Additives for the Plastics Recycling Industry

EVONIK
Leading Beyond Chemistry

SOLUTIONS FOR CIRCULAR ECONOMY

TRANSFORMING WASTE INTO VALUABLE PLASTICS

Our additives help along the entire mechanical recycling value chain to convert plastic waste into plastic goods. During washing, separation and drying our additives can help to make recycling processes more efficient, resulting in significant energy savings and higher quality of recycled polymers. And during compounding our solutions improve processing and properties leading to competitive costs and quality, and enabling higher recycled contents.

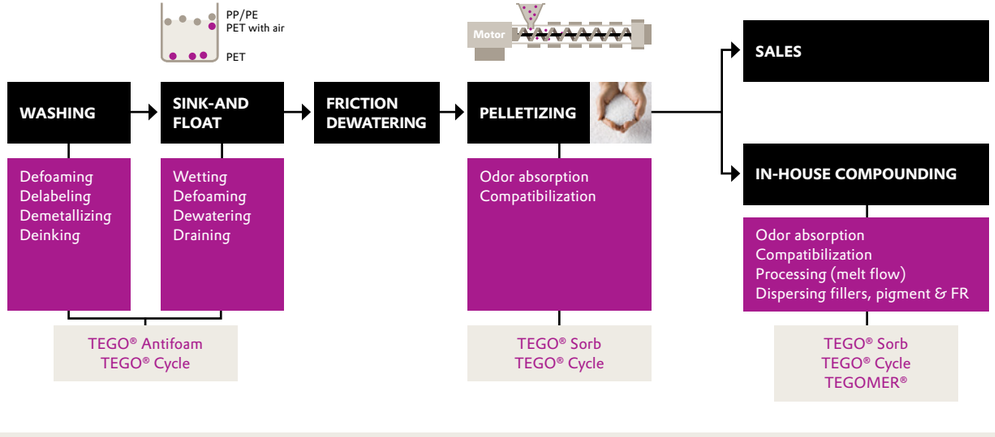
MECHANICAL RECYCLING PORTFOLIO

WET

DEFOAMER	WETTING AGENTS	DEINKING/DELABELING/ DEMETALLIZING/DEWATERING
• TEGO® Antifoam 4-94 • TEGO® Antifoam KS 6 • TEGO® Antifoam KS 53 • TEGO® Antifoam 2291	• TEGO® Cycle WA 111 • TEGO® Cycle WA 120	• TEGO® Cycle WA 111 • TEGO® Cycle WA 140 • TEGO® Cycle DW 210

DRY

ODOR ABSORBER	DISPERSANTS	PROCESSING AIDS/COMPATIBILIZER/ PERFORMANCE ENHANCER
• TEGO® Sorb PY 88 • TEGO® Sorb PY 50 PE • TEGO® Sorb PY 50 PP	• TEGOMER® E 525 • TEGOMER® P 121	• TEGOMER® H-Si 6441 P • TEGO® Cycle CP 310 • TEGO® Cycle CP 320 • TEGOMER® 6810 • TEGOMER® 6850



MECHANICAL RECYCLING PORTFOLIO

BENEFITS OF OUR WET & DRY STAGE SOLUTIONS

WET STAGE

TEGO® Antifoam 4-94
- reliable foam control and excellent long-term stability
- undesired effects associated with silicone-based antifoams (spotting, fish eyes) are eliminated in most applications
- exceeds customer requirements in recycling processes

TEGO® Antifoam KS 6
- self-emulsifying organic antifoam concentrate
- destroys foam or prevents foam formation
- foam control e.g. in process and waste water treatment

TEGO® Cycle WA 111
- wetting agent suitable for float-sink and washing processes of plastic recycling to improve the separation process
- highly effective surfactant for the deinking, delabeling and demetallizing of plastic waste
- solvent and silicone free
- outperforms conventional wetting agents due to low foaming behavior and fast surface migration

TEGO® Cycle WA 120
- extraordinary reduction of surface tension in aqueous solutions
- fast coverage of hydrophobic plastic surfaces
- non-ionic and solvent free product

TEGO® Cycle DW 210
- biodegradable dewatering aid
- reduces water content in plastic flakes after centrifugation or filtration
- lower energy costs for drying

DRY STAGE/COMPOUNDING

TEGO® Sorb PY 88 and PY 50 PE/PP
- malodor absorber with a key and locker principle
- not working with a flavor principle
- provides good heat stability in the compounding process
- especially suitable for polyolefins, rubber compound and recycled materials
- available as concentrate and masterbatch in PE or PP

TEGOMER® H-Si 6441 P
- multifunctional polyester modified siloxane
- improves polymer processing (e.g. mold fill/release, internal lubrication, rheology of polymer melt)
- improves bulk properties (e.g. impact and tensile strength, reduction of brittleness, hydrophobizing)
- improves surface properties (e.g. scratch and wear resistance, lower surface friction, higher surface gloss)

TEGO® Cycle CP 310 & CP 320
- used as a processing additive, as compatibilizer and for permanent modification of the polymer properties
- reduction of pressure and higher throughput by decrease of viscosity and lubrication
- prevention of melt fracture and shark skin effect
- improved mold release properties
- improves mechanical performance

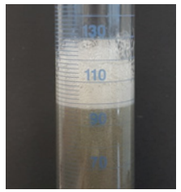
TEGOMER® E 525
- higher productivity and lower costs for filler dispersion
- less agglomerates and aggregates
- excellent clarity and reduction of speck formation in films or thin moulded parts
- increase of color strength

TEGOMER® P 121
- increase of color strength
- reducing costs through the reduction of the amount of pigments
- suppression of re-agglomeration in downstream processes

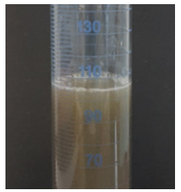
EVONIK ENABLES A CIRCULAR PLASTICS ECONOMY

SUCCESS STORIES OF WET STAGE SOLUTIONS

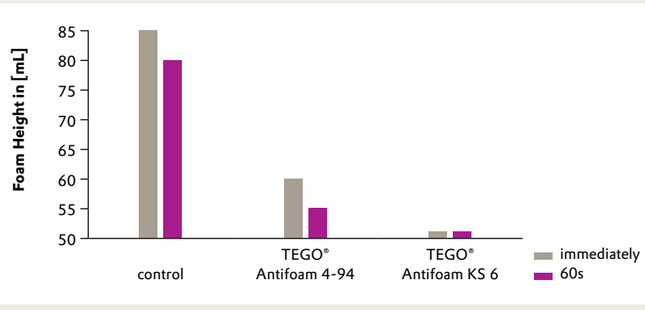
TEGO® Antifoams prevent foam e.g., in washing and floatation processes efficiently.



no additive



TEGO® Antifoam 4-94



FLOATATION

For additional wetting properties **TEGO® Antifoam** can be combined with non-foaming wetting agents such as **TEGO® Cycle WA 120** to facilitate separation of different kinds of plastics and/or foreign materials.

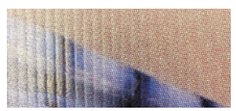
PET bottle/PP cap

PET flake with air bubbles floats next to PP flakes

WA 120 facilitates separation of flakes (no air bubbles)

DEINKING

Discoloration of the plastic counts for the efficiency of Evonik Additives. Inks differentiate strongly, so that a full removal is not always possible, but a significant improvement can be achieved thanks to **TEGO® Cycle WA 111.**



PP rigid

BOPP flexible

PP rigid

before deinking/after deinking

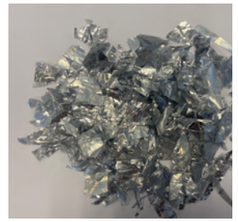
additive solution

DEMETALLIZING

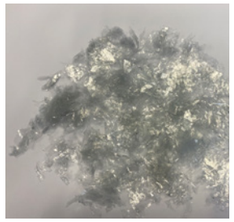
Metallization on flexible packaging is limiting the recyclability of the plastics and thus, need to be sorted out of the waste streams. Unsorted impurities of metallized plastics also limit the processing conditions of a subsequent washing process, as alkaline conditions lead to the formation of hydrogen gas upon presence of aluminum.

Metallized multilayer materials can be separated completely with the use of **TEGO® Cycle WA 111.** The additive quickly migrates into the interface between metal and polymer and weakens the interaction to enable an efficient debonding.

No Additive | Additive 1 | WA 111



No Additive



WA 111

DEWATERING

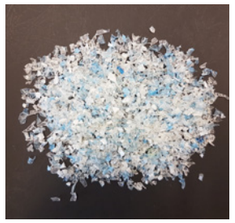
Shredded plastic materials after washing processes contain significant amounts of water, depending mainly on the polymer type, the flake/particle dimensions and surface properties.

With the help of **TEGO® Cycle DW 210** additives, the water content after centrifugation can be reduced up to 70%, compared to centrifugation without the use of additives.

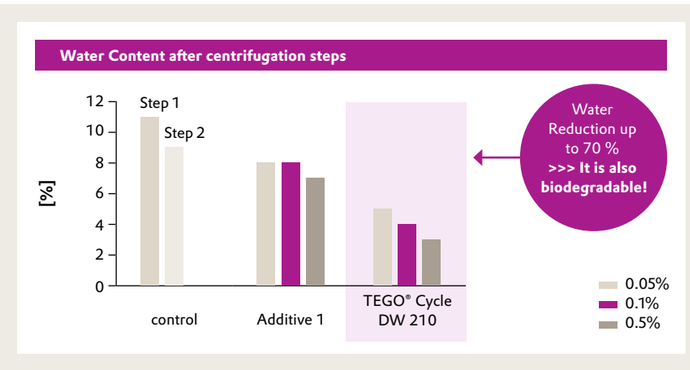
This results in a big saving potential in a consecutive thermal drying step or in weight reduction for transportation.

r-HDPE or r-PP Flakes contain 5–10% water without DW 210

r-LDPE Film contains 10–15% water without DW 210



r-PET Flakes contain 0.5–2.0% water without DW 210

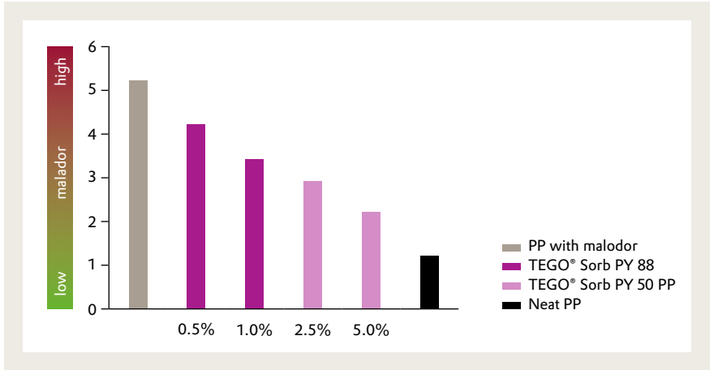


EVONIK ENABLES A CIRCULAR PLASTICS ECONOMY

SUCCESS STORIES OF DRY STAGE SOLUTIONS

MALODOR ABSORPTION

TEGO® Sorb reduces the smell in recycled polyolefins. **TEGO® Sorb PY 50 PE** and **TEGO® Sorb PY 50 PP** are even suitable for single screw applications directly in the recycling plant while pelletizing/granulation.



COMPATIBILIZATION

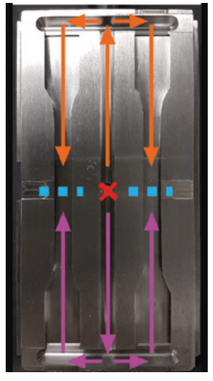
(rigid material example)

PP impurities in PE or PE impurities in PP generate insufficient recycling polymer properties which can be improved by the introduction ...of compatibilizers, such as **TEGO® Cycle CP 310** and **TEGO® Cycle CP 320.**

Mold with front conjunction to test weld line strength was used (see image – right)

r-HDPE specimen without additive

r-HDPE specimen with 2% TEGO® Cycle CP 310



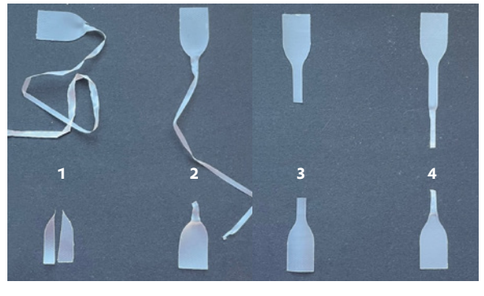
special mould with weld front line

COMPATIBILIZATION

(flexible material example)

Compatibilizers for the use in flexible application account for better elongation in mechanical testing. With **TEGO® Cycle CP,** multilayer systems containing EVOH and/or PA6 can also be improved.

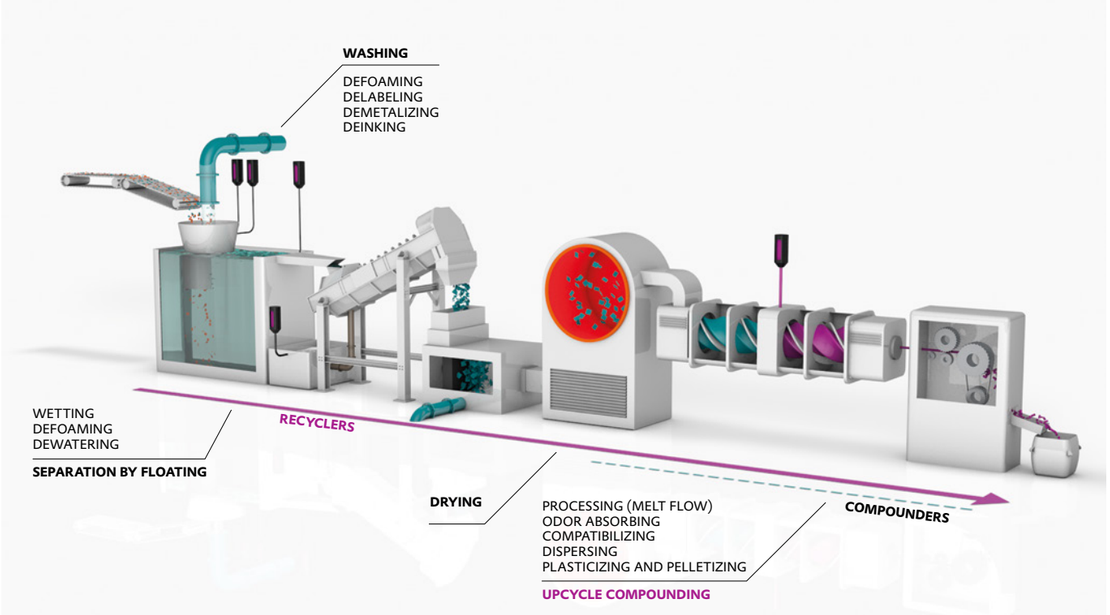
Specimen – multi polymer



mechanical test of multi polymer material in machine direction without (1) with TEGO® Cycle CP 310 (2); transverse to machine direction without (3) with (4) TEGO® Cycle CP 310

SOLUTIONS FOR A CIRCULAR ECONOMY

SCAN QR CODE FOR MORE DETAILS ON HOW TO TURN WASTES INTO VALUABLE PLASTICS



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