PERP Program
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Chem Systems' Process Evaluation/Research Planning program has published a new report, ***Polymer Compounding (99/00S2)***.

Polymer compounding, simply stated, is the activity of mixing a base resin with some type of color, additive, or another resin. Rarely are base resins consumed “as is.” Rather, the base resin is compounded to impart the desired performance or color for the end user’s

finished fabricated product. Sometimes compounding is employed to reduce the cost of a resin system so that the end user is provided with a more economical product.

Masterbatch, or concentrates, represent a different type of polymer compound; they contain a high loading of color or additive and are never used “as is.” Rather, masterbatch itself is added to the base resin to impart the desired color or performance. In a sense, masterbatch may be viewed as a polymer additive, which was produced by compounding. For the purposes of this report, a compound is defined as a mixture of polymer and ingredient(s) in specific proportions to give a defined result or product. This is typically a separate production step, independent of polymer polymerization.

The compounding industry structure is among the most complex of any sector of the chemical industry. This is a direct result of the poor structural features of the industry, including low investment hurdles, few patent or other technical barriers, and the need to be very responsive on a local level. These features have all served to encourage new entrants into the business in virtually all parts of the world.

Since many polymers must be either colored or otherwise modified prior to fabrication, the activity of compounding generally began as an obligation of the resin supplier, and indeed remains with the producer in many of the engineering thermoplastics. However, over time, new entrepreneurial entities entered the compounding business and became increasingly competitive, particularly for the commodity polymers, giving rise to a separate group of companies, with a distinct part of the total polymer value chain increasingly dominated by a set of independent companies.

With the continued evolution of the industry, the segmentation and characterization of the marketplace has become increasingly difficult, and is aggravated by the entrepreneurial

nature of most participants. One approach to segmentation is on the basis of participant-independent (a firm not affiliated with a resin producer), captive (an affiliated entity of a resin producer), or fabricator with compounding operations.

Economics were developed for three “families” of compounding equipment: conventional twin screw, continuous processor, and high torque twin screw. For each family of equipment, economics were developed for five different sizes. These five sizes span the range of compounding equipment presently used commercially in industry. Capital costs for the high torque lines are about 10-15 percent higher than the capital cost for the similarly sized conventional twin screw line. This additional capital is to offset changes in the power train.

Compounding rates vary widely depending on the polymer used as well as on the additive system. The economics developed in this report are for coloring ABS, producing a product which is about 95 percent high impact ABS and the remainder colorants and other additives.

From our analysis it is evident that compounding costs decrease dramatically with the larger line sizes, particularly in the areas of overhead costs and capital charges. The economics for the smallest line for each type of equipment are not that competitive, and thus these lines are used mainly in producing small production runs. Although the economics favor the largest lines, the volumes associated with a minimum run size are substantial, and are typically found only with the largest volume compounded products. Consequently, the 133mm twin screw and #9CP are used mainly by suppliers as part of the resin production process.