VALUE ADDED PRODUCTS FROM RECYCLED PET BOTTLES

WASTE PET BOTTLES

CLEAN PET FLAKES

SHEET & FILM FOR PACKAGING

RECYCLED PSF / POY / PFY

RECYCLED PET RESIN PELLETS

NON FOOD BOTTLES

BLENDING WITH VIRGIN PET RESIN

BLENDING WITH ABS, PMMA, PC

Re-cycling of Post Consumer PET Bottles

PET is one of the few thermoplastics that can be Up-Cycled and not only Re-cycled. However, there are certain impediments when PET polymer is recycled. The PET resin is highly hydrophilic i.e. readily absorbs moisture from the surrounding air. When post consumer PET bottles flakes are recycled (extruded) the polymer resin undergoes Thermal, Oxidative & Hydrolytic Degradation leading to undesirable drop in mechanical & chemical properties such as

- The Intrinsic Viscosity (IV) of the PET polymer decreases leading to a drop in physical - mechanical properties
- Generates impurities like Aldehydes and other VOCs due to which it cannot be used further for food contact applications
- Leads to Dis-colouration or yellowing of the resin
- Formation of agglomerates & lumps
- The post consumer PET bottle flakes contain foreign matter & impurities that needs to be filtered out.

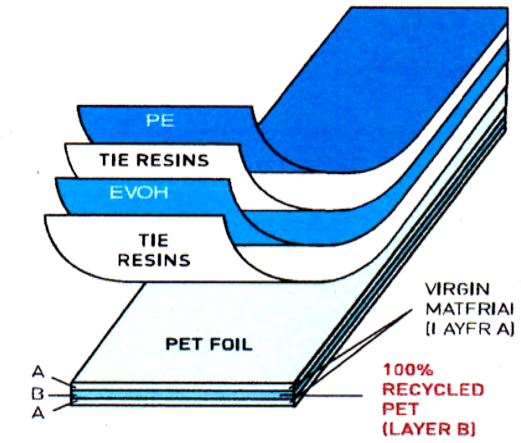
What is the way out? There are various methods & technologies available. Some of them are used together in conjunction to do the job as per end requirement.

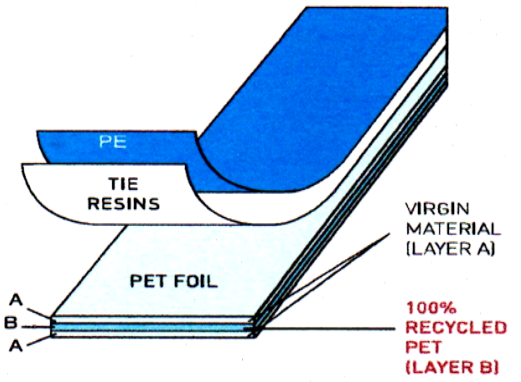
1) Pre-drying of PET bottle flakes to reduce moisture content
2) Vacuum De-gassing to remove moisture and VOCs during extrusion
3) Melt Filtration through Screens to remove agglomerates and solid contaminants
4) Adding chemicals called Chain Extenders to increase polymer IV
5) Liquid State Polycondensation (LSP) process utilizes the inherent capability of the PET polymer to condensate in the molten phase under vacuum that leads to an increase of IV. The high performance vacuum effectively decontaminates the material from harmful chemicals enabling it to be used for food contact applications.
6) Solid State Polycondensation (SSP) at elevated temperature and under vacuum of the recycled PET pellets to increase IV followed by thermal crystallization.

1) Extruded Film for Flexible Packaging of Foodstuff

Post consumer PET bottle flakes are directly extruded into multi-layer film by sandwiching Recycled PET layer between two outer layers of Virgin PET for food contact applications at much reduced cost. The clear PET film is laminated with PE and printed to produce flexible packaging for Atta, Rice, Pulses, Sugar, Spices, Snacks, Sauce, Namkeen, Confectionary etc. The material is supplied in roll form to the end users who use Form-Fill-Seal (FFS) to produce pouches / bags, fill the foodstuff and seal the pack. The material is also used for shampoo sachets and hand wash pouches. To produce packaging material for dairy products, frozen food, meat, seafood the clear PET film is laminated with barrier layers like EVOH or Nylon to extend shelf life and prevent spoilage of the food.

- Three layer co-extruded (A-B- A) film
- 15% Virgin PET + 70% R-PET + 15% Virgin PET (A-B-A structure)
- 120 to 1500 micron thickness





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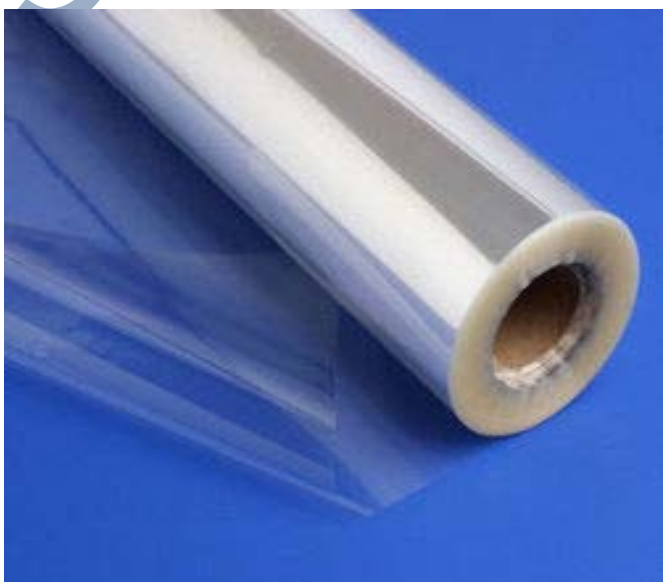
2) Extruded Sheet for Thermoformed Packaging Material

Post consumer PET bottle flakes are directly extruded to produce Clear PET Sheet which is further used for manufacturing thermoformed packaging material used in packaging of health care and cosmetic products, ready meal and snacks, dairy and bakery products, confectionary, consumer electronic items, fruits etc. The sheet industry has the ability to extrude multi-layer sheet and this enables them to sandwich a Recycled PET layer between two outer layers of Virgin PET particularly for food contact applications at reduced cost.

- Single layer or Three layer co-extruded (A-B- A) sheet
- 15% Virgin PET + 70% R-PET + 15% Virgin PET (A-B-A structure)
- 0.2 to 1.5 mm thickness
- A-PET / PET-G / C-PET Sheet for Thermoformed Packaging



3) Recycled PET Resin Pellets or Granules

Production of Recycled PET granules involves two steps

1. Conversion of waste PET bottles into clean flakes by grinding, hot washing, removal of contaminants (caps, labels, glue, organic waste etc.)
2. Conversion of flakes into recycled PET granules (pellets) by means of a special extrusion process with vacuum degassing to remove moisture & volatile contaminants and physical screen filtration to remove solid contaminants and agglomerates. Extruded material is pelletized by means of strand pelletizer.

Recycled PET granules produced have no discoloration, have low level of contaminants (aldehydes & VOCs) with minimal drop in Intrinsic Viscosity which is a measure of the length of polymer chains and hence physical – mechanical properties of the PET polymer.

Recycled PET resin is used for the manufacture of **Containers / Bottles for non-food contact applications** such as Liquid Detergent, Hand wash, Cleaning Solution, Shampoo, Hair Oil, Lotions, Cosmetics, Phenyl, Battery water etc.

These are manufactured by Injection moulding of Preforms and then Stretch Blow moulding of these into bottles and containers.

PET Strapping Tape can be produced from both recycled PET resin as well as post consumer PET bottle flakes. PET tape is used to secure boxes firmly held on their transport pallets, used for bailing of raw cotton etc.

Recycled PET resin is used for **Blending with Virgin PET** for various end applications like production of Polyester Oriented Yarn (POY), Polyester Filament Yarn (PFY), Polyester Staple Fiber (PSF), Extruded Sheet and Bottles & Containers. Recycled PET is blended with engineering plastics like ABS, PMMA, PC to reduce compound cost while maintain mechanical & optical properties.

4) Bottle Grade PET Resin (for food contact application, US FDA approved) from post consumer PET bottle flakes. The per capita consumption of PET in India is very low at 0.3 Kg as compared to a world average of 2.0 Kg. In India the use of PET bottles is growing at the rate of 7% per year. These are used for bottled water, carbonated soft drinks and juices. This presents a lucrative and growing business opportunity as greater usage of PET bottles means higher consumption of bottle grade PET Resin and greater availability of waste PET bottles for recycling.

Different technologies are available for the purpose, notably

- Liquid State Polycondensation (LSP) process that enables rapid increase in polymer IV and high level of decontamination for producing US FDA compliant food contact bottle grade PET resin pellets – either clear (APET) or crystalline (CPET).
- Solid State Polycondensation (SSP) and Thermal Crystallization. The extruded recycled PET resin pellets undergo SSP that involves application of heat under vacuum which increases the polymer IV and effectively decontaminates the material making it suitable for food contact applications with US FDA approval

In all the above process other waste materials like industrial waste polyester fiber, PET performs, PET sheet, PET trays, PET sheet thermoforming cuttings etc. can be used along with post consumer PET bottle flakes.

We are a leading Project & Technical Consultancy organization in the field of plastics and rubber recycling and have more than 20 years expertise in the field. We can prepare Techno Economic Project Report enabling you understand all aspects of the project and take an informed business decision, for Bank Finance and Govt. statutory approvals. We can provide project consultancy services like Selection and Sourcing of plant & machinery, Plant layout design, Processing & Compounding know-how, Installation & Commissioning, Trial running of the plant, Quality Control & Testing system, Market intelligence etc.

Regards,

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