



COMUNICAZIONE INTERNA

Nr. I-38 Documento dedicato alle aziende associate

7/11/2023

IMBALLAGGI IN PLASTICA E AMBIENTE - LE NUOVE NORME EUROPEE PER IL RICICLO E LA RICICLABILITÀ

L'importante settore dell'imballaggio verrà regolamentato nel prossimo futuro da nuove norme relative alla progettazione ed al riciclo dei materiali utilizzati.

Grande impegno viene dedicato in seno all'ente normatore europeo per confezionare norme condivise rivolte ai materiali utilizzati per produrre imballaggi finalizzate a come progettare per riciclare nel modo più semplice il componente una volta aver raggiunto il fine vita e quali siano le prestazioni di questi rifiuti per essere riutilizzati per la produzione di nuovi manufatti.

Il gruppo di lavoro dedicato a quanto sopra riportato è il CEN/TC 261.

Gli obiettivi, il campo di interesse e la struttura sono così riassunti:

CEN/TC 261 è responsabile dell'elaborazione di norme relative alla terminologia, dimensioni, capacità, marcatura, metodi di prova, requisiti prestazionali e aspetti ambientali nel settore dell'imballaggio.

L'ambito di interesse copre imballaggi primari, secondari e per il trasporto e unità di trasporti, per qualsiasi materiale, forma, contenuto o sistema di distribuzione utilizzato.

CEN/TC 261/SC1	Packaging – Generalità
CEN/TC 261/SC2	Imballaggi primari
CEN/TC 261/SC3	Distribuzione e trasporto
CEN/TC 261/SC4	Degradabilità e riciclo organico e materiali da imballaggio
CEN/TC 261/SC5	Imballaggi primari e trasporto
CEN/TC 261/WG1	Gestione dell'igiene nella produzione degli imballaggi per contatto alimentare
CEN/TC 261/WG2	Sistema di aperture

Anche il settore dell'imballaggio in EPS avrà almeno due norme europee dedicate a:

- Design for recycling of plastic packaging – Guideline for EPS protective packaging and food contact packaging
- Recyclability evaluation process for plastic packaging. Guidelines for EPS protective packaging and food contact.

Relativamente alla norma rivolta al **design** si riportano due paragrafi della bozza di particolare interesse.



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4.2 General considerations for EPS packaging

EPS packaging should be designed in a way that the recycled material ideally can stay in the packaging loop. The different applications of EPS packaging need to be considered.

The following packaging components should be addressed in standard design for recycling guidelines.

- Color – important to address color of all layers
- Additives (material, %)
- Closures (material and type)
- Labels (material, inks and adhesive)
- Direct print (% surface coverage and inks)
- Additional components (material, attachments, coatings)

Besides the main packaging body made from EPS as well as closures and labels are important for functionality or providing information to consumers. Additional components can be necessary to enhance package performance.

However coloured packaging, direct printing and additives can reduce the recyclability of packaging or represent a pollutant for other EPS streams.

The following general principles should be followed when designing EPS packaging:

- Maximization of the proportion of EPS in the main packaging component, while minimizing any other ingredients compatibly with the technical requirements.
- If not needed for technical reasons avoidance of multi-material solutions and favoring of mono-material solutions.
- Minimization of printing.
- Minimization of colored packaging
- Avoidance of PVC components, metallic components, and non-NIR-detectable colours to enable correct sorting.



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4.4 Design guidelines for EPS food contact packaging summary table

	Full compatibility	Limited compatibility	Low compatibility
Material composition (amount of EPS in the packaging)	≥ 95% and all packaging features are FULLY compatible with recycling	≥ 90% and all packaging features are FULLY compatible with recycling	≥ 80% and all packaging features are FULLY compatible with recycling
Material	Monomaterial EPS – can be coated with PS foil		Any EPS packaging mixed with other polymer types, especially PVC, EPE, EPP, PUR
Colours	White, uncoloured	Grey, pink, blue, yellow	Any other colours
Additives	Additives that are unavoidable in processing (stabilizers, antioxidants, lubricants, nucleating agents, peroxides)		Mineral fillers, Any other additives (flame retardant, plasticizer, bio/oxo/photodegradable)
Closure & Lids	Closure system from EPS/PS	Other than from PS	Other than from PS not separable
Tamper evidence wrap	Wrap from EPS/PS	Other than from PS	Other than from PS not separable
Other components	PS		Tapes, any other material
Inks	Non toxic and non-bleeding inks (follow the EuPIA Guidelines)		Inks that bleed; Toxic or hazardous inks; PVC binders
Labels	No label Labels in PS	Non-PS labels manually peelable	Any other label
Direct printing	Laser marked; covering < 25% of the surface	Print covering < 50% of the surface	Print covering > 50% of the surface



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Per quanto riguarda la linea guida per la **riciclabilità** si riportano i seguenti paragrafi:

4.2 Applicable unit operations for packaging type

For *EPS protective packaging & food contact packaging* the following unit operations are applicable:

- Evaluation of innovative packaging solutions carried out by independent and accredited laboratories, simulating commercially operating recycling processes at lab scale, based on benchmark recommendations, considering the following steps:
 - o Evaluation of existent best available technology/state of the art sorting and recycling infrastructure
 - o For products not intended to be separately collected, a sortability evaluation by means of sensor-based recognition and others will be done
 - o Pre-treatment: testing of 1st grinding, compacting, 2nd grinding, washing, drying etc.
 - o Extrusion: pellet production and evaluation
 - o Conversion: address in what product the recyclate can be used
 - o Quality and performance evaluation

Step #	Unit operation	Process description
1	Control sample selection	<p>Before any testing, control material to compare the evaluated packaging needs to be selected. The selection of the control material needs to be approved by the expert pool.</p> <p>Note: If there is an EPS container known to be recyclable, consisting of the same base EPS virgin materials as the Innovation, except/apart from the specific ingredient/feature being evaluated, it can be selected as the control for this Protocol, with the approval of the expert pool.</p>



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2.1.	Pre-treatment: washing (only for food contact packaging)	<p>Control and innovation EPS samples are separately washed to test the impact on wet washing operations. The procedures take care of labels, adhesives, coatings, paper and printing present in the innovation EPS container. If none of those are present, go directly to step 2.2.</p> <p>Procedure: - Prepare the washing water in a vessel of 20L minimum with tap water. No added detergents or caustic soda.</p> <ul style="list-style-type: none"> - Heat the water at 40°C. - Wash innovation sample separately at a maximum ratio of 1:4 (5 kg sample vs 20l water) at 200 rpm for 5 minutes. Ensure that the integrity of the samples is not damaged. In the case some samples would be damaged, please provide pictures of the damages. - Rinse the samples in the strainer with cold running tap water and stir vigorously for 5 minutes using manual stirring bar. Then drain the material. - Take photos at each step. - Record the moisture content. <p>Save the washing and rinsing water separately for visual observation. Record the presence of suspended particles or fibres within the water as well as any water coloration. Check and record if the glue has been diluted after the rinsing or it remains attached to beads.</p>
2.2.	Pre-treatment: grinding 1 st	<p>Control and innovation samples are separately ground in order to further be compacted and extruded.</p> <p>Procedure:</p> <ul style="list-style-type: none"> - Grind separately control and innovation sample into fragments. - Store in separate containers. - Record the masses.
2.3.	Pre-treatment: compacting	<p>Control and innovation samples are separately compacted.</p> <p>Procedure:</p> <ul style="list-style-type: none"> - Analyse moisture content. Moisture content of samples should be lower than 8% before compacting . If moisture is above 8%, apply mild heating conditions (40°C without vacuum) to decrease the moisture content under the threshold. - Spread the EPS fragments collected after grinding in trays. - By using compaction, compress the EPS fragments up to have an average density around $0.3 \pm 0.05 \text{ g/cm}^3$. This represents approximately a 1:20 volume reduction of the material. Ensure that



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		the pressure is evenly shared on all the beads present in the tray. Report the pressure used to compact both control and innovative samples.
2.4.	Pre-treatment: 2 nd grinding	<p>After compaction, both control and innovative samples must be reground in order to obtain fragments that can be fed into a standard laboratory extruder.</p> <p>Procedure:</p> <ul style="list-style-type: none"> - Grind separately control and innovation sample. - Store in separate containers. - Record the masses.
3.1.	Extrusion: fragments blends preparation and composition	Once the control and innovation sample have separately gone through the pre-treatment steps, blending with the reference material will be prepared as per agreed test program. Standard blending ratios are 2, 5, 10, 25 and 50%.
3.2.	Extrusion: pellet production	<p>Both control and innovation beads can be mixed manually before extrusion for blends preparation. The beads will be dried at the same conditions with a desiccant bed drying unit or with hot air and extruded using co-rotative twin-screw extrusion at temperatures of 220 °C. The extrudate will be melt filtered (about 180 microns filtration).</p> <p>The extruder has to be cleaned before starting the extrusion process. This involves pulling the screws out of the barrel and then mechanically cleaning them with brass brushes until they reach a glossy finish. The barrel has to be also mechanically cleaned with round brass brushes from the mandrel to the run-out zone.</p> <p>Procedure:</p> <ul style="list-style-type: none"> - Dry samples with a bed desiccant for 1 hour at 80 °C or with hot air at 80 °C for 1 hour. - Extrude for first the sample at a temperature of 220 °C and with a 180 µm melt filter pack, for no less than 30 minutes. - Monitor the extrusion process for heat stability. - Rapidly cool the extrudate in a water bath and fed into a pelletizer. - The pelletizer speed has to be controlled to get a final pellet with a diameter of 3 mm. - Monitor pressure build-up during pelletizing and report significant differences. - Randomly collect the pellets to perform all the characterizations



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		<p>reported in Table 2.</p> <ul style="list-style-type: none"> - Change the melt filter pack between samples for visual examination. - Be sure to produce enough pellets for all the tests, including the conversion tests.
3.3.	Pellet properties evaluation	See table 1.
3.4.	Conversion: injection moulding	<p>The samples have to be tested for injection moulding to evaluate tensile properties, colours, as well as defects.</p> <p>Procedure:</p> <ul style="list-style-type: none"> - Dry the samples at 90 °C for 2 hours. - Mould the control sample at 210-260 °C to multipurpose specimens' type 1A according to EN ISO 527-2 and to plates with measures of about 60 x 60 x 2 mm³. - The run time is variable, but should be not less than 30 min. The specimens should be completely filled without any shrinkage, overspray, and inclusions. - Samples A.25 and A.50 (optionally A.100) have to be moulded following the identical operating conditions of the control sample. - Tag the plates produced by A.0, A.25 and A.50 (optionally A.100) as C.0, C.25 and C.50 (optionally C.100), respectively. - Small variations in operating conditions could be acceptable but have to be documented in the report. - For each material monitor the heat stability and the injection pressure. <p>Record properties' results in Table 3.</p>
4.1.	Converting: pellet blends preparation	Since the Protocol aims to assess the highest value recycle application, PS sheet extrusion will be a priority.
4.2.	Converting: pellet blends composition	
4.3.	Converting: sheet extrusion	



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Table 2: pellet properties evaluation

ASSESSMENT	STANDARD	BENCHMARK RECOMMENDATION
Bulk Density (kg/m³)	ISO 60	No less than 600 kg/m ³
Density (kg/m³)	ISO 1183-1	Between 1 and 1,08 g/cm ³
Melt Index (g/10 min)	ISO 1133-1 (200 °C/5kg)	Between 3 and 15 g/10min
Ash content (wt%)	ISO 3451-1 by TGA	A.25, A.50 and A.100 respectively lower than 1.5, 3 and 5wt%
Filtration (µm)	Visual inspection	No build-up on screen
Moisture (wt%)	ISO 11358-1	<1wt%
Impurities	Visual inspection	Record
Surface appearance	Visual inspection	Record
Volatiles (wt%)	10 g air-dried pellets exposed to 200°C for 10 minutes	±0,1wt% for A.25 and A.50 respect to A.0
Average Pressure (MPa)	Average Pressure it after extruding through 120 microns for the stable 30 minutes run time, compared to 100% control	No more than a 10% delta increase to A.0
Pressure Variation (MPa)	(ΔP_5 last minutes - ΔP_5 first minutes)	No increase higher than 25% compared to start in 30 min

Table 3: injection moulded parts properties evaluation:

ASSESSMENT	STANDARD	BENCHMARK RECOMMENDATION
Flexural modulus (MPa)	ISO 178 or ISO 24022-2:2020	No more than 10% delta decrease to A.0
Tensile Strength at Yield (%)	ISO 527 or ISO 24022-2:2020	No more than 25% delta decrease to A.0



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Tensile Stress at Break (MPa)	ISO 527 or ISO 24022-2:2020	No more than 25% delta decrease to A.0
Reflection Colour	(L*, a*, b*)	Record
Surface Appearance	Visual inspection	No black specks
Inclusions of extraneous material	Visual inspection	Record

In some cases a paper evaluation can be sufficient, in other cases testing is involved. This is to be proposed by the expert pool and to be approved by the steering group (will be in the agreement to be signed by the applicant);

After completion of the evaluation of plastic packaging, the plastic packaging is declared as:

- Recyclable;
- Limited compatibility with recycling;
- Not recyclable



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4.3 Testing table for EPS protective packaging & food contact packaging

The following features should be listed in a standardised data sheet for rPS to enable harmonised communication of recyclates properties. Standardised measurement procedures to determine the different properties and make them comparable are essential and need to be elaborated.

Technical properties

- Melt mass flow rate (g/10 min)
- Filtration level (μm mesh)
- Non-PS impurities (%)
- Moisture (%)
- Odour

Additional technical properties

- Vicat softening temperature
- Bulk density (kg/m^3)
- Molecular weight (MN/MW/PD)
- Ash content (%)
- Residual humidity (%)

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- Gas content
- Residual styrene (ppm)
- Halogens content
- Appearance
- Dust (%)
- Particle size determination (mm)
- Shape
- Presence of modifying additives (%)
- Volatile content (%)

AIPE partecipa all'attività normativa partecipando al gruppo di lavoro Mirror dell'Ente nazionale UNI.

Sarà compito dell'Associazione mantenere aggiornate le aziende associate.