



Powder vs. Waterborne Coatings: A Comparison from an Environmental Perspective

by Rich Saddler

At first glance, comparing powder coatings to waterborne coatings is like comparing an apple to an orange. They are both round and grow on a tree, but is there more to it than that?

Waterborne coatings, along with powder coatings, were developed years ago to compete with traditional solvent-based coatings. The goal was to reduce the amount of volatile organic compounds (VOCs) from the solvents in the paint, while increasing the percentage of resin.

Waterborne coatings are a product family which accomplish much of the first goal while still providing the benefits of liquid paint. Liquid paint represents the highest

volume of industrial coatings applied with approximately 85 percent of the market share. Liquid paint is versatile, can be applied in a wide variety of environments, and across a wide range of substrates. However, liquid paint still is typically between 45 and 75 percent resin (depending on the specific product). Several other components in the formulation are necessary for keeping the product fresh for a reasonable amount of time to account for transport and storage stability.

PCT FEATURE

When the percentage of solids and transfer efficiency during application are factored in, the actual film-forming content of a gallon of liquid paint is reduced to less than 60 percent. The rest of the components in that gallon end up in the filters or are exhausted into the atmosphere.

On the other hand, powder coatings are, for all practical purposes, 100 percent solids. As much as 96 percent of one pound of powder coat paint purchased from your paint supplier can be applied to the final part that the customer is purchasing. This percentage is based on the efficiency of the paint system and the reclaim capabilities of that system. However, this improvement in utilization percentage can come with some constraints as compared to liquid coating. For example, the temperatures required to cure and crosslink powder coat paint can be elevated to a level that some substrates cannot withstand. Color matching or adjusting the paint at the point of application is also an advantage of liquid.

Which coating fits?

So how does a manufacturer decide which type of coating is best for their product and operation? One of the first questions one should ask: Is it capable of being powder coated? Years ago, when powder technology was in its infancy, that was an easy question to answer. If the substrate you were coating was not metal, then powder coating was not a viable option and liquid coating was the answer. However, with the developments in lower curing and ultraviolet curing

resins, the answer to this question is not so simple and should be investigated thoroughly. Products that were not powder coating candidates before, in many cases are now being powder coated successfully across the country and the world.

Calculate Total Cost

If your product is a candidate for powder coating, how do you determine whether or not it is an economical choice in terms of dollars and cents? Comparing the cost of a gallon of paint to a pound of powder is not the final answer. The true applied cost of a coating incorporates a wide range of variables which should be included in your evaluation to get the total picture. Variables such as environmental rules and regulations, coating application efficiency, coating reclaim, disposal of waste from the entire coating operation, energy requirements, employee health and safety, and equipment costs all need to be taken into consideration.

Energy Requirements

Energy required to cure the two different coatings is a factor to evaluate from an environmental as well as financial perspective. Typical cure curves for thermoset powder coatings are in the range of 350 degrees Fahrenheit for 20 minutes. Depending on the size and quantity of your product, which determines the size of your cure oven, the energy required to heat up this space and maintain it at temperature can be expensive. Energy sources available to heat this space



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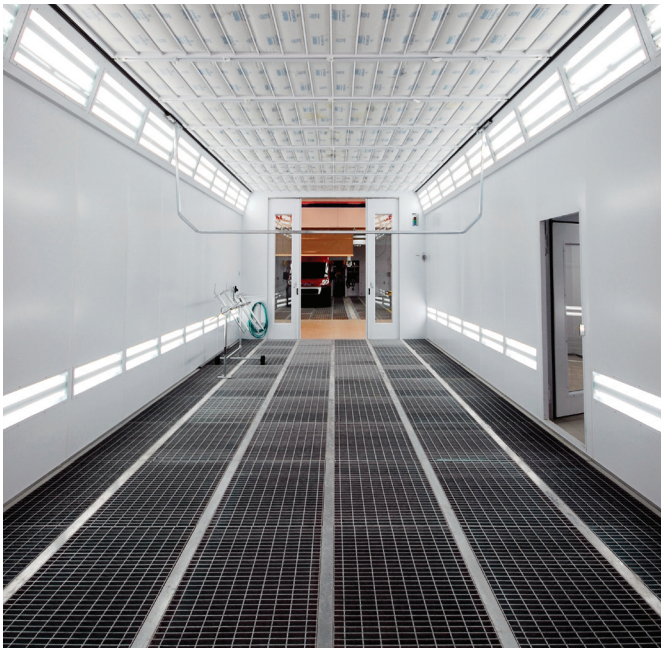
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should also be considered. Natural gas, steam, liquid propane, and electricity are some of the typical energy sources used in industrial ovens. Each has a different cost per thermal energy that should be calculated to determine costs for your particular application.

Waterborne liquid paint can be cured at ambient temperatures or elevated temperatures depending on the desired appearance, formulation and application. The more important factor is to monitor the relative humidity of the curing space to allow for the water to evaporate out of the coating before the resins harden. If the surface of the film hardens before all of the water is evaporated underneath, sagging, popping, or a milky discoloration of the film can occur. Reducing the relative humidity in the curing process is achieved with dehumidification systems or increased temperature which reduces the relative humidity. Your paint supplier will recommend the process best suited for the paint applied.

Although the percentage of flammable components in waterborne paints is small, National Fire Protection Association (NFPA) standards for safety require the exhaust rate of liquid ovens be higher than powder ovens. The warm contaminated air that is exhausted must be replaced with fresh air that needs to be heated to operating temperatures, increasing energy costs. These additional energy costs can be significant, especially in cold climates. In addition, the spray booth for a liquid coating must be exhausted to the



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atmosphere and the volume of air exhausted needs to be made up with fresh, outside air to ensure proper ventilation. The air replenishment adds to the cost of energy.

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Color Changes

Application equipment has experienced continuous updates and improvements. Historically, liquid coating technology has been capable of changing colors in seconds, while powder coating color change times were evaluated in minutes. With new technology developed by powder coating equipment manufacturers, powder color changes can now be performed in seconds with multiple colors available to the painter with the push of a button.

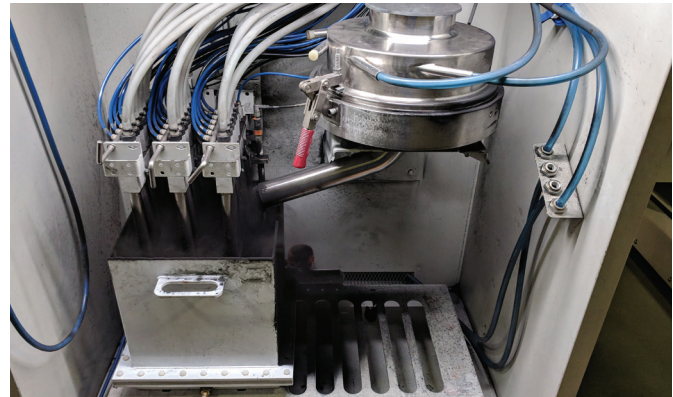
Reclaim

Powder coatings have two basic methods of paint reclamation. A collector module dedicated to the reclaim color enables all of the overspray paint to be collected, processed through a sieve to remove any contaminants and then placed back into the feed hopper for a very high rate of reclaim capability. The drawback to this method is a separate collector module, and the associated equipment, is required for each reclaim color. As the number of colors increase, the payback of the required equipment for each color decreases for the lower volume colors.

The other option for reclaiming powder is cyclone-based technology. Powder-contaminated air from the booth is drawn through a cyclone system where the powder particles are separated from the air flow, and the reclaimed powder is returned to the feed hopper. This technology allows for an unlimited number of colors to be reclaimed but the

efficiency of the system ranges from approximately 80-95 percent of the oversprayed powder.

The overspray of waterborne coatings can also be collected and resprayed. Overspray paint is collected utilizing different types of baffle systems. Although cleaning the baffles when required is a rather messy process, reclaim of liquid coatings is a proven technology. The collected paint is typically filtered to remove any solids which would cause plugging of the gun tip. It is then sprayed out as a primer coat on other parts. Depending on the product, system, and customer requirements, recovering waterborne paint



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overspray could result in 50 percent of the oversprayed paint being reused.

Solvent

In waterborne coatings, most of the solvents are replaced with water. There can also be other minor components of alcohols and other solvents which are required for successful application and meeting customer coating requirements.

One of these commonly used components of waterborne coatings is glycol ether. EPA Title V Permit has identified certain glycol ethers as being a Hazardous Air Pollutant (HAP). Title V also states that if the plant/factory/facility meets certain threshold limits, these HAPs must be reported to the proper agencies. The local, state, and federal rules of HAPs is a long and complicated document. Further complicating the issue, the HAPs requirements for a waterborne system in one municipality can be completely different than a system located in another location. It is highly recommended that you contact your Local Authority Having Jurisdiction (LAHJ) to review your individual system. Regardless of your system size and complexity, consulting with an environmental engineering firm specializing in the rules and regulations in your location is suggested.

With the near 100 percent solids nature of powder coatings, most powder coating systems can be installed with little to no permit requirements from the local air emissions regulatory agency. Again, regardless of your system size and complexity, an environmental engineering firm should be consulted to determine what, if any, work needs to be completed with the LAHJ.

Waste Paint

Even with technology capable of reclaiming both waterborne liquid and powder paint, there are still situations where the excess paint cannot or is not recovered for reuse. The disposal of this excess waste paint is another variable that needs to be included in your comparison of coating options.

Excess powder coat paint has options for a second life. For non-visible surfaces, the surplus paint can be used as a coating to protect the surfaces from the elements. Excess powder material can also be reworked and re-tinted to be sprayed on other components. And, using leftover powders as an inert filler to other products has also been developed in certain applications.

However, should these types of reuse for waste paint not be available to a powder coater, most landfill operations

will accept waste powder paint. Once again, it is advised that you work with your LAHJ and landfill companies to verify local rules and regulations related to your powder coat waste.

Waste waterborne liquid paints can be processed through a waste treatment system. The solids are settled out and disposed of in an approved manner, typically a landfill, while the liquid portion is separated into non-hazardous and hazardous waste and processed in facilities dedicated to processing of these waste streams.

Conclusion

Although there are applications where waterborne liquid paint is the best solution for painting of a product due to substrate material, existing equipment, or piece price costs, powder coating, with its clear environmental advantages, is often a preferred option and should be considered when evaluating a finishing operation. The benefits of higher paint utilization through reclaim, reduced waste disposal costs, and being a user-friendly material are all important factors that point to powder paint as a more environmentally friendly finishing process.

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