

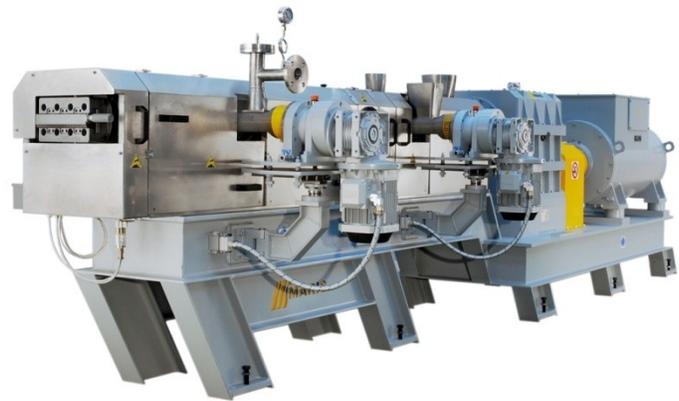
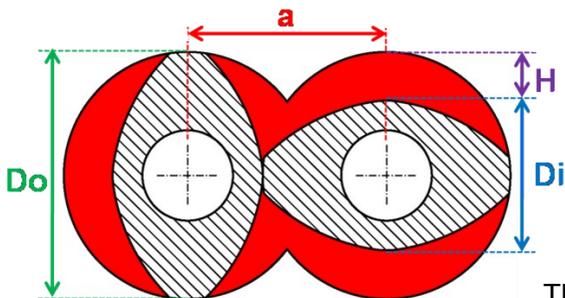
MARIS / The New Frontiers Of Masterbatch

Maris, Advanced Solutions

SINCE ITS INCEPTION IN 1962, MARIS, MANUFACTURER OF CO-ROTATING TWIN-SCREW EXTRUDERS, HAS ALWAYS BEEN A LEADING INNOVATOR IN THE RESEARCH OF NEW, STATE-OF-THE-ART APPLICATIONS FOR ITS PRODUCTS.

WITH THE AIM TO PROVIDE THE CUSTOMERS WITH THE WIDEST RANGE OF CHOICES, EVERY MECHANICAL COMPONENT OF THE EXTRUDER IS ENTIRELY MANUFACTURED

IN-HOUSE. MARIS IS INDEED ONE OF THE FEW COMPANIES IN



THE WORLD THAT IS CAPABLE OF SUPPLYING CO-ROTATING TWIN-SCREW EXTRUDERS WITH THREE DIFFERENT D/d RATIOS: 1.55, 1.65 AND 1.78

$$H = D_o - a = \frac{D_o}{2} \left(1 - \frac{D_i}{D_o} \right)$$

$$\dot{\gamma} = \frac{\pi \cdot D \cdot v}{H} = \frac{2\pi \cdot v}{1 - D_i / D_o}$$

v = screws speed (s^{-1})

MASTERBATCHES PRODUCTION

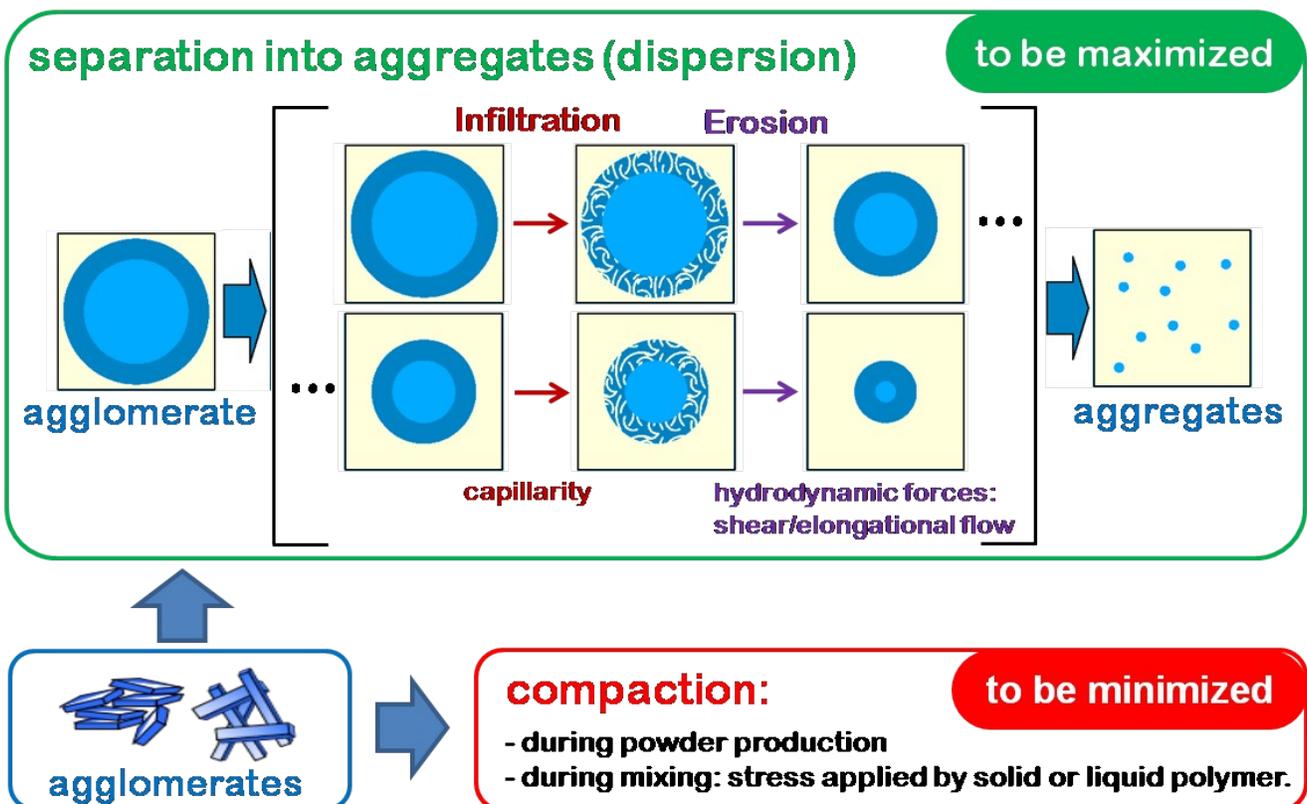
The Importance Of The Choice

The concept of Masterbatch encompasses an extremely wide family of polymer-based concentrates, being them related to colours, additives or fillers.

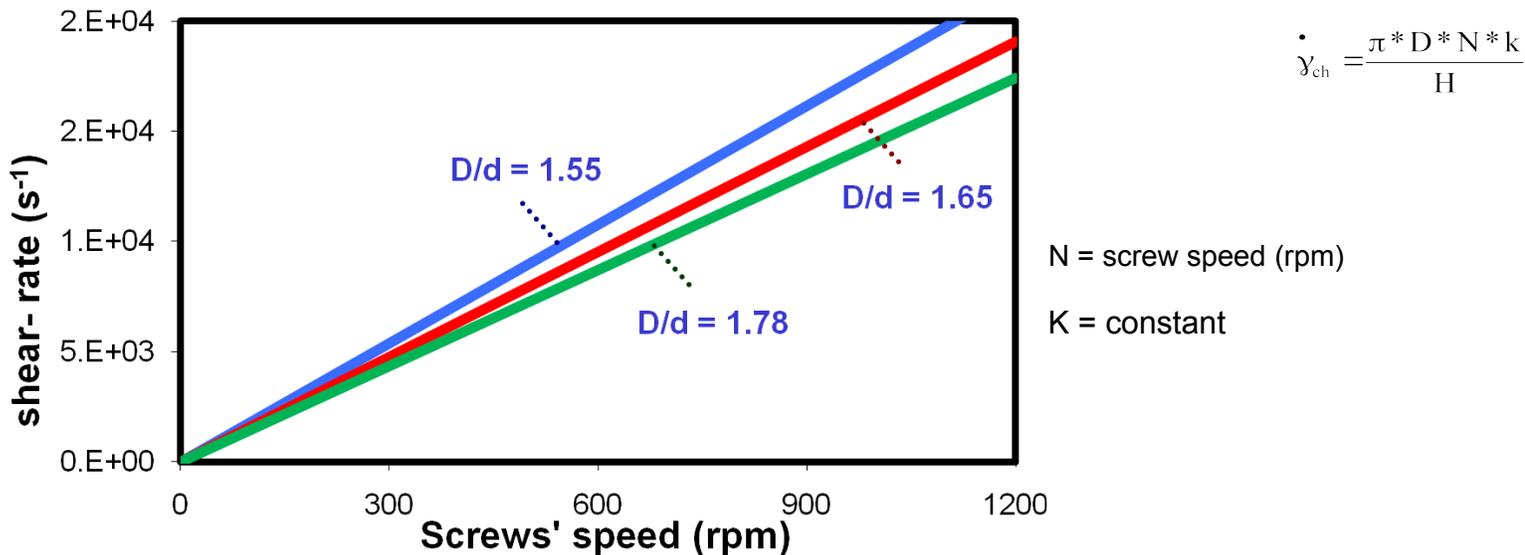
The components, of organic or inorganic origin, added to the matrix share the characteristic of existing in form of agglomerates. A high quality Masterbatch implies their dispersion in aggregates, with dimensions the most homogeneous as possible and a correct distribution inside the polymer.

	Nanocrystals	Aggregates	Agglomerates
Typical dimension	nm	0.01-1 μm	10-100 μm
density	very high	high	low
Cohesive Forces	Chemical (very strong)	Van Der Waals (quite strong)	Van Der Waals (weak)

The dimensional reduction and homogenization is obtained through the effect of a mechanism of intrusion/erosion created by high shear fields and elongational rate during the working phase. With such flow fields, it is absolutely necessary to avoid the compaction of the dispersed phase, which can occur during the process and causes the re-formation of agglomerates.



Each substance to be additivated at the matrix differs and can therefore require a different process. This can be achieved in several ways with the co-rotating twin-screw extruder. Considering the different requirements of the materials to be processed, the Masterbatch can be improved by means of various methods, the most efficacious being the change in the geometry of the screw channel. This can be accomplished using special elements, but also by means of a suitable D/d.



All extruders can produce Masterbatch. Taking advance of the decennial experience at MARIS, it is possible to diversify their use by exploiting their geometry in function of the materials to process. It is in fact suggested to use:

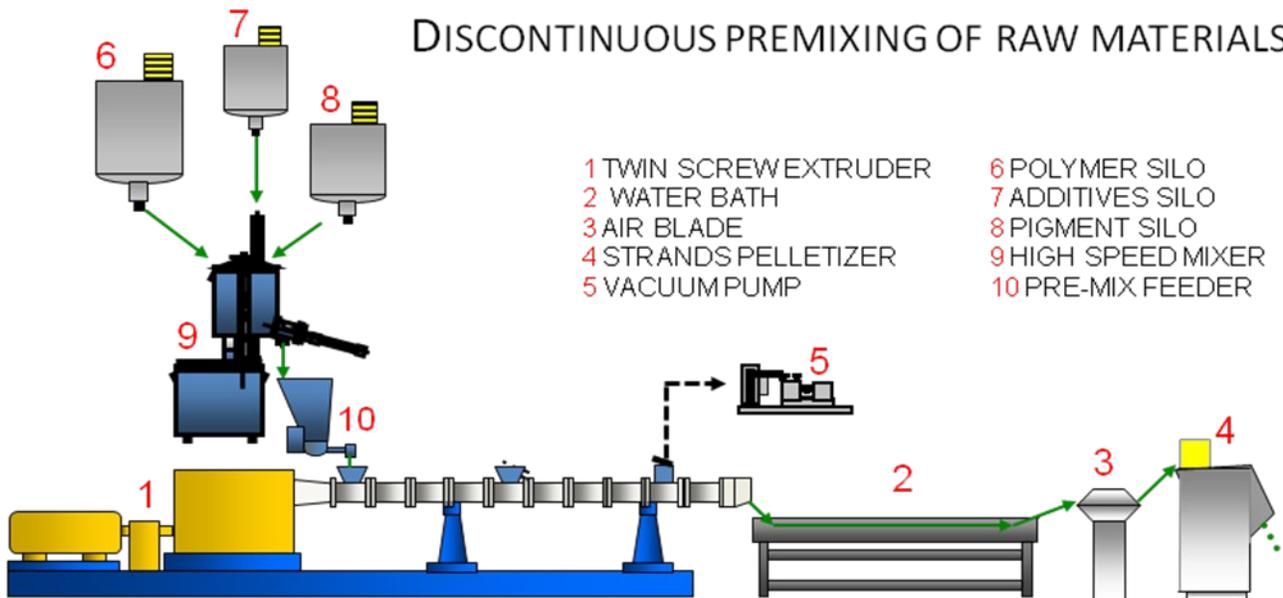
- Extruder D/d 1.55 (High Shear-Rate) when the formulation or the type of pigments requires a high shear-rate or when it is difficult to obtain a good dispersion due to the low quality of pigments.
- Extruder D/d 1.65 (Medium Shear-Rate) for high quality pigments or when it is acceptable a low dispersion level.
- Extruder D/d 1.78 (Low Shear-Rate) when the formulation or the type of pigment requires a delicate processing. It is also possible to use these machines when the concentration of the dispersed phase is high or in case it has a low bulk density.

	1.55	1.65	1.78
<i>Monopigment inorganic</i>	+	++	++
<i>Color masterbatch</i>	++	+	--
<i>Monopigment organic</i>	++	+	--
<i>Fluorescent</i>	+	++	+++
<i>Perlescent</i>	+	++	+++
<i>Filled</i>	+	++	+++
<i>White TiO₂</i>	+	++	+
<i>Carbon Black</i>	++	++	++
<i>Additives</i>	++	+	--
<i>Flame Retardant</i>	+	++	+

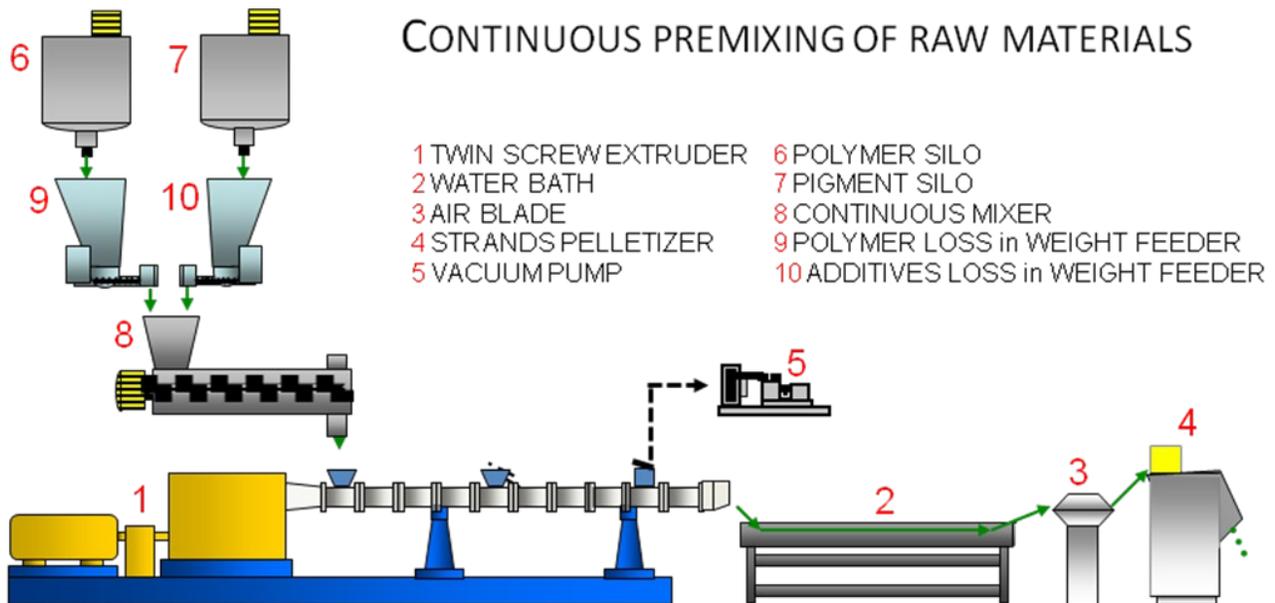
For the production of Masterbatches it is fundamental to define the most suitable feeding layout. The decision ultimately depends on the level of investment, but also on the quality required.

- Raw materials discontinuous pre-mixing: solution aimed at reducing the engineering costs or to produce, on the same equipment, a number of different formulations.
- Raw materials continuous pre-mixing: solution which exploits a single feeding point on the extruder. It is suggested to produce large quantities of material, with a limited number of formulations, while maintaining the quality of the batch mixing.
- Raw materials split feeding: solution that is economically more expensive, but unquestionably more advantageous in terms of output and, in a number of cases, also in terms of quality. It is preferable when the equipment is operated exclusively for a single class of products.

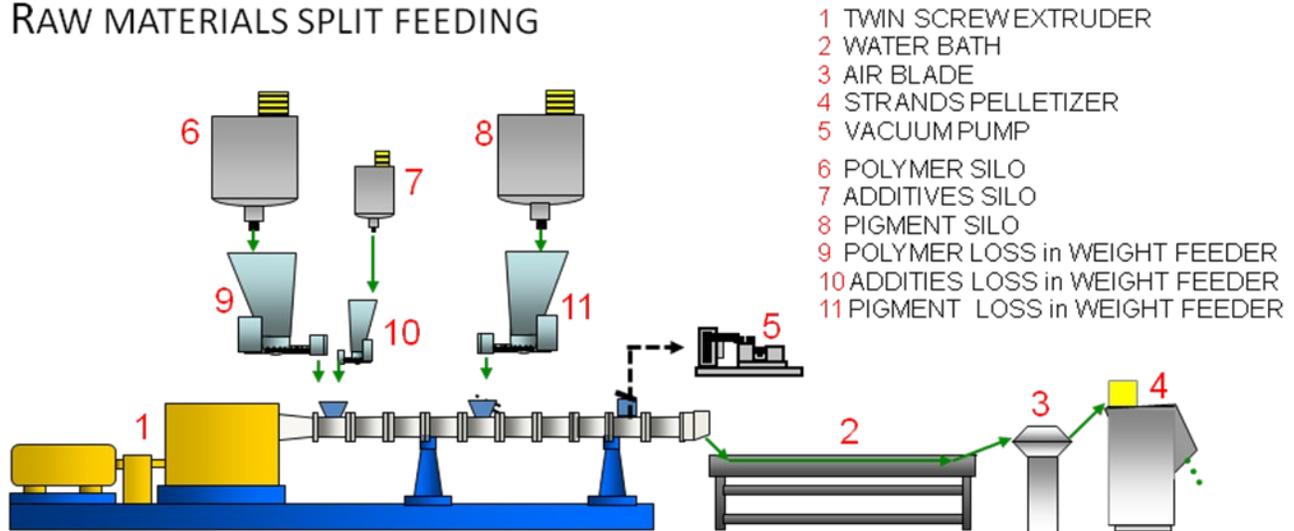
DISCONTINUOUS PREMIXING OF RAW MATERIALS



CONTINUOUS PREMIXING OF RAW MATERIALS



RAW MATERIALS SPLIT FEEDING



On-line Filter Test®: MARIS' Real-Time System to Monitor the Production

How many times does it occur that materials are produced and then reprocessed, because of the impossibility to evaluate simultaneously their non-compliance in terms of dispersion quality? How often an inconstant feeding implies several hours of extrusion process before the problem arises? For these very reasons, MARIS has conveyed its knowledge on the analyses of concentrated Masterbatch, carried out in the company's state-of-the-art Technological Center, thus introducing and industrializing an instrument bound for the on-line control over the dispersion rate. By using an particularly limited quantity of material, thanks to a user-friendly touch-screen instrumentation, it is possible to know in real-time the quality of the material exiting the extruder die. This patented technology dramatically cuts down time, money and material waste.

