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Manufacturing Paint and Coatings

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The manufacture of paint or coatings is a physical process that seldom involves significant chemical changes. Clear coatings, such as varnishes, are made by mixing specific ratios of resin binders with volatile solvents, which may include water. This is done using a mechanical agitator in a mixing tank. Once mixed, the batch is pumped through a filter and packaged for sale. When opaque (white or colored) paint is manufactured, the process is the same as for making varnish except that pigments are first dispersed in a portion of the vehicle. The batch is finished by mixing the balance of the vehicle into the pre-dispersed pigment/vehicle mixture. Virtually all paint production employs the batch process, with continuous processing being quite rare. Figure 1 shows the steps in the paint manufacturing process.

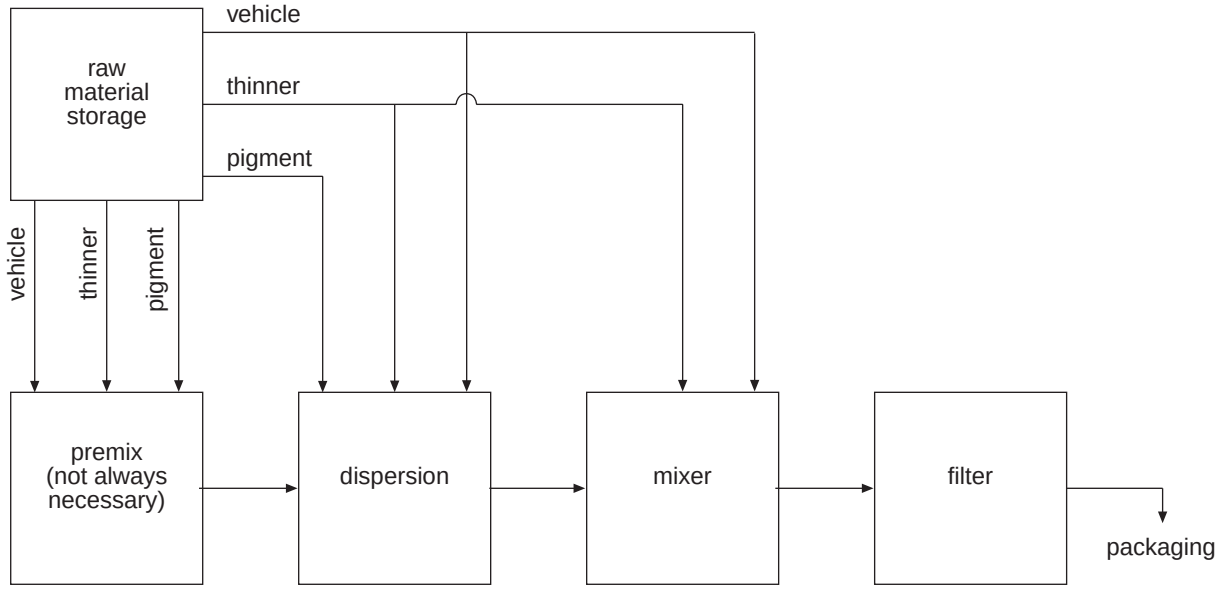

Figure 1: Paint manufacturing process

Although the basic process is simple, its details must be carefully designed in order to produce each different paint product, to adapt the process to the characteristics of different ingredients, and to achieve the desired product performance. In order to obtain consistent performance from a product, procedures must be rigidly followed as batches are made.

The pigment dispersion step is a critical one in the paint-making process. Each dry pigment particle is actually a cluster of many smaller particles; the objective is to separate them from one another so that the surface of each small particle can be wetted with the vehicle and the particles can be evenly distributed throughout the paint. This is accomplished by applying powerful mechanical forces using dispersion machinery of several different designs. The simplest machine is a high-speed disperser, which is simply a shaft with a disc-like toothed blade on one end. It may be visualized as a huge soda-fountain milk-shake mixer. When the blade is spun at high speeds in the viscous pigment/ vehicle mix, shearing forces are produced at the surfaces of the blade. This machine is used when the

dispersion is easily achieved; for more difficult dispersing situations, more powerful equipment is required. Often it is necessary to make a premixed paste of pigment/vehicle using a high-speed disperser. This paste is then fed into one of the other types of dispersion machinery.

Once dispersed, pigment particles have a tendency to associate, or flocculate, into loose clusters or to settle into a hard cake. To prevent these processes from occurring, each dispersion must be stabilized. In water-thinned paint, stabilization is usually accomplished by imparting like electrostatic charges to pigment particles so that they repel each other. In solvent-thinned paint, stabilization usually depends on steric hindrance, with molecules of binder adsorbing onto the pigment particle surfaces to form immobile envelopes around the particles. These envelopes of binder act as a physical barrier to particle association. Special additives are often necessary to enhance dispersion stability.

The filtering step provides a way to remove any undispersed particles or other extraneous material that might have been introduced to the batch. One often-used method employs vibrating screens with 40–300 mesh per square inch as strainers to separate the unwanted materials from the paint. Another filtering method allows the paint to drain through felt bags. Sometimes the paint is passed through cylindrical cartridges of porous material; here the paint filters through the walls of the cartridge, leaving the separated material in the container. Once filtered, the paint batch is packaged.

References

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