

JIS

JAPANESE INDUSTRIAL STANDARD

**Sampling method of
industrial wastes**

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**In the event of any doubt arising,
the original Standard in Japanese is to be final authority.**

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Sampling method of industrial wastes

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1. Scope

This Japanese Industrial Standard specifies general matters relating to the sampling methods and reduction method of sample required for determination of the average quality of a lot when various tests intended for industrial wastes (hereafter referred to as wastes) are carried out.

Remarks 1. The industrial wastes that are referred to in this standard shall be sludge, slag, waste acid, waste alkali, combustion residue, soot and dust, waste solidified by concrete (hereafter referred to as concrete block), etc.

2. This standard may be applied to other industrial wastes than abovementioned and general wastes of similar shape.

3. Applicable standards in this standard are as follows.

JIS M 8100-General Rules for Methods of Sampling of Bulk Materials

JIS Z 8101-Glossary of Terms Used in Quality Control

JIS Z 8401-Rules for Rounding Off of Numerical Values

JIS Z 8801-Test Sieves

2. Definitions

For the main terms used in this standard the definitions in JIS Z 8101 apply, and the rest of the terms shall be as follows.

- (1) lot The waste of the same generation source which can be considered as almost the same properties and component when various tests are carried out. The quality of waste composing a lot is called as the lot size. However, in the case where those mixture is sampled, all the mixture is taken as one lot.
- (2) sub-lot A lot divided into a suitable quantity, as required. The quantity composing a sub-lot is called the size of sub-lot.
- (3) increment The waste of one unit quantity sampled, as a rule, by one motion of a sampler from a lot or a sub-lot. The quantity of an increment is called the size of the increment.
- (4) sub-sample The waste that is composed of several increments. The waste that is composed of several increments each of which has been crushed and reduced, as required, may be called sub-sample as well.

- (5) gross sample The sample obtained by collecting all increments or sub-samples from one lot in order to obtain the average quality of the lot. The collected sample of increments or sub-samples each of which has been crushed or reduced, as required, may be called gross sample as well.
- (6) sample reduction The preparation of a sample for measurement by gradually reducing the quantity of material collected as sample, when a sample is taken from bulk material.
- (7) sample preparation The preparation of an analysis sample or a sample for moisture measurement by means of crushing or reducing the material sampled from a lot, or taking a portion from some liquid.
- (8) sample for analysis A sample taken for the purpose of measuring the average quality of the component of a lot.
- (9) sample for measurement of moisture A sample taken for the purpose of measurement of the average moisture or solid mass ratio of a lot.
- (10) random sampling A procedure by which the sample is taken so that the unit quantity of waste composing a lot is contained in any sample with the same probability.
- (11) systematic sampling A procedure by which the sample is taken at a definite interval in regard to quantity, time, or space in transferring a lot. In this case, the integer number less than the value obtained by dividing the lot size by the sample size shall be decided as sampling interval. The first increment is taken out at random⁽¹⁾ in the first sampling interval quantity and hereafter, following increments are successively taken out at a specific sampling interval.

Example: An example of systematic sampling When 100 t of slag of 20 mm in the maximum grain size are transferred with a conveyor, the following systematic sampling is carried out.

It is necessary to sample not less than 30 increments in accordance with Table 2. Therefore, an increment sampling interval is as follows:

$$\frac{100}{30} = 3.3 \div 3 \text{ t}$$

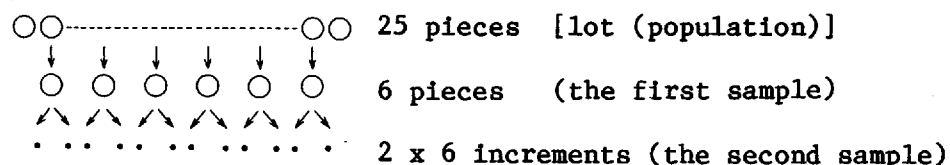
16 is obtained by drawing one line within 30 on the random sampling table. Therefore, the first increment is to be taken out when 1.6 t is moved, then, when 4.6, 7.6 91.6, 94.6, 97.6 t is taken away at the interval of 3 t, each one increment is taken. In this case, 33 increments are taken.

Note (1) The quantity of the first sampling interval is determined in accordance with the random sampling table or the like.

- (12) two stage sampling The procedure is as follows. Divide a lot into several parts (the first sampling unit). On the first stage, sample at random the said several parts. Then, as the second stage, sample at random each several increments (the second sampling unit) among them.

Example: An example of two stage sampling (In the case where a lot is composed of many trucks, containers such as drum cans, bags or the like, or concrete blocks) (See Fig. 1).

Fig. 1. An example of two stage sampling



Each 2 increments

When there are 25 drum cans containing soot and dust, take 6 drum cans in accordance with Table 3, and mark a number on the drum can. When 1, 3, 11, 13, 19, 25 are obtained by use of the random sampling table, sample those numbered drum cans as the first sampling unit. Then, sample at random each two increments, total 12 increments, from the sampled 6 drum cans by using a 15 ml or over scoop in accordance with Table 1.

- (13) stratified sampling The procedure is as follows. Divide a lot into several sub-lots (strata), and sample at random increments from each sub-lot. Generally, sample proportionally to a size (quantity) of the stratum. It is called size proportional stratified sampling.

Example: An example of stratified sampling One lot of total 8 tons of soot and dust is loaded on a 5 ton truck and a 3 ton truck. In this case, there are two trucks, which mean existence of two strata. It is necessary to take 14 increments according to Table 2.

From 5 ton truck, $14 \times \frac{5}{8} = 8.7 \rightarrow 9$ increments (see Table 3, Remarks 1) and from 3 ton truck, $14 \times \frac{3}{8} = 5.2 \rightarrow 6$ increments are needed. Therefore, 9 increments are taken from the 5 ton truck at random places and depths by using the scoop of not less than 15 ml, then 6 increments are taken similarly from the 3 ton truck, and total of 15 increments shall be made a gross sample.

- (14) stockpile [accumulated waste] sampling A sampling method to take increments from a random location or depth of a stockpile.
- (15) container sampling In the case where a lot is contained in bags, drum cans, tanks, or other containers, a sampling method to take the increments from these containers. This method is equivalent to (18).
- (16) pipe sampling When a lot flows in a pipe or a gutter, a sampling method to take the increments from the chute, flow or the like.

- (17) conveyor sampling When a lot is transferred with a conveyor, a sampling method to take the increments from on the conveyor or from its chute. In the case of being kept in a hopper, the increments are similarly taken during being discharged from the hopper.
- (18) vehicle sampling When a lot is on a truck or a freight car, a sampling method to take the increments while material is being handled from the truck or the freight car.
- (19) concrete block sampling A sampling method in which a test piece is prepared from the waste to be solidified by concrete and the test piece is sampled as an increment, or a sampling method in which a concrete block is sampled as the first sampling, and increments are taken therefrom after crushed.
- (20) hatch sampling In the case where a lot is on board, a sampling method to take the increments from the hatch or cargo handling appliances while the lot is being handled.
- (21) error A difference between the measured value and the true value.
- (22) precision Degree of dispersion, which is, for instance, presented by standard deviation. It is occasionally called the grade of precision.
- (23) bias A difference between the center (mean value) of distribution of measured values and the true value.
- (24) maximum grain size A size of sieve aperture by which the residual rate corresponds to approximately 5 %.

The size of sieve aperture in this standard shall, as a rule, comply with JIS Z 8801.

- (25) concurrent use of sample A sample is used for measurement of two or more characteristics by dividing the sample.

3. General matters

3.1 Outline of sampling method The kind of sampling is decided according to the condition of a lot and handling facilities in accordance with 4., and a gross sample or a sub-sample is made by taking increments. Then, sample reduction is carried out in accordance with 5.

Remarks 1. When the sampling method is decided, the experimental and technical knowledges being accumulated in the past are very important. When the process of waste discharging is under a controlled condition, sampling is rather easy. However, when dispersion of a process is large or the history of a lot is not clear, sampling becomes difficult and cares are needed. That is to say, prior to sampling it is important to grasp the daily situation of the process where the waste is discharged.

2. In order to improve sampling precision, it is preferable to increase the number of increments specified in this standard or to enlarge the size of an increment. Generally, the precision may be improved more by the increase of the sample size in sampling than the enlargement of an increment size.
3. In order to improve the precision of sample preparation, in the case of solid, it is preferable to make sample reduction after sufficiently mixing the increment that is so crushed as to let the maximum grain size be as small as possible.

3.2 Handling of sample

3.2.1 Sample container The container for taken sample shall be large enough to contain whole quantity of the sample, clean, rigid and stoppered securely or sealed firmly. Specially the container for sludge shall be made of the material being free from change in quality of the sample and adsorption, be of air-tight, no water leakage, no hygroscopic, no letting water evaporate, and be of no rusting property of the inside of it.

- Remarks 1. As the container for the sample for moisture measurement, a straw bag, gunny-bag, or wooden box is not suitable.
2. Since the sample of sludge, waste acid or waste alkali may be changed in quality, when the container made of such as plastics, glass or others is selected, cares shall be taken therefor.
 3. Since the sampling error from the sample container may be considerably large, sufficient mixing is needed when the sample is taken from the container.

3.2.2 Concurrent use of sample In the case where a test can be started just after sampling, the sample for analysis can be concurrently used as the sample for moisture measurement.

3.2.3 Packaging and marking of sample A prepared sample shall be sent, distributed or stored by hermetically sealing. Following information shall be, as a rule, marked on the package.

- (1) Name and lot name
- (2) Lot size
- (3) Site of sampling
- (4) Date of sampling (time, climate, and so on)
- (5) Sample number
- (6) Name of person in charge of sampling

- (7) Sampling method
- (8) Name of person who prepared the sample
- (9) Date of sample preparation
- (10) Other necessary items

3.2.4 Transfer and storage of sample

- (1) In the case where a sample is transferred, the sample container shall be hermetically sealed, be strongly packaged lest the container should be damaged, lest air tight should be broken, and lest alien matter should be mingled, and be marked as specified in 3.2.3. In this case, attention is needed not to give damage on marking and it is preferable to enclose the same label as the marking inside the sample container.

When the sample is stored, it shall be, as a rule, hermetically sealed and attention shall be paid at the storing place lest the sample should be influenced by temperature, direct sunshine, moisture and others. As for the samples liable to change the quality or to emit gas during the storage, the preparation of sample shall be performed quickly.

Further, for the sample which contains volatile chemical substances as the test subject, it should be preferably shielded from the light, be preserved at 0 to 10°C during transportation and storage.

- (2) The sample for measurement of moisture shall be hermetically sealed in the sample container to be transferred.

3.2.5 Precaution in sample handling When the sample is taken and prepared, the sample shall be prevented from mixing with alien matter by sufficient cleaning or the like of the machines and appliances to be used and further precaution shall be taken lest the sample should be deteriorated in quality.

3.3 Safety

- (1) In the case where a sample is taken in a container, a pipe, a manhole, a gutter, a pit, a tank, a hatch, etc., operate taking cares for shortage of oxygen, or toxic gas such as hydrogen sulfide or the like.
- (2) Wear clothes shielding exposure of the skin, put on a safety helmet, safety shoes, etc. in order to prevent danger.
- (3) For the sample with a fear of the oxidation, explosion, etc. in its transfer or reservation, take safety countermeasures not to happen dangerous accident and carry out quickly various waste tests.
- (4) After the completion of the test, take cares lest secondary pollution due to disposal of the sample should occur.

3.4 Rounding off of numerical value As described in JIS Z 8401.

4. Sampling

4.1 Classification of sampling The following sampling methods are considered according to the condition of a lot.

4.1.1 Stockpile [accumulated waste] sampling

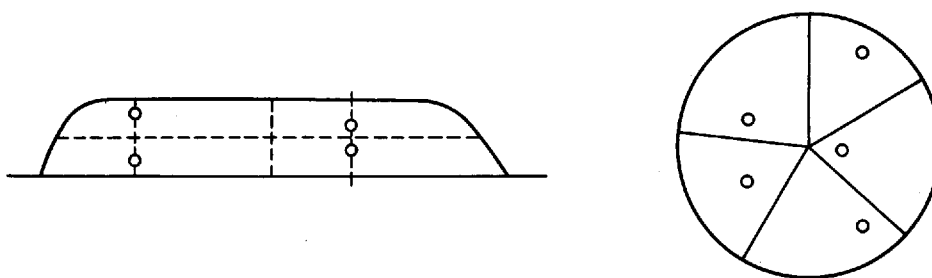
- (1) Increments shall be taken from random depth at random places of a stockpile. The whole quantity, taken by boring until reaching the bottom by means of a boring machine at the place chosen at random, may be taken as one increment.
- (2) The number of increments to be taken shall comply with Table 2. In the case of boring until reaching the bottom and making the whole quantity as one increment, the half of the least necessary number shown in Table 2 is sufficient.

- Remarks
1. It is preferable to apply proportional stratified sampling after stratifying the stockpile in each place and both horizontally and vertically.
 2. When increments are taken only from the surface of a lot under a still condition, they shall be, as a rule, not considered as the sample representing the mean property. However, the sample taken thus inevitably, is called a top sample. In such case, the abbreviation (T.P.) shall be appended.
 3. In the case where a sample is taken at random positions of each upper, middle, lower layer by using a sampler corresponding to the maximum particle size of a lot, the abbreviation (T.P.) may not be appended.

Example: In the case where, for example, 2 t sludge is stockpiled, increments shall be taken as follows.

At first, the stockpile is leveled down to make the top surface almost flat at the same height. Since the least sampling number of increments is ten in accordance with Table 2, when its height is not more than one meter, this trapezoidal stockpile is equally divided into five parts. Then take one increment respectively from upper and lower layers at the random portions of the divided stockpile, i.e., $5 \times 2 = 10$ increments in total. (See Fig. 2)

Fig. 2. An example of stockpile sampling



Mark of O means the location where an increment is taken.

When its height is more than 1 m, for example, this trapezoidal stockpile is equally divided into four parts. Then take one increment respectively from upper, middle and lower layers at the random portions of the divided stockpile, i.e., $4 \times 3 = 12$ increments in total.

4. Sampling from a stockpile as it is, is rather difficult since bias is easily induced. Therefore, it is generally preferable to carry out sampling by other sampling method in transferring, that is, while the stockpile is being formed or pulled down. As for the use of a tube sampler, see Remarks 4. of 4.2.1.

4.1.2 Container sampling or vehicle sampling When a lot is contained in containers, trucks, freight cars, tanks or others, increments shall be taken by stratified sampling method or two stage sampling method.

- (1) As a rule, increments shall be taken from the place decided at random on the new surface appeared while lot-handling.
- (2) Increments may be taken from the waste that is dropping while lot-handling by means of systematic sampling.

Attention, however, shall be taken not to induce bias, and checking experiments shall be carried out preliminarily.

- (3) Increments may be taken from lot-handling tools while lot-handling. In this case, however, after it is decided which lot-handling tools are chosen by systematic sampling method, increments shall be taken from random position of the tool.

4.1.3 Pipe sampling When a lot flows in a pipe or ditch, increments shall be taken from the flow or its chute by means of a systematic sampling method.

Remarks: When the flow of waste in a pipe becomes to be turbulent flow and is regarded as uniform state, it may be taken proportionally to the flow rate and continuously from the pipe.

Example: In the case of flow in a ditch of approx. 1 m width and 50 cm depth When 20 increments are to be taken per 1 h, if there is no oil floating on surface, an increment shall be taken successively from each of six layers which are consisted of vertical two layers and horizontal three layers.

For instance, when the sequence of Nos. 6, 1, 5, 3, 4, 2 is decided by casting die, at first from random position in the layer of No. 6, one increment is taken by means of a 200 ml sampling bottle. Hereafter, every three min, that is 60 min divided by 20, an increment is to be successively taken in the order of Nos. 1, 5, 3, 4, 2, 6, 1 ... and finally 4 l, that is 200 ml of 20 times, shall be taken as a gross sample.

Fig. 3. An example of pipe sampling

1	3	5
2	4	6

4.1.4 Conveyor sampling When a lot is being transferred by a conveyor, increments shall be sampled by a systematic sampling method from the conveyor or its chute.

- (1) Increments shall be taken from the specified place on the conveyor (designation of a sampling point) or from its chute.
- (2) When full width of the flow on the conveyor is taken as an increment, the following shall be adopted.
 - (a) In the case of sampling from the conveyor under working, increments shall be taken from the full width of the flow of waste that is fallen at the chute by using a sampler (see Fig. 4).