Technical Bulletin

Waterborne vs Solventborne Paints

With ever-increasing pressure to reduce volatile organic compounds (VOC), and for quite a few years now, paint shops across North America have been converting to waterborne paints. This transition is not industry-specific, but the most visible industry impacted by tighter VOC regulations is the automotive industry. Paint companies have worked diligently to meet this challenge and continue to develop improvements to waterborne paints for all the paint layers – including primers, basecoats and clearcoats.

This technical bulletin will 1) take a brief look at the differences between waterborne and solventborne paints, and 2) how waterborne paints are dealt with in water recirculating paint booth systems.

Waterborne vs Solventborne Paints

<table>
<thead>
<tr>
<th>Waterborne Paint</th>
<th>Solventborne Paint</th>
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<tbody>
<tr>
<td>• Low VOC – less solvent</td>
<td>• High VOC – more solvent</td>
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<tr>
<td>• Emulsifies in water</td>
<td>• Paint is rejected by water</td>
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<tr>
<td>• Can cause foam</td>
<td>• Lower foaming tendency</td>
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<tr>
<td>• Solids content has been increasing</td>
<td>• Solids content can range from low to high</td>
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<tr>
<td>• Need to coagulate paint particles in booth system</td>
<td>• Need to “detackify” paint particles in booth system</td>
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<tr>
<td>• Treated particles are more difficult to separate &amp; dewater in the booth system</td>
<td>• Treated particles generally easier to separate &amp; dewater in the booth system</td>
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<tr>
<td>• Higher BOD/COD content</td>
<td>• Lower BOD/COD content</td>
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Dealing with Waterborne Paints in Recirculating Paint Booth Systems

Waterborne Paint Particles Need to be Conditioned First

Since waterborne paints readily emulsify in water, the challenge begins with conditioning the paint particles so they can be removed from the booth water. This begins with the paint detackifier, which in this case means it needs to behave more like a coagulant – i.e. it needs to neutralize the electrical charge of the fine paint particles, allowing the paint particles to come closer together and form large clumps. Once in this state, the particles can be more readily accepted by the paint sludge conditioning process, for example, flotation and dewatering. pH control is also an important aspect of conditioning the waterborne paint particles. The correct pH level is normally determined by testing as it also plays a key role in the charge neutralization of the paint particle.
Dealing with Foam

Due to their inherent chemistry, many waterborne paints will enhance foaming tendencies in water recirculating paint booth systems. This is best addressed by 1) having the booth treatment chemistry in balance, 2) using a defoamer to control the foam to acceptable levels, and 3) minimizing mechanical effects that can magnify foaming tendencies. Excessive foam can lead to booth operational issues as well as problems with the sludge processing system.

Removing Waterborne Paint from the System

Once waterborne paints are coagulated, they can be removed from the system using a variety of sludge processing devices such as a skimmer/flotation unit or centrifuge. Typically these devices will pull a side stream (and on occasion, the full flow stream) from the main tank, pit or booth - and will then send the booth water containing the paint solids to the device. These devices are designed to use flotation or gravity to help separate the paint solids from the booth water. The resulting sludge that comes out of the device is now higher in solids and is readily removed for further dewatering.

A sludge conditioning polymer is typically fed to the stream ahead of the flotation unit or centrifuge. These polymers are high molecular weight, long chain polymers that wrap themselves around the paint particles to pull them together. So, the paint particles that are brought together in this step are now transitioned into a sludge that is acceptable for further handling. The booth water is also much cleaner and can be recycled back into the system – which conserves a lot of water. Sometimes sludge conditioning polymers will need to be fed to optional locations as well – such as the return water coming back into the pit/sump.

Further Conditioning of the Paint Sludge - Dewatering

In many cases, the sludge coming out of a flotation unit or centrifuge will still contain a significant amount of water – which may be higher in moisture content than is deemed acceptable for final handling/disposal. The next step in the process that can facilitate further moisture removal, if required, is called dewatering. Paint sludge can be further dewatered by giving it additional time and the proper conditions to facilitate this.

Several examples of this include – dewatering bags, gravity filters, vacuum filters, filters presses, and pressure filters, to name a few. All of these approaches either use gravity or some form or energy to speed up the process of sludge and water separation. A well-conditioned sludge coming into one of these devices will readily separate from the water creating a sludge dry enough for acceptable handling and disposal/recycling once it leaves the plant.

BOD/COD Issues

Natural organic detritus and organic waste from waste water treatment plants, failing septic systems, and agricultural and urban runoff, acts as a food source for water-borne bacteria. Bacteria decompose these organic materials using dissolved oxygen, thus reducing the DO (Dissolved Oxygen) present for fish.
**Biochemical oxygen demand (BOD)** is a measure of the amount of oxygen that bacteria will consume while decomposing organic matter under aerobic conditions.

**Chemical oxygen demand (COD)** does not differentiate between biologically available and inert organic matter, and it is a measure of the total quantity of oxygen required to oxidize all organic material into carbon dioxide and water. COD values are always greater than BOD values.¹

BOD and COD levels can increase in the plant’s waste stream as a result of using waterborne paints. Depending on the plant’s waste treatment capabilities, the BOD or COD may not be removed to acceptable levels prior to discharge. There are approaches available to reduce BOD/COD. Please contact Galaxy Chemical Corporation to learn more about this.

Consult with Galaxy Chemical for all of your paint spray booth chemical and technical needs.

¹ Northeast Georgia Regional Development Center, “Watershed Protection Plan Development Guidebook”, Appendix B.