

Paint Sludge Reuse Summary

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According to internal General Motors (GM) Paint Engineering reports, the paint system within a conventional automotive OEM assembly plant accounts for as high as 70% of the energy consumption for the site. The paint system is also responsible for significant amounts of solid waste that often goes into a landfill. Many OEMs are moving toward landfill-free initiatives to eliminate all solid waste. The paint process offers many opportunities to move toward that goal.

Many forms of solid waste were identified within the paint shop, ranging from disposable materials such as gloves to weld balls that come from the body shop. One significant form of waste that was identified was paint overspray waste. Paint sludge is a by-product of overspray, the fraction of paint that does not contact the vehicle but instead is driven into tanks below the spray booth by air flow. The overspray is primarily tacky, uncured paint polymers, and would be difficult to handle in that form. Therefore, chemical treatment is used to process the overspray. When treatment within the paint process is complete, the resultant sludge is approximately 40% solid paint / 60% liquid (primarily water) and is either sent to landfill or is burned, which is the current landfill-free method of disposal.²

A literature search revealed the following methods for processing and/or reusing paint sludge²:

1. Reclamation of useful materials from paint sludge via pyrolysis
2. Reuse of paint sludge in the sealant industry
3. Reuse of paint sludge in building materials
4. Conversion of paint sludge into reusable paint

Subject matter experts also identified the following methods that have been trialed within the automotive industry^{3,6}:

1. Use of dried sludge as fillers in various rigid components
2. Reuse of dried sludge as a filler for automotive sealers and sound deadeners

Our goal is to design a more sustainable method for disposing of paint sludge that meets the customer demand for not sending any sludge to landfill. The primary customer for this process is the GM Detroit Hamtramck (DHAM) paint shop; other critical stakeholders are GM Environmental and GM Paint Engineering. The customer requirements were identified, treating both GM and the environment as customers, and then the requirements were rated. Engineering metrics were generated based on customer requirements, and then ranked accordingly. The baseline environmental impact of the DHAM paint process was evaluated, and then many concepts were generated for other ways to dispose or recycle the paint waste. The following five were selected to evaluate:

1. Baseline DHAM disposal process (Incinerate at DTE, 90% reject rate sent to landfill)
2. 100% Landfill
3. Incineration at Covanta for energy recovery
4. Implementation of process controls for 100% DTE acceptance
5. Create injection molded pallets or containers from paint sludge and other recycled materials

With the use of a Quality Functional Diagram (QFD), these processes were judged against the customer and environmental requirements; these requirements included ease of implementation by the paint shop, affordability, energy usage, landfill space requirement and others. A Pugh analysis was used for this activity, and based on the results the stakeholders decided to move forward with the design of recycling the paint sludge into shipping pallets. In this process, paint sludge with no additional in-plant processing will be transported to an outside company. This company will use the paint sludge in addition to polypropylene waste materials from DHAM to manufacture plastic shipping pallets. The pallets will be comprised of approximately 15% paint sludge and 85% polypropylene waste. GM will dispose of these materials at an estimated 25% cost savings versus their current disposal costs and purchase pallets at a small discount over virgin material made pallets. The result is a product that significantly improves the overall sustainability, requires no GM capital investment or any process changes, and still meets all GM engineering specifications for coating quality and shipping pallets.