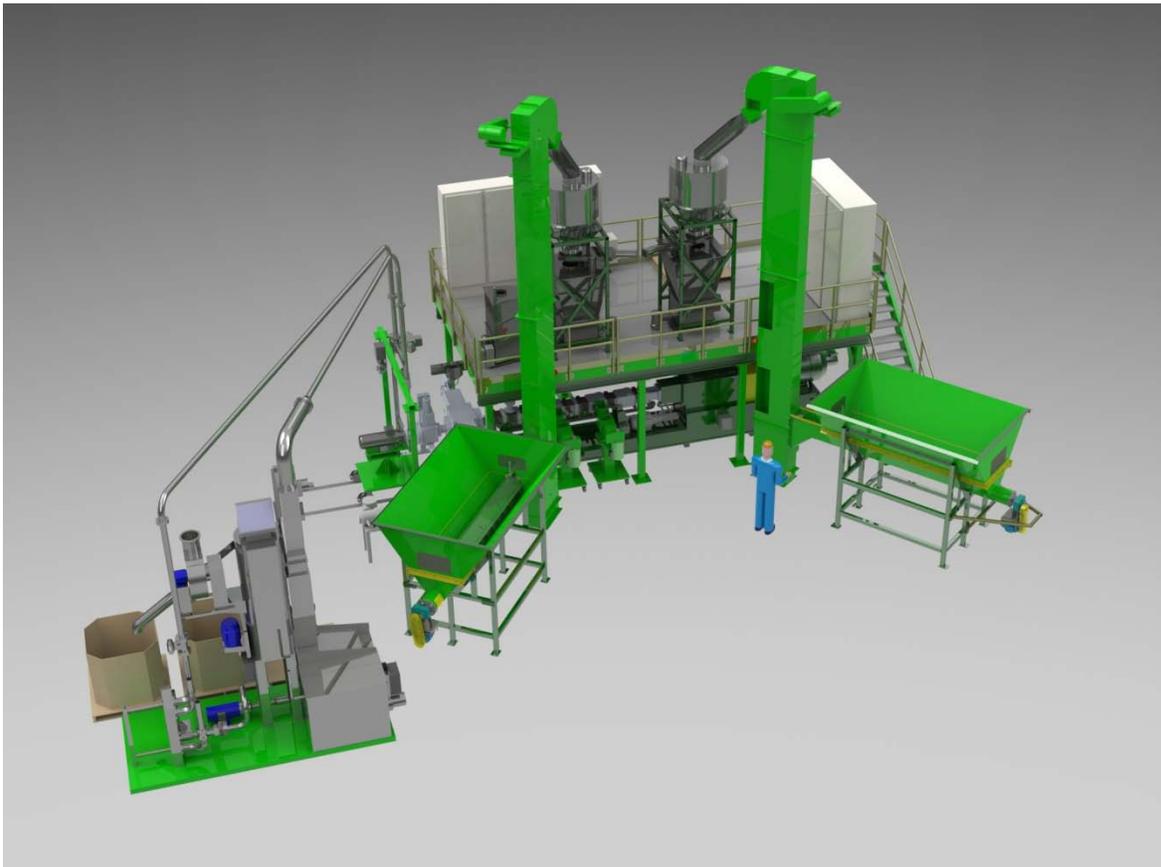


The XyCom TPE Blending System by RTI Cryogenics Inc.

The Patent Pending turnkey XyCom TPE blending system is a continuous compounding process where crumb rubber from recycled tires is chemically bonded at a molecular level with recycled post-industrial thermoplastics such as polypropylene (PP), high-density polyethylene (HDPE) and low-density polyethylene (LDPE) to produce a thermo plastic elastomer (TPE) without any chemical additives.

XyCom TPE can be blended to include from 20% to 80% recycled cryogenic rubber. XyCom TPE is the only TPE that is 100% recycled without using any additives.

The system produces very spherical pellets for injection molding applications. It can also be configured for extrusion applications.



The turnkey blending system has been developed through empirical testing to be a very efficient system that maximizes productivity while minimizing energy use, floor space and manpower.

The main components are a twin screw extruder, an underwater pelletizer, a chiller, a control system and a mezzanine with feeders.



The twin screw extruder is designed and configured to maximize the shearing force on the crumb rubber before it is mixed with the molten plastic in the extruder inducing cross-linking or chemical bonding between the two materials. The compounding temperature is determined by the processing temperature of the plastic (PP, HDPE, LDPE) just as the residence time is determined by the type of

plastic.

Note: A more technical explanation of the compounding process is that the rubber crumb and the thermoplastic resin are chemically bonded (cross-linked) by a mechanical/chemical process called dynamic vulcanization. Cross-linking occurs when the vulcanized rubber is subjected to several mechanical shearing forces in the molten state of the thermoplastic resin. The vulcanized rubber undergoes homolytic bond scission to form chains of free radicals which cross-link with the thermoplastic resin. Surface appearance and the mechanical properties of the resulting compound (XyCom TPE) are improved by using smaller sizes of crumb rubber, preferably 60- mesh.

The design of the individual components and their integration into a turnkey solution should be patentable because:

- there are over 40 individual elements on each shaft of the twin screw extruder that need to be in the correct order and the right configuration (length, pitch, stagger) or the system will not work
- the location/position in the twin screw extruder where the **rubber crumb** is fed into the extruder is critical to the process
- the location/position in the twin screw extruder where the **recycled plastic** is fed into the extruder is critical to the process
- a number of variables are controlled in the process and they are dependent on the type of plastic being blended with the crumb rubber
 - the compounding temperature in the extruder needs to be exact
 - the amount of residence time in the extruder needs to be exact
 - the variable speed of the twin screw extruder needs to be set and maintained
- the temperature of the die plate in the pelletizer is critical
- the size of rubber crumb to be blended is an important variable in the process and must be managed along with the other variables in a complete system

The blending plant utilizes the 60- output from an RTI Cryogenics' fine grind system to ensure that the proper inputs are used to maximize XyCom TPE's properties.

Colourant can be added during the compounding process to produce coloured XyCom TPE pellets. The colour range is muted due to the carbon black in the recycled rubber however.

A turnkey XyCom TPE blending plant with a fine grind system and three blending lines can produce approximately 80 million pounds of XyCom TPE per year.

The XyCom TPE blending process is being patented in all jurisdictions along with copyrighting of the XyCom TPE name.

More XyCom TPE product development will be undertaken to finalize solutions for blending cryo rubber crumb with ABS, PVC and PET plastics.

RTI Cryogenics is also looking at adapting the XyCom TPE blending process to develop a rubber activation solution (devulcanization) for crumb rubber using a proven chemically based batch process as the starting point for this exciting research.

A plan to set up a permanent lab is being finalized.



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