling of periodic non-random non-uniform materials

Periodic non-random non-uniform materials refer to materials whose characteristic values show periodic changes in a continuous material flow, and the change period has a certain frequency and amplitude. For such materials, it is best to sample on the material flow line; and the sampling frequency shall be higher than the change frequency of the material characteristic value, and the two shall not be synchronized. Increasing the number of sampling units shall help reduce sampling bias.

7.5.4 Sampling of mixed non-random non-uniform materials

Mixed non-random non-uniform material refers to a mixed material composed of two or more characteristic value variability types or two or more characteristic average values. For example, a material that is combined from several production batches. For this type of material, first separate the components as much as possible, and then sample according to the above-mentioned sampling methods for various types of materials.

7.6 The number of samples and the quantity of samples

Under the premise of meeting the needs, the minimum number of samples and the minimum quantity of samples that can give the required information are the optimal number of samples and the optimal quantity of samples.

7.6.1 The number of samples

For general chemical products, multi-unit materials can be used for processing. Its unit boundaries may be tangible, such as a container; or imagined, such as a specific time interval for flowing material.

For multi-unit materials to be sampled, the sampling operation is divided into two steps. The first step is to select a certain number of sampling units; the second step is to sample each unit according to the variability of material characteristic values.
If the unit number of the overall material is less than 500, the number of sampling units is recommended to be determined according to the provisions of Table 1. If the unit number of the overall material is greater than 500, the number of sampling units is recommended to be

When sampling, the condition and sampling operation of the collected materials shall be recorded, such as the name, source, serial number, quantity, packaging, storage environment, sampling location of the materials, the number of samples and the quantity of samples, sampling date, name of sampling personnel, etc. If necessary, fill in the sampling report according to the records.

For routine general sampling, the above specification can be simplified.

10 Sample Container and Storage

10.1 Sample container

10.1.1 Caps, plugs or valves that meet the requirements must be washed and dried before use;

10.1.2 The material must not interact with the sample material and must not be permeable;

10.1.3 For photosensitive materials, the sample container shall be light-tight, or cover the container with a light-proof plastic bag.

10.2 Sample label

10.2.1 The name and serial number of sample;

10.2.2 Batch number and quantity of overall material;

10.2.3 Production units;

10.2.4 Sampling location;

10.2.5 The quantity of sample;

10.2.6 Sampling date;

10.2.7 Samplers, etc.

10.3 Saving and withdrawing of samples

The product sampling method standard or sampling operation procedure shall stipulate the storage amount of the sample (as a test-pre sample), storage environment, storage time and withdrawal method. For the saving and withdrawing of highly toxic and dangerous samples, in addition to complying with general regulations, relevant regulations on toxic substances or hazardous chemicals shall also be followed.

11 Measuring One-Time Sampling Inspection

Appendix A

(Informative)

Relevant Examples of this Standard

A.1 Example 1 (example for standard deviation is known in 11.2.1.1):

Given a batch of chemical raw materials, the distribution of a certain chemical composition is normal, and its standard deviation σ = 0.45 (%) is known. It is hoped that the average value of this chemical composition shall be no lower than 42 (%). If it does not exceed 41 (%), it can only be accepted with a small probability. And specify α = 0.05, β = 0.01, try to give a sampling acceptance scheme (n, k) that meets the above requirements.

Solution: it is known $\mu_1=42$、$\mu_2=41$、$\sigma=0.45$、$\alpha=0.05$、$\beta=0.01$。It can obtain from Table B.1 of Appendix B

$$\phi^{-1}(\alpha)=\phi^{-1}(0.05)=-1.64$$

$$\phi^{-1}(1-\beta)=\phi^{-1}(0.99)=2.33$$

Substitute into the formula, and obtain n=3.2 (by n=4), k=41.6; thus, the sampling acceptance plan is:

Collect 4 unit-products from the overall materials; detect and calculate the average value $\bar{x}$ (%) of its chemical composition, and obtain the judgment rules as follows:

If $\bar{x}\geqslant 41.6$, it is judged as qualified

If $\bar{x}<41.6$, it is judged as unqualified

A.2 Example 2 (example for standard deviation is unknown in 11.2.1.1):

In Example 1, if σ is unknown, 0.45 (%) is only a less precise estimate of it, and find the sampling acceptance plan.

Solution: According to the formula, n = 4.54 (by n = 5), k = -0.92. Therefore, the sampling acceptance plan is:

Take 5 unit-products from the overall materials, detect and calculate the average value $\bar{x}$ (%) of its chemical composition and the standard deviation s of the sample, and the judgment rule is obtained as follows:

If $\bar{x}+0.92s\geqslant 42$, it is judged as qualified

If $\bar{x}+0.92s<42$, it is judged as unqualified

A.3 Example 3 (example for standard deviation is known in 11.2.1.2):

A batch of steel plates for manufacturing chemical equipment, it is stipulated that when the average Rockwell hardness does not exceed 70, it is considered to be a qualified product; and if the average hardness is equal to 73, it is considered to be unqualified; and it is specified that α=0.05, β=0.10, and it is known that σ =2. Find a one-time sampling acceptance scheme (n, k) that meets the requirements.

Solution: it is known $\mu_2=70$, $\mu_1=73$, $\alpha=0.05$, $\beta=0.10$。 It can obtain from Table B.1 of Appendix B

$$\phi^{-1}(\beta)=\phi^{-1}(0.1)=-1.28$$

$$\phi^{-1}(1-\alpha)=\phi^{-1}(0.95)=1.64$$

Substitute into formula, obtain n=3.79 (by n=4), k=71.68; therefore, sampling acceptance plan is:

Take 4 blocks of samples from such batch of steel plates, determine its hardness; and calculate their average value $\bar{x}$ (%); and obtain the judgment rules are:

$$\begin{cases} \text{If } \bar{x}\leqslant 71.68, \text{ it is judged as qualified} \\ \text{If } \bar{x}>71.68, \text{ it is judged as unqualified} \end{cases}$$

A.4 Example 4 (example for standard deviation is unknown in 11.2.1.2):

In the above example, assume that σ is unknown, find the sampling acceptance plan.

Solution: According to the inspection data of recent batches of similar products, the σ value is estimated to be about 2.5. Substitute the data into the formula, obtain n = 7.26 (by n = 8) and k = 0.67. Therefore, the sampling acceptance plan is:

Take 8 blocks of samples from such batch of steel plates; measure their hardness; calculate their average value $\bar{x}$ and sample standard deviation s, obtain the judgment rules are:

$$\begin{cases} \text{If } \bar{x}-0.67s\leqslant 70, \text{ it is judged as qualified} \\ \text{If } \bar{x}-0.67s>70, \text{ it is judged as unqualified} \end{cases}$$

A.5 Example 5 (example in 11.2.2):

The quality indicator μ_0=1.40 (%) for the average content μ of a certain component in the material, it is required that the deviation from μ_0 be as small as possible; and the tolerance d_0=0.07. According to historical data, it is known that σ = 0.043, when $\mu=\mu_0$, the probability of being judged as a Class-1 product is 0.999; and if $|\mu-\mu_0|\geqslant 0.07$, it shall be judged to be downgraded; and the probability of misjudgment does not exceed 0.10. Find its one-time sampling acceptance plan (n, d).

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