APPLICATION NOTE

COMPOUNDING AND MASTERBATCH

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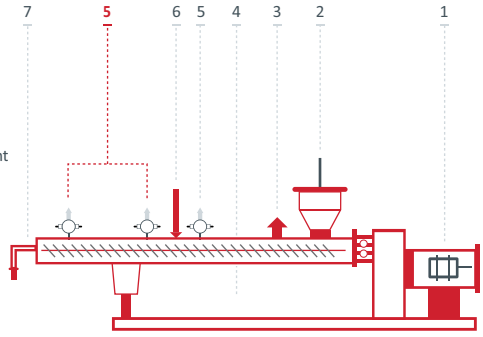
DESCRIPTION

Polymers are blended with a variety of additives and colourants to impart specific physical, thermal, electrical or aesthetic properties by the compounding process. Masterbatch contains polymers with a high concentration of additives or colorants for later dilution in the compounding process.

Compounding is done in several steps by premix, split-feed or colour-matching feed process. Virgin polymer in the form of pellets, powder and/or liquids are combined with additive(s) in an extruder. The melted compound exits the extruder which is cooled and cut into pellets, to be later used in plastic-forming processes such as profile extrusion, injection moulding, rota-moulding, blow moulding, co-extrusion, film extrusion, lamination, calendaring, roll coating, foaming etc.

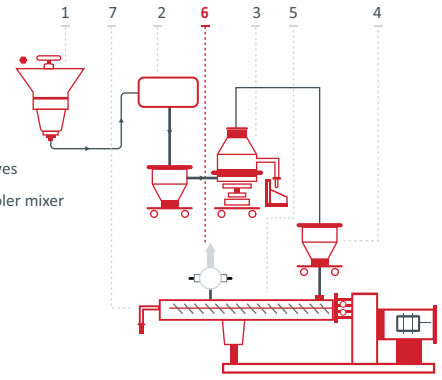
Usually, twin-screw extruders are preferred as they provide better mixing at lower melt temperatures. They are equipped with single or multiple vents for devolatilisation/degassing. Extruder size varies from tiny lab machines to the biggest extruders in the industry, running as much as 100 tons per hour.

Typical Set-up for Degassing



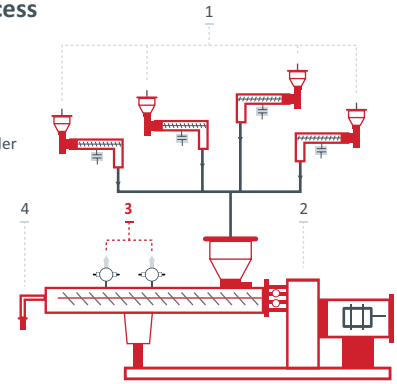
1 Motor
2 Hopper Feed
3 Atmospheric Vent
4 Melt Zone
5 **Vacuum Degassing**
6 Side Channel Feeder
7 Pelletizing

Premix Process



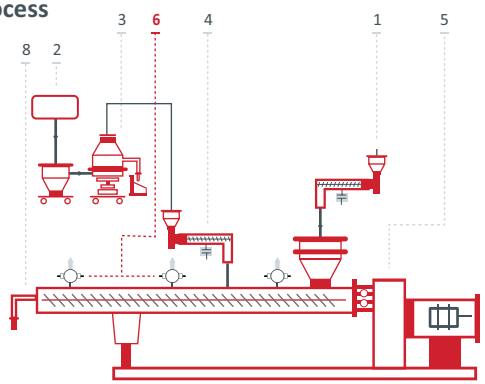
1 Polymer pellets
2 Wax, Pigments, Additives
3 Mixer. e.g. heater - cooler mixer
4 Volumetric feeder
5 Twin screw extruder
6 **Vacuum pump**
7 To pelletizer

Colour Matching Process



1 Metered Masterbatches feeder
2 Twin screw extruder
3 **Vacuum Degassing**
4 To pelletizer

Split Feed Process



1 Polymer pellets
2 Wax, Pigments, Additives
3 Mixer
4 Twin screw side channel feeder
5 Twin screw extruder
6 **Vacuum Degassing**
7 To pelletizer

COMPOUNDING AND MASTERBATCH

1. CHALLENGE

- Process gases condense and build up in the vacuum pump after a while which may also be caused by incorrect operation of the vacuum system. For the vacuum system to function without issues, the pump needs to be periodically flushed with appropriate solvents.
- Depending on the end product, there is often a need for flexible vacuum on extruders with multiple vacuum vent ports. Vacuum systems must be capable of providing flexible vacuum anywhere between 10–400 mbar reliably.
- Vacuum stability is important during masterbatch production as minute instability will lead to batch rejection.
- Compounding of recycled polymers such as PP, PE, PS, PA etc. generate sticky residual process gases which need to be captured by inlet filters before it enters the vacuum pumps.

3. MAIN BENEFITS

Individual compounding and masterbatch production plants will typically require non ATEX vacuum systems. But, larger polymer production companies manufacture compounds and masterbatches on site and may require ATEX vacuum pumping systems.

Dry vacuum solutions deliver reliable vacuum performance for degassing stages and therefore help to maintain the thermal stability of additives, pigments and resins. There is no waste water generation and vacuum levels are easier to control.

2. SOLUTION

GXS – easy integration with customer's control and automation, 0.1–400 mbar vacuum for high quality plastic production.

EDS – modular system for easy systemisation, quick pump down for degassing large extruders with multiple degassing zones, 0.01–400 mbar.

EXDM – optimised for extruder degassing, rough vacuum pumping levels 50–500 mbar.

SUCCESS STORIES

German Extruder OEM market leader for compounding and masterbatch production lines with GXS250 MD+

List of additives compounded with polymer for masterbatch or compounding:

- Antioxidants
- Antistatic Agent
- Blowing agent
- Colourants (dyes)
- Colourants (pigments)
- Coupling Agents
- Curing Agents
- Fillers
- Flame Retardants (inorganic)
- Flame Retardants (organic)
- Heat Stabilisers
- Nucleating Agents
- Plasticisers
- Polymeric Impact Modifiers
- Slip Promotors (inorganic)
- Slip Promotors (organic)
- UV and other weather stabilisers
- Viscosity aids

List of commonly used polymers for masterbatch or compounding:

- Polyethylene (PE)
- Polypropylene (PP)
- Polystyrene (PS)
- PA(Polyamide)
- EVA (Ethyl vinyl acetate)
- ABS (Acrylonitrile butadiene styrene)
- SAN (Styrene Acrylonitrile)
- PC (Polycarbonate)

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