Limited Liability Company
"Plastics Recycling Plant "PLARUS"

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HIGH-VISCOSITY GRANULATED POLYETHYLENE TEREPHTHALATE OF THE TRADE MARK ClearPET"

Technical Specifications (TU)

TU 2226-004-93705408-2009

(entered first)

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The current technical specifications are aimed for high-viscosity granulated polyethylene terephthalate (short title PET) of the trade mark “Clear PET” (“Clear PET-A”, “Clear PET-B”, “Clear PET-V”) used for tare, dishes and other goods production of technical and domestic application and they form general specifications for its usage.

The polyethylene terephthalate is produced via noncrystalline grainer processing.

This is the example of the polyethylene terephthalate symbolic notation in the document and (or) when ordered:

“Clear PET-A, TU 2226-004-93705408-2009”.

1. TECHNICAL SPECIFICATIONS

1.1 Specifications

- The polyethylene terephthalate must be in accordance with the current technical specifications.
- The polyethylene terephthalate is produced in granules. The color and size of the granules are shown when a certain trade mark of the polyethylene terephthalate ordered.
- The quality indexes of the polyethylene terephthalate must be in accordance with the specifications in table 1.

Table 1

Indicator Name	Trade Mark Norm			Test Method
	ClearPET-A	ClearPET-B	ClearPET-V	
1. Physical configuration	Granules with a cylindrical form			According to p. 6.1 of the current TU
2. Characteristic viscosity, dℓ/g	0.78 – 0.82	0.74 – 0.78	0.82 – 0.86	According to p. 6.4 of the current TU
3. Melting temperature, °C	245-252			According to p. 6.5 of the current TU
4. Specific humidity %, no more than	0,4			According to p. 6.6 of the current TU
5. Granule size - length, mm - diameter, mm	2 - 4			According to p. 6.5 of the current TU
6. Ethyl aldehyde mass content, mln-1, no more than	2			According to p. 6.2 of the current TU
7. Hygiene indexes: - aqueous extract smell, score, no more than - aqueous extract aftertaste - color and opacity change of the aqueous extract	1 not allowed not allowed			According to p. 6.8 of the current TU

1.2 Marking

- Every item of the transport tare shall be labeled with the following data:
  - the manufacturing company and (or) its trade mark;
  - the product name and its trade mark;
  - the number of production run;
  - the number of package;
  - the own weight;
  - the production date (date, month, year);
  - the guaranteed storage life.

- Transport marking – according to GOST 14192 with manipulation signs and sign "Keep dry".

1.3 Package

The polyethylene terephthalate is packed in mild specialized containers of "Big-Bag" type and made of laminated polypropylene and polyethylene insertion.

By agreement with a consumer other types of package are allowed if they provide quality safety and quantity safety of the polyethylene terephthalate when transported and stored.

2 TECHNICAL SPECIFICATIONS OF RAW MATERIAL

The raw material for high-viscosity polyethylene terephthalate is:

- polyethylene terephthalate noncylindrical of the trade mark ROSPET – AM (technical specifications of seller TU 2226-003-56475614-2009);
- polyethylene terephthalate noncylindrical of the trade mark ClearPET (technical specifications of seller TU 2226-005-93705408-2009).

3 SAFETY AND ENVIRONMENT SPECIFICATIONS

3.1 Polyethylene terephthalate is solid, flammable substance. The output form – granules of a cylindrical form. The slurry spontaneous ignition temperature is 500 °C, melting temperature is 245-251°C [1].

3.2 At standard conditions polyethylene terephthalate is not toxic and does no harm to a human-being. Polyethylene terephthalate aerosol belongs to a third-class danger. The maximum concentration limit of polyethylene terephthalate aerosol in the air of the production area working space – is 5mg/m3 [2].

3.3 Polyethylene terephthalate processing must be implemented in accordance with safety specifications of GOST 12.3.030. [3], [4].

3.4 When processing conditions are not observed or when the temperature is higher than 300 °C, polyethylene terephthalate is destructed.

The maximum concentration limits (MCL) in the air of the production area working space and danger class of the polyethylene terephthalate main destruction products are given in Table 2.

Table 2

Name of noxious substance	MCL mg/m3	Danger class	Impact on body
Acetaldehyde	5.0	3	Irritates eye mucosa and breathing passages.
Carbon monoxide	20.0	4	Causes dizziness, noise in ears, asthenia.
Terephthalic acid (Benzol – 1.4 – dicarboxyc acid)	0.1	1	Irritates central nervous system, eye mucosa and respiratory apparatus.
Organic acids (calculated as vinegar acid)	5.0	3	Irritates the upper part of the respiratory apparatus.
Dimethyl terephthalate	0.1	1	Irritates eye mucosa and respiratory apparatus.

3.5 The concentration level of noxious substances in the air of the production area working space is defined in accordance with [5]-[9], microclimate parameters in accordance with GOST 12.1.005 and [10].

3.6 The production areas must be equipped with combined extract and input ventilation, and working space – with local ventilation. Both types of ventilation shall provide an allowed level of noxious substances concentration in the air of the production area. The ventilation system of the production, storage and additional areas –shall conform to GOST 12.4.021.

3.7 The crew working with polyethylene terephthalate must be supplied with the uniform made of cotton and personal protection devices: goggles, gloves, petal respirators made according to GOST 12.4.121 for emergency situations.

3.8 According to the fire safety level polyethylene terephthalate belongs to category B. The fire-extinguishing means are chemical foam, sand, water spray.

3.9 The production waste of polyethylene terephthalate (if not to be reprocessed) is utilized in accordance with [11].

3.10 Environmental safety is in accordance with GOST 17.2.3.01. Noxious substances emission into the atmosphere are in accordance with 17.2.3.02.

4 ACCEPTANCE RULES

4.1 Polyethylene terephthalate is accepted in production runs. A production run is the quantity of the polyethylene terephthalate of the same trade mark, presented for control and with one quality document. In the quality document the following data is listed:

- the name of the manufacturing company;
- the registered address for the manufacture;
- the name and trade mark of the product;
- the number of the production run;
- the own weight of the production run;

- the quantity of tare places in the production run;
- the production date (date, month, year);
- the results of the conducted tests or confirmation that the product corresponds with the current technical specifications;
- the identification of the current technical specifications;
- the guaranteed storage life.

4.2 Polyethylene terephthalate is put to acceptance tests according to indexes 1-6 in table 1. Index 7 is defined for material used to produce goods that contact food products.

4.3 When the tests results are not satisfactory even according to one of the indexes the sample tests are repeated for this index. The sample collection of the same production run is doubled. The tests results are applied on the whole production run.

5 SAMPLING

5.1 To control the production run quality 10% of the package items are selected but not fewer than 3 items. When the production run has fewer than 3 items samples are selected from every package item.

5.2 Snap samples from package items are selected by any sample taker embedded into the vertical centerline of the container. Not fewer than 3 snap samples from different levels (upper, middle and low) are selected out of the chosen package items. The mass of the snap sample must be no less than 0,2 kg.

5.3 The chosen snap samples are connected into the integrated sample, mixed carefully and manually. Then the average sample with the mass not less than 1 kg is produced by quartering method. The produced average sample is split up into 2 parts. One part is used for the analysis and the other is placed into a clean dry hermetic tare in which the following label is put or stuck; the product name, the number of the production run, the date of the sample selection. This sample must be kept in dry area as an arbitrary sample. In case of any disagreements in quality evaluation the arbitrary sample is stored for one year after unloading. The sample is carefully mixed before every analysis.

6 TESTS METHODS

6.1 The physical configuration according to GOST P 51965

The physical configuration is controlled visually without using any magnifying devices. The color is defined by comparing chosen granules with the specimen approved by both the manufacturer and consumer.

6.2 Granules size measurement

To define the granules size from the middle sample produced according to p. 5.3 100g of the product are chosen. After slashed granules picking, 5 granules of the maximum and minimum size are chosen out of this sample. Their size is defined by a beam compass (with the imprecision of no more than 0.1 mm). The arithmetical mean of 10 measurements is taken as a result. A slashed granule is a granule the size of which is 2 times larger than that of the given one.

6.3 Characteristic viscosity measurement

To define the characteristic viscosity the capillary method of viscometry is conducted according to ASTM D 4603-96.

6.4 Melting temperature and crystallinity level measurements

Melting temperature and crystallinity level are defined by the method of differential scanning calorimetry.

6.5 Moisture content measurement.

The moisture content is defined by the thermogravimetric method.

6.6 Acetaldehyde content measurement.

The acetaldehyde content measurement is implemented by gas chromatography.

6.7 Hygiene indexes measurement shall conform to GOST P 51695.

- **Identification of the aqueous extract smell and aftertaste**

The granules PET are rinsed with flowing water in a sieve with throughs of no more than 1.5 mm. The granules are placed in any glass hermetic container and poured with distilled water of GOST 6709. The split between the granules mass and water mass is 1g of granules per 25 ml of water. The execution time is 24 hours. The smell and aftertaste of the aqueous extract is defined according to GOST 22648, chapter 2.

- **Identification of the aqueous extract color change and opacity**

The granules PET are placed in a glass and are rinsed 3 times in a hot distilled water of GOST 6709 mixing the granules with a glass stick. Then the granules are taken to any glass hermetic container and are poured with distilled water again warmed up till 80°C. The split between the granules mass and water mass is 1g of granules per 25 ml of water.

At the same time the similar container is filled with the same amount of distilled water. Both containers are placed in a thermostat with the temperature 80°C. They are kept there for 4 hours. Then 50 ml of the extract and 50 ml of the audit sample are poured into 2 colorless glass cups; the color and opacity of the audit sample and the extract are compared visually.

7 TRANSPORTATION AND STORAGE

7.1 Packed polyethylene terephthalate is transported by all the types of transport in capped transportation means in accordance with the shipping rules applied to the used transportation means. Polyethylene terephthalate is not referred to as danger cargo and is not classified according to GOST 19433.

7.2 Polyethylene terephthalate is stored in a dry closed storage space on a pallet 5 cm above the floor and no less than 1 m away from heating devices. Polyethylene terephthalate can be stored in the form of dry-placed fill in siloes in open space if compressed air is given permanently and is dried to the dew point of -60°C. At the same time however it is important to take into consideration that polyethylene terephthalate is a hydroscopic material. So when stored in a no hermetic container (as a silo is not a hermetic reservoir) in open space it can absorb break-even moisture till the mass concentration of 0.4%. In a cold time of day the moisture can condense and accumulate in the silo target sleeve if there is no constant product selection. In this case we recommend to increase a drying cycle before extrusion molding.

8 APPLICTION NOTE

8.1 Before processing it is recommended to dry polyethylene terephthalate under the temperature of 160-180°C till the residual moisture 0.004 – 0.005%.

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9 MANUFACTURER‘S GUARANTEE

9.1 The manufacturer guarantees the correspondence of polyethylene terephthalate to the current technical specifications if the rules of storage, transportation and usage are observed.

9.2 The guaranteed storage life of polyethylene terephthalate is not less than one year from the production date.

9.3 When the guarantee storage life is expired polyethylene terephthalate is to be analyzed before every usage if it can be used in accordance with the technical specifications or not. If the quality indexes are appropriate the product can be used for direct application.

Attachment A
(informational)

REFERENTIAL SPECIFICATION DOCUMENTS

Identification and name of the specification document referred to		Section, point number. subpoint
GOST 14192-96	Cargo marking	1.2
GOST 12.3.030-83	CCBT. Plastic mass processing. Safety specifications.	3.3
GOST 12.1.005-88	CCBT. General hygiene requirements to the working space air.	3.5
GOST 12.4.021-75	CCBT. Ventilation systems. General requirements.	3.6
GOST 12.4.028-76	CCBT. Respirators SHB-1 “Lepestok” (Petal type), technical specifications.	3.7
GOST 12.4.121-83	CCBT. Industrial filtering gas masks. Technical specifications.	3.7
GOST 17.2.3.01-86	Environmental protection. Atmosphere. The rules of air quality control in towns.	3.10
GOST 17.2.3.02-78	Environmental protection. Atmosphere. The rules of noxious substance allowable emissions identifications at industries	3.10
GOST P 51695-2000	Polyethylene terephthalate. General technical specifications.	6.1 6.3 6.8
GOST P 6709-72	Water distilled. Technical specifications.	6.8
GOST P 6709-72	Plastic products. The methods of hygiene indexes identification.	6.8
GOST P 6709-72	Danger cargo. Classification and marking.	7.1

Attachment B
(informational)

Bibliography

[1]	Korolchenko A.Y. “Fire and explosion hazard of substances and materials and its extinguishing means. “ Reference guide in 2 parts.4.2, Moscow: Ass. “Pozhnauka”, 2000
[2] GN 2.2.5 1313-03	Maximum permissible concentrations of noxious substances in the working space air.
[3] SP #4783-88	Hygiene rules for synthetic polymeric materials and industries for its processing.
[4] SP 2.2.2.1327-03	Hygiene requirements to technological processes organization.
[5] Issue 27, p.2, MUK 5301-90	Methodological instructive regulations for gas chromatographic measurements of acetaldehyde, oil aldehyde and crotonic aldehyde in the working space air.
[6] Issue 24, MUK 4862-88	Methodological instructive regulations for photometric measurements of carbonic oxide (II) content in the working space air
[7] Issue 11, MUK 5855-91	Methodological instructive regulations for photometric measurements of terephthalate acid content in the working space air
[8] Issue 10, MUK 4591-88	Methodological instructive regulations for gas chromatographic measurements of vinegar acid and menthol content in the working space air
[9] Issue 17, MUK 2312-81	Methodological instructive regulations for gas chromatographic identification of dimethyl terephthalate, methyl acetate, methyl p-methyl-benzoic alcohol, p-methyl-benzoic aldehyde, p-methyl-benzoic acid, p-koilol and ditolyl methane in the working space air.
[10] San RR 2.2.4.548-96	Hygiene requirements to the microclimate of industries.
[11] San RR 2.1.7.1322-03	Hygiene requirements to the placement and neutralization of industrial and consumption wastes.