



THE BENEFITS OF WATER BASED SCREEN PRINTING INKS AS OPPOSED TO TRADITIONAL PLASTISOL INKS

INK FOREST ECO-FRIENDLY SCREEN PRINTING

**JUDY MAZZUCA, OWNER
RICHARD A. MAZZUCA, JD, MSEd**

January 3, 2016



CONTENTS

CONTENTS.....	2
ABSTRACT.....	3
INTRODUCTION.....	4
SCREEN PRINTING INKS.....	5
OVERVIEW OF THE SCREEN PRINTING PROCESS.....	5
TRADITIONAL PLASTISOL INK.....	5
WATER BASED INK.....	5
THE DISCHARGE DILEMMA.....	6
WHY AREN'T ALL SCREEN PRINTERS USING WATER BASED INKS?...7	
LEGAL ISSUES.....	9
CPSIA – TESTING FOR PHTALATES, LEAD AND OTHER HARMFUL CHEMICALS.....	9
EUROPEAN UNION BANS SOME PHTALATES.....	10
CASE STUDIES.....	11
CS I – ONLINE DESIGNER AND RETAILER.....	11
CSII – BREATHEABLE WORK SHIRTS.....	12
CSIII – SCHOOL SPIRIT WEAR.....	12
SUMMARY.....	13
CALL TO ACTION.....	13
REFERENCES.....	14



ABSTRACT

At some time in our personal or professional lives, we are given the task of ordering custom screen printed t-shirts or other garments. There are generally two options. We can go to the local “t-shirt guy” that the organization has used in the past, or we go online to find the cheapest t-shirt printer. We never consider the health, legal or environmental consequences of the inks, chemicals and processes the screen printer uses.

In this paper, we discuss the benefits of using screen printers who print in a healthy and sustainable manner. These printers center their processes around using water based inks. Water based inks meet all Consumer Product Safety Commission standards, pose no health risk to the garment consumer, are environmentally sustainable, have designs that do not crack, have designs that breathe, that look good and are reasonably priced. The printing process also does not use harmful chemical solvents that can end up in the water stream or landfills.

We also give examples how water based screen printers can customize the printing process to a customer’s priorities. This often meets and exceeds expectations and gives the customer the added benefit of being environmentally conscious.



INTRODUCTION

There are numerous types of screen printing inks. Most people don't pay attention to what kind of ink is used to print their t-shirts, hoodies, sweatpants, hats, or other garments. The customer often does not consider the process of screen printing, but just on the garment's final look.

However, it is also important to become aware of, and consider the health and environmental consequences of how a garment was printed. There are significant differences between screen printing inks and techniques. Some pose health and environmental risks and others are benign. There are also legal considerations to consider when printing for specific age groups and geographic locations.

This paper attempts to shed some light on the differences between the two major printing inks and their impact on health and the environment.



SCREEN PRINTING INKS

OVERVIEW OF THE SCREEN PRINTING PROCESS

Screen printing is a process of garment design or print making in which a design is put on a screen of fine mesh. The blank areas of the design are covered by an emulsion that ink cannot penetrate. This is the stencil. The screen is placed on a garment. The ink is then put on the stenciled screen and pushed through the mesh with a squeegee. This deposits the ink on to the garment, paper or object. Garments are then heated to “set” the ink to make it more durable and wash resistant.

TRADITIONAL PLASTISOL INK

Most screen printers in the United States use plastisol inks. The inks contain hard plastic particles suspended in a paste-like substance. The particles are made of polyvinyl chloride (PVC). The base also often contains phthalates and other harmful chemicals. The United States Environmental Protection Agency classifies many of these chemicals as *known human carcinogens*. The phthalates and other chemicals are added to keep the ink mixed, enhance color, and make the final print flexible, among other things.

The plastisol ink is screened on to the garment and heated in order to melt it to the fabric. Residual chemicals remain on the garment and continue to be released when washed and dried and also can be absorbed through the skin when worn. These chemicals continue to be released throughout the life of the garment and then be released in landfills, water ways, and as dioxins when heated or burned.

The cleaning of plastisol ink from the screens also requires using harmful solvents. These can contain Benzene, Toluene, and other solvents. These solvents are often washed down the drain and into rivers, streams and landfills.

WATER BASED INK

The water based screen printing process is similar to printing with plastisol inks. The primary difference is that the ink contains a pigment suspended in water as opposed to plastic particles mixed with harmful chemicals. The water based ink is also printed on to the fabric in a slightly different manner than plastisol. Water based ink is pressed directly into the fabric, whereas plastisol is pressed lighter to lay the ink on to the fabric. As stated earlier, plastisol is then melted on to the



garment. In water based printing, the garment is heated in a manner that evaporates the water from the ink and the moisture from the garment. The garment threads then absorb the water based ink and therefore the design. The design becomes part of the garment. One can barely feel where the ink became part of the garment. It often appears that the design was woven into the garment.

In the production process and in cleaning screens, presses and other equipment, water based printers primarily use water. Harsh chemicals are not needed to clean up water based inks.

THE DISCHARGE DILEMMA

Some water based and even some traditional screen printers use a process called discharge printing. The discharge process uses water based ink but adds harmful chemicals to the process. People are often misled into believing that discharge printing is healthy or “green”.

The discharge process involves adding formaldehyde and sometimes chlorine to the inks. This bleaches the color out of the garment’s threads when the ink is laid on to it. This process allows a semi-transparent ink to be used to design a dark shirt.

The formaldehyde and chlorine are prevented from damaging the garment by heating it and evaporating the chemicals. This produces a steamy environment of formaldehyde and chlorine gas. Most printers wear respirators during this process and a few have been diagnosed with formaldehyde poisoning.

Residual chemicals are also left on the garments. Some printers wash the shirts before they deliver them. Others put warning labels on them. It is not known if any printers deliver discharge shirts without warnings or laundering them, but it is advisable to wash shirts printed in this manner before wearing them.

It is probably a good idea to avoid discharge printing all together. If you are looking for a “discharge look” for a garment, talk with your printer. There are many options for getting a “discharge look” while being both healthy and sustainable.

WHY AREN'T ALL SCREEN PRINTERS USING WATER BASED INKS?



In the United States, most screen printers use plastisol inks. As we discussed, there are many health and environmental concerns over plastisol use. So why are American screen printers still using it?

Plastisol has been used in the screen printing industry for several decades. It is the standard ink that most printers were trained on and they continue to use. It is easy to use, easily covers shirts, and is relatively inexpensive.

Plastisol ink doesn't dry without being heated. It can be left on a screen or in an open container for weeks or even months without drying. The printer can walk away from the press, take a break, take phone calls, etc., without worrying about the ink drying in or clogging the screen.

On the other hand, water based inks will dry on the screen within minutes. When printing with water based inks, the printer has to be focused on the task at hand. Seasoned water based printers maintain awareness of how the ink feels, its moisture content and how it is flowing. She also monitors the amount of pressure she places on the squeegee, the depth of the color going on the garment and the sharpness of the design. It is difficult to multi-task when printing with water based inks.

Water based inks generally take longer to dry. Plastisol ink only needs to be heated enough to melt the plastic particles to the garment. Water based ink needs to be heated in a manner that allows full evaporation of the water out of the ink and garment. While heating, there also needs to be a gentle airflow within the dryer. This assists in the evaporation and the setting of the ink.

Water based inks are also more expensive than plastisol. They are similar in price to high end plastisol but approximately 80% of the ink is water. The water is evaporated away during the drying process. Plastisol ink does not evaporate, so it goes farther in production.

Water based screen printing is more time consuming, labor intensive and has higher costs than traditional screen printing. But, most full time water based screen printers are dedicated to printing in a healthy and sustainable manner. They have learned their craft and believe in it. They have become highly skilled in production techniques and keep their costs down. They also keep up with new products and techniques and can advise their customers on how to achieve their printing needs while being healthy and green. As you can see, it is advisable to use a dedicated water based screen printer instead of a traditional screen printer who "dabbles" in water based inks.



LEGAL ISSUES

CPSIA – TESTING FOR PHTALATES, LEAD AND OTHER HARMFUL CHEMICALS



The Consumer Product Safety Improvement Act of 2008 (CPSIA) requires testing of printed garments for children 12 years of age and under. The individual garments must be permanently labeled regarding such testing. Children's Products Certificates must be issued by the manufacturer regarding the testing. Screen printers are regarded as manufacturers.

The CPSIA bans the use of various phthalates in child care articles, such as bibs, blankets and other articles used to facilitate sleeping or eating. This pertains to children 3 years of age or under. Again, Children's Products Certificates must be issued and the product permanently labeled with identifying information and verification of testing.

Many screen printers may not be aware of these regulations and don't test, label or issue certificates pursuant to the CPSIA.

Water based inks meet and exceed the CPSIA standards for safety. Since water based screen printers are concerned about their customers' health and the environment, they are most often aware of testing requirements and readily comply with it.

There is a side issue here. A person, team, park district, school district, etc. may order garments and deliver them for use by children. They may be considered to be a distributor of these garments and can incur liability for non-compliance with the CPSIA if the garments are non-complaint. People or organizations ordering garments for use by children may wish to consult with their organization's attorneys to see if they have responsibilities pursuant to the CPSIA.

EUROPEAN UNION BANS SOME PHTHALATES

Most traditional screen printers in the United States use plastisol inks. These inks contain PVC particles suspended in a chemical laden caulk-like substance. There are many chemicals in this ink, including phthalates. Phthalates are chemicals that make hard plastic flexible. Phthalates have been associated with various health issues.



Since 1999, The European Union has restricted some and banned other phthalates. European printers generally don't use plastisol inks, so this isn't much of an issue to them. The practice of using plastisol inks never seemed to have caught on in Europe. But, if you are a designer or retailer looking to sell your garments internationally, you need to be aware of what chemicals are allowed in various countries. As far as we know, water based screen printed garments are able to be exported and sold everywhere.

CASE STUDIES

CASE STUDY I – ONLINE DESIGNER AND RETAILER

Online designer and retailer, “ABC Designs” (pseudonym), had lagging sales from an older clothing line. They wanted to re-launch the line, but at a higher end, eco-conscious market. They decided to keep their name because of its good will, brand recognition, and dedicated online fan base, although the fan base



wasn't interested in the older designs and fabrics. ABC decided to use water based screen printing, an eco-conscious printing process and organic clothing with a youthful and contemporary styling. They introduced new graphics consistent with their organization's philosophy, branding and eco-consciousness.

Their marketing included discussions about the inks used and green production techniques. They detailed the sourcing and manufacture of the garments. Each new product introduction includes information about the product and its origin. They emphasize the connection between the customer, the garment and the organization.

Their products are sold internationally. Since a significant number of ABC's customers are European and Australian, ABC is particularly aware of the EU standards regarding chemicals. They will only use printing methods that comply with EU standards.

ABC's fan base has increased along with its increased sales. ABC's customers gladly pay a premium price for garments that look good, feel good, are of high quality, and consistent with their personal beliefs.

This new clothing line has increased ABC's bottom line. It has also increased the quality and perceived credibility of the brand.

It is no wonder that large, high-end manufacturers, such as Patagonia have discontinued plastisol use. This is consistent with the company's low impact business model. They also don't have to worry about plastisol graphics that crack and chip off, thus cheapening their brand.

CASE STUDY II – BREATHEABLE WORK SHIRTS

"DEF Construction" (pseudonym) went through a lot of employee work t-shirts. Their employees worked in hot and sunny conditions. They needed shirts that were durable, highly visible and breathed. Their graphics covered a large area of the shirt. The plastisol ink used on their previous shirts felt like a large plastic "bullet proof vest". The workers' backs and chests were constantly covered with sweat and they were taking numerous breaks to cool off.



DEF needed large colorful graphics that breathed, and were cool and comfortable. Sustainability was not a primary concern but it was an added bonus. Water based printing turned out to be the same cost as the previous plastisol printed shirts. The employees didn't notice the difference in the look of the shirts but they did notice that they were much cooler. The whole shirt breathed not just the unprinted areas. There was no more hot and sweaty spots on the shirts. Water based inks were the answer to the "hot spots".

CASE STUDY III – SCHOOL SPIRIT WEAR

"GHI School" (pseudonym) is a school in a working class town in the Chicago area. The school staff teaches and practices sustainability with their students. The time came to order school "spirit wear" for the students. GHI wanted to order t-shirts that were as sustainably produced and printed as possible, but cost was their main concern.

GHI didn't realize that federal law and product safety was another concern. They weren't aware of the CPSIA and its requirements. They had no idea if their previous orders complied with the CPSIA.

All of their concerns were addressed by using water based ink on shirts that were manufactured in a fair trade manner and certified fair labor. They were consistent with the school's sustainability curriculum and practice. The spirit wear complied with the CPSIA requirements and came in at the same cost as the previous printer. But, best of all, the shirts were bright and colorful and with great graphics that the students loved.

SUMMARY

As you can see, there are many benefits to using water based inks as opposed to plastisol inks. Printing cost is usually similar between the two options. Water based printing can add value to garments because it is known to be safer to the wearer and the environment. The distributor enhances his or her brand because the end user of the garment is aware of its safety and sustainability. There is little to no downside to ordering garments printed with water based inks. The only problem one may encounter is that there are not many water based screen printers in the United States. The number is growing, but for the short term, one has to conduct research to find an eco-friendly, water based ink screen printer.



CALL TO ACTION

When looking for a screen printer, take that extra step to find one that uses water based inks and sustainable printing practices. It may be a little more work on the front end, but it will be worth it. Most water based screen printers believe in what they do and are customer oriented. They will provide you with a safe and green product that wears well and will make you proud to deliver it to the end user.

THANK YOU.

FOR MORE INFORMATION CONTACT: JUDY MAZZUCA
myinkforest@gmail.com

References

Factor-Litvak P, Insel B, Calafat AM, Liu X, Perera F, et al. (2014) Persistent Associations between Maternal Prenatal Exposure to Phthalates on Child IQ at Age 7 Years. PLoS ONE 9(12): e114003. doi:10.1371/journal.pone.0114003.

Fresener, Scott, & Fresener, Pat (2012). *How to Print T-shirts for Fun and Profit* (8th ed.). Scottsdale, Arizona: How-To Publishing.



GovTrack.us. H.R. 4040 110th Congress (2007): Consumer Product Safety Improvement Act of 2008, GovTrack.us (database of federal legislation).

Lopez-Cariilo, L., Hernandez-Ramirez R.U., Calafat, A.M., Torres-Sanchez, L., Galvan-Portillo, M., Needham, L.L., Ruiz-Ramos, R., Cebrian, M.E. (2010). "Exposure to phthalates and breast cancer risk in Northern Mexico. *Environmental Health Perspectives* 114 (4): 539-544.

Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency.

Robin M. Whyatt, Xinhua Liu, Virginia A. Rauh, Antonia M. Calafat, Allan C. Just, Lori Hoepner, Diurka Diaz, James Quinn, Jennifer Adibi, Frederica P. Perera, Pam Factor-Litvak. Maternal Prenatal Urinary Phthalate Metabolite Concentrations and Child Mental, Psychomotor and Behavioral Development at Age Three Years. *Environmental Health Perspectives*, 2011; DOI: 10.1289/ehp.1103705