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Fact Sheet

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ENVIRONMENTAL MANAGEMENT OF PHOTOPOLYMER FLEXOGRAPHIC PRINTING PLATES

The defining characteristic of flexographic printing is the flexographic printing plate. Flexographic plates have the printing image in relief, which means the image area is raised relative to the non-image area. As with any industry, technological evolution has brought changes in flexographic plates. Plates made from light sensitive photopolymers are now being used throughout the industry. Photopolymer plates are similar to traditional rubber plates in that they are flexible and resilient, but their use poses different environmental concerns.

In this fact sheet, environmental considerations are described in the use of various photopolymer flexographic plate development processes.

CONVENTIONAL PHOTOPOLYMER PLATES

Conventional photopolymer plates are either viscous liquids or solid sheets of various thickness. The photopolymer is exposed to ultraviolet light through a film negative and the unexposed areas are washed out by means of a solvent or water wash (Figure 1). The result is the relief plate that is capable of transferring ink from the anilox roll to the substrate.

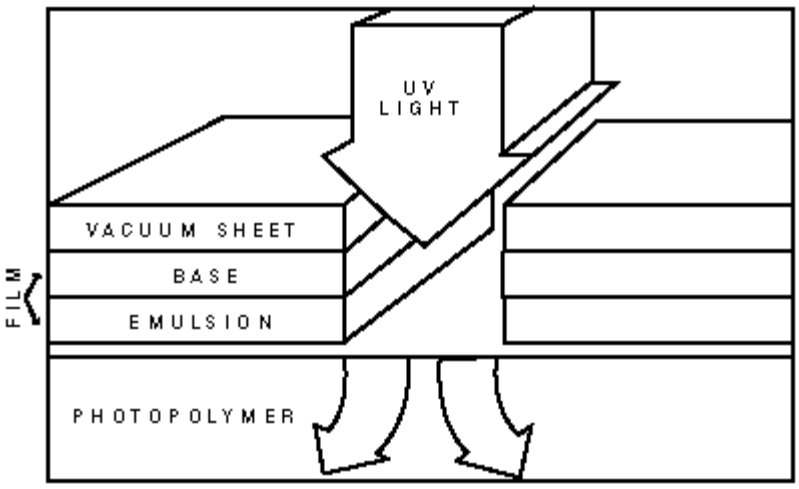

FIGURE 1

There are several steps to making conventional photopolymer plates. Though the process may differ slightly from system to system, they all require the following:

- Back exposure of the plate base to UV light to harden (cure) the floor and establish relief depth.
- Face exposure of plate surface to UV light through a film negative to harden (cure) printing images.
- Washout in appropriate solvent or water to remove unexposed polymer and leave printing images in relief.
- Dry to remove absorbed solvent.
- Post exposure to UV light for final cure of floor and establish character shoulders of the

raised image.
- Finish plate with water, solvent or UV light to remove residual tackiness.

In conventional photopolymer plate making, waste is created when the film is developed. Film processors use developer and fixer solutions which in most cases, can be discarded to the sewer after silver recovery is performed on the used fixer solution. In some regions of the country there is strict control of the waste silver. Both developer and fixer solutions can be removed, recycled and replaced by a film chemistry service. Rinse waters contain low concentrations of silver. Although there is little economic benefit to recovering silver from rinse waters, the Clean Water Act and stringent state/ local discharge regulations can trigger application of silver recovery on untreated wash water if the silver concentration exceeds regulatory limits. On-site recovery of silver involves metallic replacement, electrolytic recovery and chemical precipitation. After silver recovery, effluent is generally discharged into the drain where it goes to the publicly owned treatment works (POTW) for treatment and eventual release back to the environment. Processing solutions must not be discharged to a septic system and instead must be collected and shipped for processing. After use, the films must be discarded or, sometimes, recycled.

Perchloroethylene (PERC, PCA), a Hazardous Air Pollutant (HAP), was traditionally used as a solvent to wash photopolymer plates. The regulation of chlorinated solvents due to air contamination, health hazards and hazardous waste has promoted the introduction of alternative solvent and water washable plates.

For any type of flexographic printing plate, purchasing the right size sheet or using the correct amount of liquid, based on negative film size, will minimize waste of unexposed photopolymer. If waste is still generated, it is recommended to save unused strips as test plates for the resetting of exposure and washout conditions.

For both solvent and water systems, filtered polymer, unexposed photopolymer plates and processed photopolymer plates are normally classified as non-hazardous wastes. Cured plates may be incinerated, or alternatively, sent to a landfill that is authorized to accept the material. However, they should be qualified to determine if they are hazardous wastes by exhibiting the characteristics of toxicity. Ask the plate supplier for details on what is a hazardous waste.

Solvent Washable Plate Specifics

Percholorethylene alternative solvents (PAS) are now being used by many platemakers. Drying times using PASs have improved significantly over earlier versions. PASs can be used to develop almost any solvent washable photopolymer plate.

PASs are volatile organic compounds (VOCs) comprised of hydrocarbons and alcohol which can be eye and respiratory irritants. Therefore, adequate ventilation must be provided while PASs are being used. Also, safety glasses or goggles and gloves should be worn when handling these chemicals. PASs typically have a flashpoint of 150-200^{o}F and are stable under normal room temperature and storage conditions.

Solvent can recycled, but its useable lifetime depends on the number and size of the plates and the amount of material removed. Once the solvent is spent, it can either be sent to an off-site distiller, or equipment can be purchased to distill the solvent on-site. PASs can be recycled by using vacuum distillation. PASs that are mixtures may require balancing (with chemicals) after distillation to get back to the correct ratio of components.

Still bottoms generated from distillation are usually incinerated, but can be landfilled depending on local requirements. It also is possible to use still bottoms for fuel blending. It is advised to run the appropriate tests to determine if waste products are classified as hazardous wastes. If they are

determined to be hazardous wastes, then they can not be landfilled without prior treatment. Information and test results should be available from the supplier to help with this determination.

Water Washable Plates Specifics

Water washable plates largely reduce or eliminate many of the concerns of solvent washable plates including emissions of VOCs; flammability because of lower flash point; hazardous waste; and influence on human health. The use of these more environmentally friendly water washable plates enhances corporate image with regulators, customers and the public. By switching to these types of plates, the need to purchase and install pollution control equipment may be reduced or avoided.

Water washable plates come in two versions: sheet and liquid photopolymer. Early versions of water washable sheet plates had some limitations in their application. Recently, the qualities of water washable plates have been much improved.

Water washable sheet plates are prepared with almost the same procedure as that used for solvent washable sheet plates. The biggest difference in process equipment between solvent washable plates and water washable plates is the washout unit, which is usually accompanied with a washout water treatment unit. A washout water treatment unit is designed to satisfy the requirements of most local POTWs. Analytical data of filtered washout water should be available from the plate supplier. However, before discharging filtered washout water into a sanitary drain, the local sewer authority should be contacted to determine if such discharge is permissible. Sometimes, secondary treatment may be required to pass strict limits along with the need to obtain a permit.

Water washable plates are also available as a viscous liquid. Liquid photopolymer resins (LPRs) are completely curable materials that are developed in a totally aqueous medium. Their main environmental advantage (over sheet material) is that unexposed portions of the plate can be reclaimed manually with a squeegee and reused. This is especially beneficial when a relatively large plate with minimal impressions is required. These materials are not regulated as hazardous substances or as toxic chemicals and are therefore not regulated as hazardous waste if discarded. LPRs contain no chemicals that are regulated as priority pollutants under the Clean Water Act (CWA).

After the available unexposed liquid resin is recovered, the residual material is removed in an aqueous bath containing additives such as detergents, defoamers, stabilizers and water treatment agents. Spent washout solutions should be acceptable to most conventional POTWs that use typical biological treatment technology.

Extracting uncured resin from the waste water requires the use of organic solvents which may indicate the presence of oil and grease. In some operations for which effluent would not meet local discharge limits prior to entering the sewer, pretreatment, such as flocculation, coagulation and clarification may be required. Before discharging any waste water, it is important to contact the local sewer authority to determine if the discharge is acceptable.

Most discarded liquid resin systems are not regulated as hazardous wastes or as CWA priority pollutants. However, manufacturers recommend careful handling of the waste resin as LPRs can act as a skin irritant. Waste resins can be incinerated at a licensed treatment and disposal facility or they may be cured and disposed of as plate material. Contact the supplier for information and data to support the nonhazardous classification.

DIGITAL PHOTOPOLYMER PLATES

Traditional plate processing requires the use of film using developer and fixer chemicals and generates silver bearing waste. A significant environmental advantage of digitally imaged sheet photopolymer flexographic platemaking is that it uses no film during the production process. This

eliminates used film and processing chemicals as well as the need for silver recovery equipment.

First introduced in 1995, digital flexo plate imaging technology incorporates a very thin layer of material, termed the integral mask, that is not transparent to UV light. An imaging device (much like an imagesetter) using a high-power infrared laser(s) removes, or ablates, the integral mask in an imagewise fashion, revealing the uncured photopolymer underneath (Figure 2a). The underlying photopolymer does not absorb the infrared laser radiation, and thus it is not affected by the laser ablation.

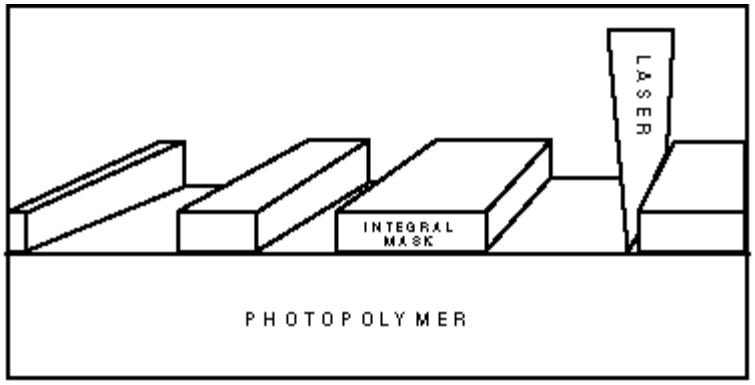

FIGURE 2A

The digital plate receives a main ultraviolet exposure after laser ablating which images through the integral mask (Figure 2b). The remaining black layer absorbs the ultraviolet radiation. The ultraviolet radiation polymerizes the underlying photopolymer where the black layer has been removed. The plate is washed, dried and finished with the same process as a conventional solvent washable photopolymer plate.

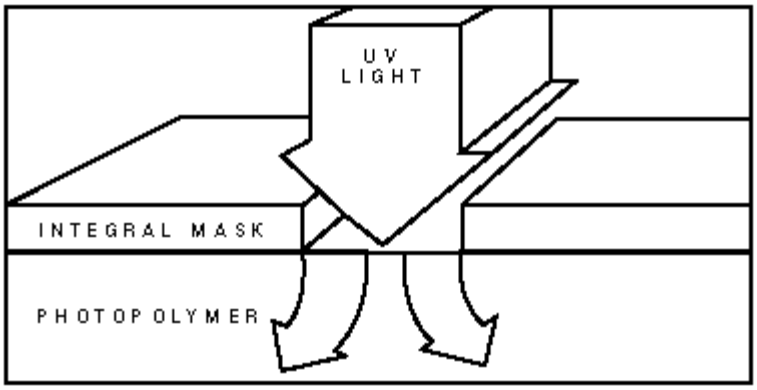

FIGURE 2B

Today's digital plates are all solvent washable technology and like conventional processes using PASs, the solvent is handled, distilled and reused as discussed above for PASs. Water washable digital plates are in development.

Like conventional photopolymer plates, filtered polymer, unexposed photopolymer plates and processed photopolymer plates are normally classified as non-hazardous wastes. However, they should be examined to determine if they exhibit the characteristics of toxicity. Characteristics of ignitability, corrosivity and reactivity may also need to be examined under RCRA. Ask the plate supplier for information and data to support the nonhazardous classification.

Additional Information

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For additional information on flexographic printing plates and environmental issues impacting

flexographic printers, contact the Flexographic Technical Association at http://www.flexography.org/ or call(516) 737-6020.

For further guidance on managing photoprocessing waste water, contact the Silver Council at http://www.silvercouncil.org/ or call (301) 664-5150 and request information on the *Code of Management Practice; Guide for Commercial Imaging.*
