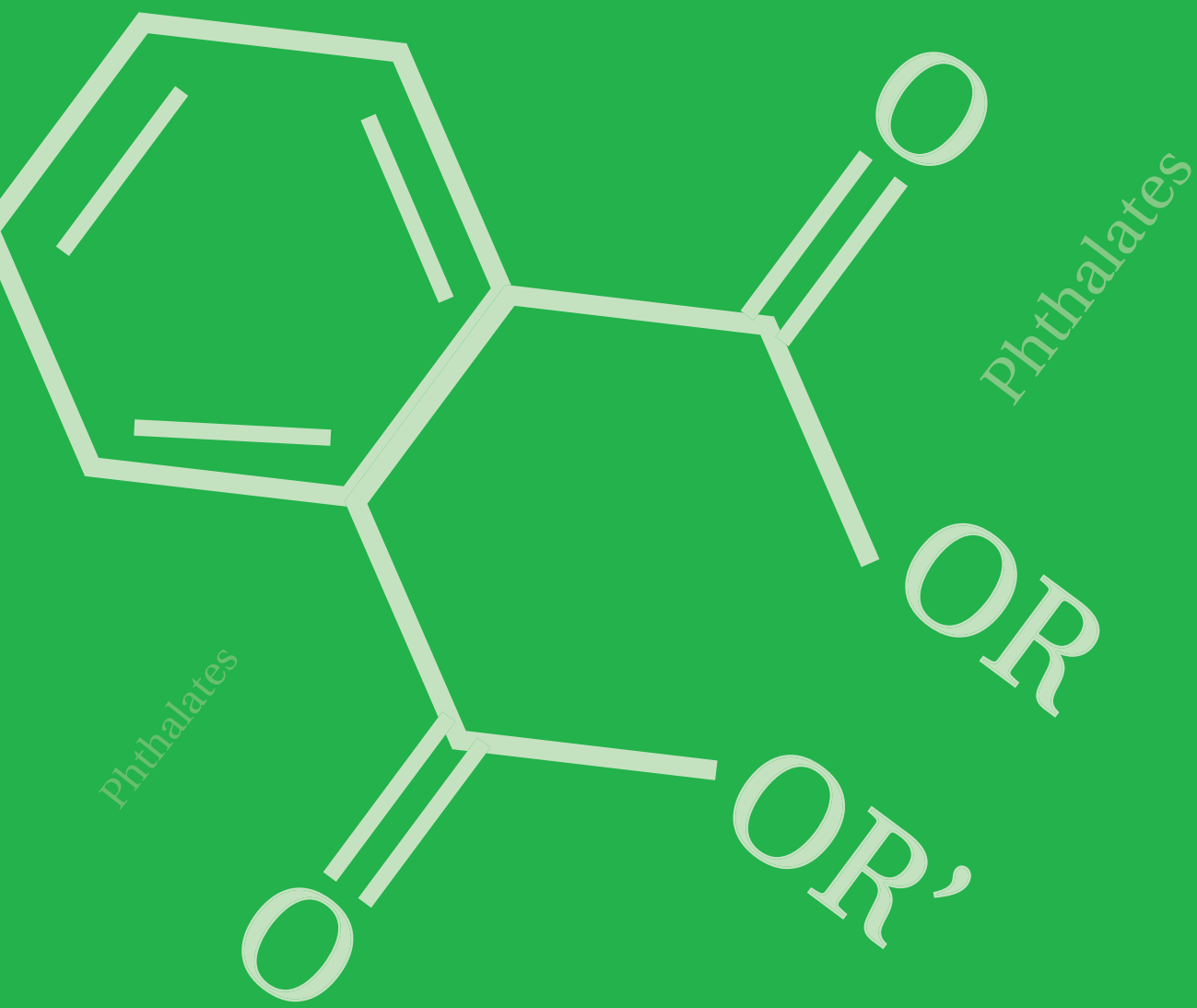
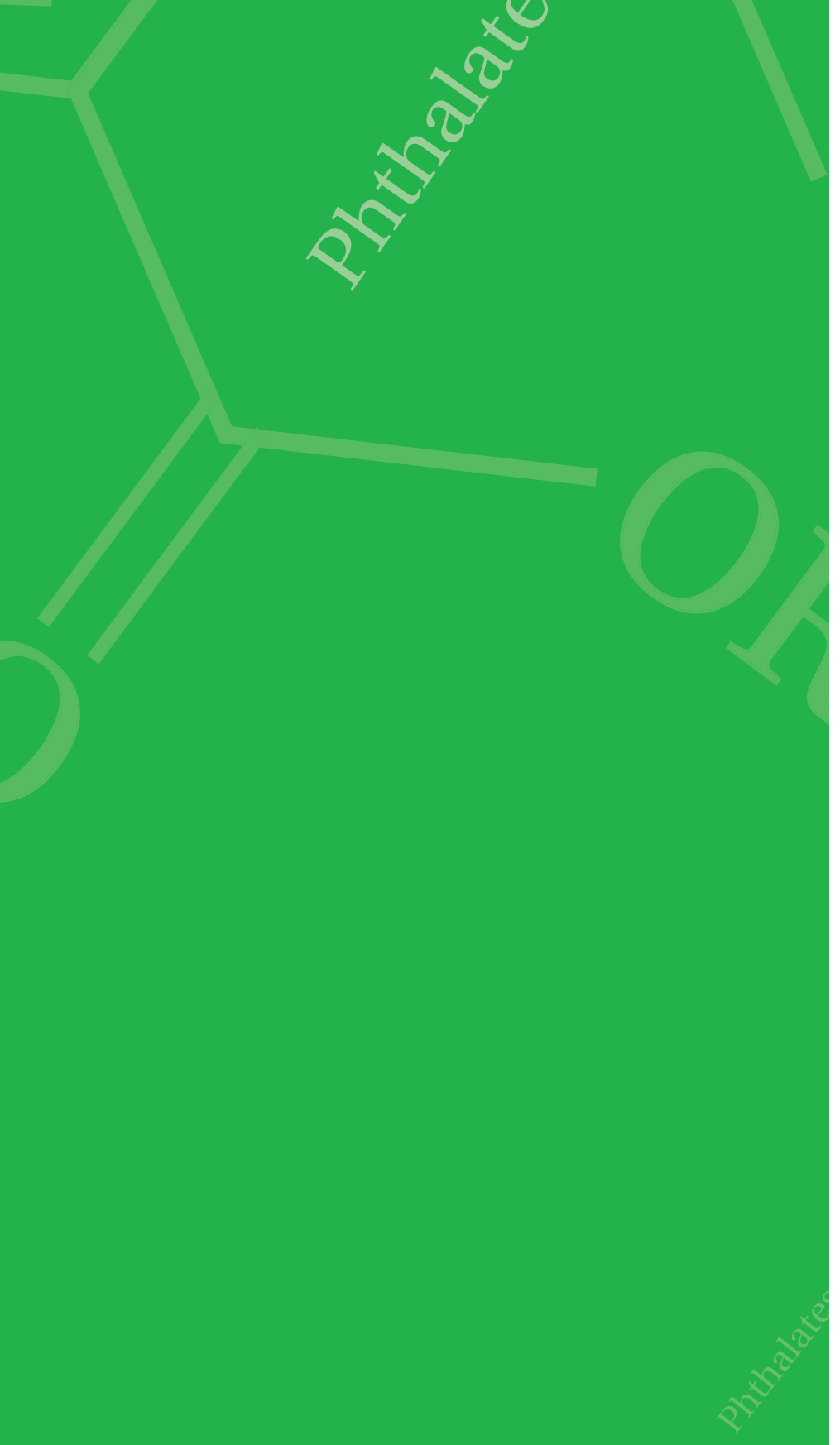
# Phthalates in textile inks present complex concerns






The author delivers a comprehensive overview of the real issues surrounding phthalates in apparel decorating inks, and dispenses some myths about new regulations and old assumptions on water-based inks.

By Ed Branigan,
Contributing Writer

The movement toward environmental protection and sustainability has recently garnered a lot of media attention. It really is no longer a movement in the sense that the idea is directing change. The change already has occurred, and not just in the textile screen printing market — we are seeing it across all market sectors. At this point, it's odd if a company or manufacturing sector is not making some effort toward sustainable practices in production facilities and workplaces.

In the U.S., the Consumer Product Safety Improvement Act (CPSIA) of 2008 and similar laws in California and other states restrict the use of certain phthalates in children's toys and childcare items. The European Union (EU) has had restrictions on phthalates in place since 1999. This ubiquitous chemical compound is the subject that is driving change in the garment printing world.

In the recent past, the demon was another chemical compound

*All photos courtesy of International Coatings Co., Cerritos, Calif.*

**Shown here** is an example of a special-effects plastisol ink application with raised texture and foil.

**This example shows** the multiple application possibilities with plastisol ink, including a soft hand, raised texture, metallic ink, and foil and flock adhesions.

— PVC, or polyvinyl chloride. In response to calls for its ejection from ink systems and pressure from some of the bigger players in the retail fashion world (particularly those oriented toward sports), manufacturers developed PVC-free plastisol ink lines, including high-density inks. However, these inks were priced higher than traditional PVC plastisol inks and, performance-wise, are only now catching up. Because of this and it's all round versatility, PVC plastisol has managed to maintain a strong market presence.

The emergence of phthalates as an issue has brought the constituent elements of plastisol inks under the microscope again. The word itself catches the eye and makes us wary. What is a phthalate anyway, and why is it such a big deal for textile printing?

Phthalates are a family of chemical compounds primarily used to soften PVC and make it flexible. There are different types of phthalates, with some considered more problematic than others. Phthalates can be found not only in inks, but also in millions of other consumer products, including toys, adhesives, detergents, flooring, deodorant, shampoo, cosmetics and many more. Phthalates are in the coatings of the pills you take for migraines, as well as the dashboard and console of your car. That "new car" smell everyone talks about? It comes from phthalates.

The concern with phthalates centers on one particular chemical class — ortho-phthalates. It has been suggested that ortho-phthalates may disrupt the endocrine system in laboratory test animals. Phthalate plasticizers are not chemically bound to PVC, so they may leach out. The fear is that children and infants will chew on or place an offending toy or item containing phthalates into their mouths and absorb some of the chemicals.

Although the recently enacted legislation in the U.S. restricts the use of six ortho-phthalates, a cloud of suspicion now seems to hang over any and all phthalates. Some end users now demand inks that are free of phthalates but still exhibit the desirable attributes of phthalate inks. They also ask many more questions about the chemical composition of inks in general and are often surprised by the answers.

## UNDERSTANDING WATER-BASED INKS

It used to be that a common response from printers when asked to use more "earth friendly" inks was to switch to water-based products. These inks are more difficult to use than plastisol inks, but the thinking is that at least they are mostly water.

Both of these traits are arguably true, but there are some additional qualifiers that should be recognized. Many people do not realize that some water-based inks contain upwards of 70% to 80% water and, as such, don't offer the same yield as plastisol inks, which, by definition, are 100% solids. In other words, most of the content of water-based inks evaporates and leaves just 20% to 30% solids on the garment. On the other hand, 100% of the plastisol inks printed on a garment remain after curing. In addition, some water-based inks contain solvents, such as formaldehyde or alcohol, that vaporize when cured.

Independent of ink's content, remember that one of the criteria in measuring sustainability is the amount of water used during the manufacturing process — both in the making and the cleaning up. Wa-

ter-based inks relatively "consume" a lot of water — remember that they can be 70% to 80% water. And water is used to clean up these inks, so while we don't need to use any harsh solvents or chemicals on that end, water consumption is increased when compared to cleaning up after using plastisol inks.

These are some of the reasons that support the opinion that many water-based inks should not really be viewed as completely sustainable products.

There's also the question of what is in the 20% to 30% solids portion of water-based inks. That portion mostly consists of resins, pigments, binders and additives. In some cases, water-based inks also contain biphenyls, chlorinated hydrocarbons, heavy metals and pesticides. These inks can release volatile organic compounds (VOCs) during the curing process.

For a water-based ink to cross link completely — the equivalent of plastisol curing — the water must be completely evaporated from the ink. To accomplish that, garments printed with water-based inks may require a longer drying period than if they were printed with plastisol. It seems reasonable to assume that along with the water, other compounds are gassed off during drying, particularly if the inks contain solvents.

That said, there are water-based inks on the market today that buck the traditional water-based inks just described. In particular, some vendors have introduced high solids water-based inks — containing up to 70% solids content. These new inks are available with none of the agents mentioned above, and demonstrate a better ability to resist drying in the screen (a major problem with water-based inks).

Taken together, these attributes make the new high solids water-based inks infinitely more attractive as an alternative to plastisol than the first generation of water-based inks.

Another positive development is the advent of closed filtration systems for cleaning screens after use. With these systems, any liquid used for cleaning is re-circulated after the solid content has been sieved out. Nothing goes down the drain. Any solid or liquid waste is removed and disposed of according to local toxic waste regulations. These filtration machines, while a bit pricey, can be used for water-based or plastisol ink systems.

Although recent advances have renewed interest in water-based inks as a viable printing alternative to plastisol, there are characteristics and a variety of application methods available to plastisol that can't be matched even by the newest water-based inks.

For instance, plastisol textile inks can be reduced to achieve the same soft-hand feel as water-based ink. They also can be textured and raised in ways that water-based inks cannot.

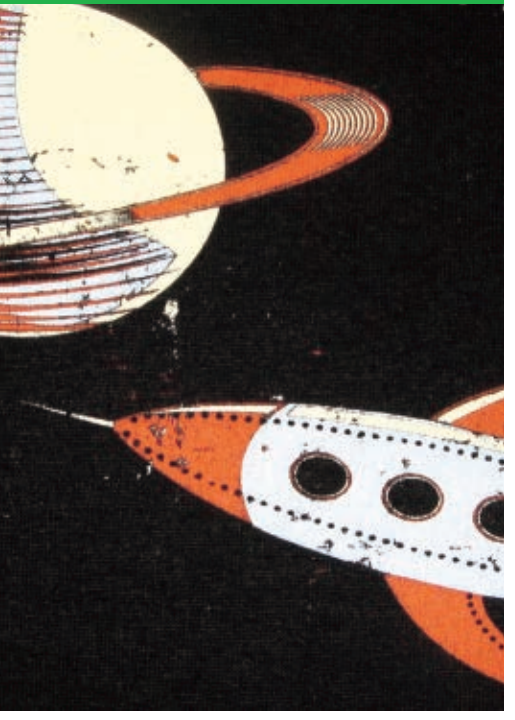
Digital direct-to-garment printing is now and will become a greater competitor to traditional screen printing. The ability to achieve a full-color print on a dark shirt with optimum opacity using digital technology is emerging. Many decorators are attracted to the idea that soft-hand prints in full color are achievable on light or dark fabrics without the use of traditional inks and screens.

As with water-based inks, various garment application methods are available to plastisol that are not

**This multiple foil** application shows the adhesion properties of plastisol ink.

**Shown here** is a design printed using PVC-free, high-density stacked ink.

**This design** was printed using a high-solids, water-based ink. This degree of opacity was not available with previous generations of water-based inks.



**An example** of a design created using a water-based discharge ink.

possible with digital printing. A merging of the two technologies at the print production end offers much promise and seems most practical as far as garment printing goes.

There are automatic screen printing machines that now incorporate both screen heads and a digital head. As far as sustainability goes, direct-to-garment digital would seem to be a winner — no film to output, screen emulsion or inks to use (and none of the attending solvents or chemicals used to manufacture these necessary tools) and no clean up and disposal.

## SAFER PLASTISOLS

While it is possible to print many types of special effects on garments using water-based inks, garment printing still is (and will most likely stay for now) the purview of plastisols. The versatility and long shelf life of plastisol inks make them very attractive for large-scale production garment printing. PVC in general is not going anywhere, but its primacy in the garment printing world is now questionable. It's now clear that the phthalates that soften the inks can be eliminated, if necessary.

Many of the major ink manufacturers now offer non-phthalate PVC plastisol ink lines. For a time after this new generation of non–phthalate plastisol came to market — like its PVC–free cousin(s) — it was price-prohibitive for many end users. That is changing as more plasticizer choices become available. The questions on ortho-phthalates keep coming and are driving demand for non-ortho-phthalate inks.

The recent restrictions on phthalates imposed in the U.S. with regard to textile print applications applies only to products destined for young children and infants, not adults. Still, the demand among end users for phthalate-compliant inks for all sizes and ages is rising regardless of the legislation and in spite of the higher cost.

More rigorous testing will no doubt take place and phthalates, in particular, will be further studied to determine their environmental impact; but the market will ultimately determine the inks used. In the U.S., sustainability's direction is being worked out by consumers, retailers and the print manufacturers that serve them. PVC plastisol inks are still very much favored in spite of the fact that the phthalate issue has brought them under renewed scrutiny.

In the end, it will likely come down to price. The non-phthalate and PVC-free plastisol ink systems are waiting in the wings for demand to rise. Once it does, we may end up waving goodbye to PVC in our plastisol — just as we are now doing with phthalates, and did in the past with lead.

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