Printers' National Environmental Assistance Center

Fact Sheet

PNEAC
www.pneac.org

1-888-US-PNEAC

A Clean Look at Anilox Cleaning Systems

By David J. Lanska M.B.A.
Narrow Web Sales Manager for Stork Cellramic, Inc.

Anilox plugging issues have been around since the dawn of flexography. In a never-ending push for better print quality, anilox manufacturers' are continually pushed to create smaller, higher linecount cells. As cell sizes have decreased, a two-fold problem has arisen. The microscopic cell architecture, so critical to color density and print quality, has become so fine that ink tends to build up in the cells that determine color density and print quality. This presents increased challenge in removing dried ink from a fine cell structure.

Many approaches have been devised to combat these issues. There are currently arguably seven off-press anilox cleaning methods. Each has its own pros and cons. Issues of cost and effectiveness have to be weighed against environmental concerns and potential for damage to the anilox rolls. Virtually any of these methods can be effective if used properly. Used improperly, they can result in damage and deterioration of the cell structure they are designed to rejuvenate.

When considering which method(s) to use in your operation, it is important to be aware of the risks associated with each type of system. To get a good idea of how well a given system works with your particular inks, it is a good idea to have an in-house demonstration of the particular system(s) you are interested in. This will allow you to judge the system's effectiveness (against your cleaning challenges), as well as space considerations and ease of use. Regardless of the system chosen it is imperative that proper procedures are followed and that recommended personal protective equipment is available and used. Following is a brief overview of the most common anilox cleaning methods currently in use.

1. **Manual Cleaning** - The primary cleaning mechanism is the chemistry applied. Chemicals are dispersed and agitated by movement with rags or roll cleaning brushes. Microscopic cell cavities do not allow penetration by the bristles or the rag fibers, (particularly above 300 LPI), so the cleaning effectiveness is based on the "power" of the solution. Consequently, the temptation is to use highly caustic, or in some cases highly acidic, chemistries. The desperation to get rolls clean too often leads to the application of these cleaning solutions, without the proper attention devoted to safety precautions, use of PPE, or proper disposal of the resulting hazardous waste.

2. **Soak Tanks** - Submerging rolls in a heated chemical bath again relies on the chemical solution as the cleaning mechanism. As ink is removed, ink components become suspended in the solution. Upon removal from the tank, the solution is redeposited on the surface of the roll. Because the solution is heated, it quickly evaporates, leaving residue, in the cells.

The more this system is used, the greater the level of contamination of the cleaning solution. This not only increases the risk of redepostion, but also reduces the effectiveness of the chemistry to break down ink components on subsequent rolls. The result is that the cleaning becomes less and less effective. The typical reaction is to leave rolls in for longer and longer periods of time. When time alone fails to clean the rolls, heavier concentrations of high pH chemicals are added. Extended exposure to high pH chemistries corrodes the roll's journals. These caustic materials leaching under the edges of the ceramic can cause the base metal to corrode, resulting in blistering. Eventually, so much contamination is present that the only way to improve the performance of the cleaning operation is to empty the tank and start over with fresh chemistry.

3. **Ultrasonic** - System uses cavitation to agitate a heated chemical solution. Cavitation (the implosion of microscopic bubbles formed as the result of varying pressures from the sound waves produced by the transducers) generates tremendous turbulence in the tank that penetrates the finest of cavities and crevices. Cleaning solution is forced into those crevices by the cavitation action.

Effectiveness and damage potential are predicated on the frequency of the system and the proper application of the cleaning chemistry. Higher frequency systems are gentler to the roll face (and less likely to cause damage), but take longer to clean the cells. Contamination of the chemistry again reduces cleaning effectiveness. Redeposition of cleaning residue increases as the chemistry becomes saturated with ink components.

3A. **Multi-frequency Ultrasonic** - Relatively new approach that modulates frequencies to reduce the potential for damage from the "hot spots" (concentrations of extreme cavitation pressures) that result from single frequency systems. The system controls cycle time to limit exposure to the cavitation action. Cleaning chemistry is drained into a holding tank for reuse on subsequent rolls. A rinse cycle removes the cleaning residue to prevent redeposition.

4. **Pressure Wash Systems** - Utilize cleaning chemistry forced at the roll surface through a series of high pressure nozzles to dislodge imbedded ink. This system also relies heavily on the effectiveness of the heated chemistry to remove ink components. This type of system has a holding tank and rinse cycle to help prevent redepostion. Cleaning chemistry is filtered to prevent suspended particles from acting as projectiles that could damage the cell walls when forced at them under high pressure.

5. **Sodium Bicarbonate Media Blast** - Specially formulated baking soda powder is forced through a nozzle under pressure at the roll surface as the nozzle traverses back and forth past the rotating roll. Upon contact, the baking soda fractures sending microscopic particles into the cell cavities. These particles etch away at ink components clinging to the cell walls. Excessive exposure to the etching action results in deterioration of the cell walls themselves. Excessive exposure results from the use of excessive air pressure, repetitive cleaning cycles, extended exposure of a given area of the roll surface to the blast action (from unnecessarily slow nozzle traverse or roll rotation settings).

A frequent complaint is the mess that results from the media. Clumping of the media occurs as a result of high humidity levels. Clumping can cause the nozzle or feeder lines to clog and results in inconsistent cleaning cycles. Consequently, it is recommended that cleaning systems not be placed in close proximity to garage doors. Waste byproducts are considered safe for disposal.

6. **Plastic Media Blast** - Specially formulated plastic media is forced through a nozzle (or nozzles) under pressure at the roll surface. The cleaning mechanism is similar to the baking soda systems. In this case, however, the roll is held stationary as the nozzles traverse past it. As it reaches one end, the roll jogs and the nozzle(s) traverse back the other way with a slightly

overlapping spray pattern. This process is repeated until the entire roll surface has been blasted.

The plastic media is stored and reused on multiple cleaning cycles. Media is available in a coarse and fine grain size for use on low linecount and high linecount rolls respectively. Coarse media used on fine linecount rolls has been known to plug the cells. Many printers mix the particle sizes since they do not have dedicated systems for high and low linecounts.

The cleaning cycle is slow compared to the baking soda systems and the system cost is higher, but the consumable (media) cost is said to be lower since the media can be reused on multiple cleaning cycles. The plastic media is safer for the cell structure and is also considered non-hazardous waste.

7. **Cryogenic (Dry Ice) Media Blast** - A similar concept to the other media blast options. There is virtually no waste to dispose of because the dry ice evaporates into the air. This method is extremely hard on the cell structure and is not recommended by manufacturers for use on anilox rolls. It can, however, be used to remove caked on ink from many other press components.

Critical Points

- Every cleaning method is most effective **before** ink has been allowed to harden.

- Every off-press cleaning method should **ONLY** be used to **supplement** good press-side housekeeping practices.

- Poor press-side housekeeping (allowing ink to harden in the cells, failing to remove large quantities of wet ink from the roll surface, allowing large quantities of dried ink to build up on the sides and journals etc.) can degrade the performance of off-press cleaning methods by quickly contaminating cleaning chemistries and blast media.

- The vast majority of the ink should **always, always, always** be removed from the roll surface **prior** to use of any off-press cleaning method.

- **Prevention is the best cure !** When properly adjusted, ink should not dry on the anilox. Ink viscosity and pH must be monitored and properly adjusted. Doctor blade pressure should be correctly adjusted. Ambient air humidity levels should be monitored (and controlled if necessary). Proper press speeds should be maintained.

Too often, the tendency is to slow the press when problems occur. This allows greater dwell time between the time the ink evacuates from the cells until the cells are refilled with wet ink on the subsequent revolution. Excessive dwell time allows dry ambient air to steal humidity from the ink, causing it to dry prematurely. If humidifiers are not available, then drying inhibitors should be added to the ink on very dry days to compensate for this effect.

Cleaning Method	Estimated Cost	Cleaning Effectiveness	Environmental Impact	Damage Potential
Manual Cleaning Typically high pH chemicals agitated with a Stainless Steel (for ceramic) or brass (for chrome) roll brush or cloth.	**Extremely Low** Under $100	**Low** Slow and cumbersome. Bristle size is too large to be effective for high linecounts.	**Moderate** Chemically soaked rags must be disposed of. Possible safety issues depending on specific chemical hazards.	**Extremely Low** Brush bristles do not damage cells.
Soak Tanks Roll soaked in a heated chemical bath.	**Low** Under $3000	**Low** Chemistry is not agitated. Cleaning residue returns to the roll surface.	**High** High pH cleaning chemistry must be frequently replaced.	**Moderately Low** Long term exposure can cause blistering.
Ultrasonic Cavitation agitates a heated chemical cleaning solution.	**Low to Moderate** Typically under $7000	**Moderately High** Effectiveness deteriorates as chemistry becomes saturated	**High** Cleaning chemistry must be frequently replaced.	**Moderately High** Excessive exposure deteriorates cell walls
Multi-frequency Ultrasonic Varying frequencies is said to reduce cell-wall deterioration.	**Moderately High** Under $15,000	**Unknown** Cleaning cycle includes a rinse cycle.	**Moderate** Chemistry is filtered for reuse, but eventually must be disposed of.	**Moderate** Fresh water rinse prevents redeposition of cleaning residues.
Pressure Wash Heated cleaning chemistry forced at roll through a series of nozzles at the roll surface under high pressure.	**Moderate to High** Prices vary by features and model. Most under $15,000	**Moderate** Cleaning cycle is fairly slow, but includes rinse cycle. Multiple rolls can be washed at one time in more expensive models.	**Moderate** Chemistry is filtered for reuse, but eventually must be disposed of.	**Low** Fresh water rinse prevents redeposition of cleaning residues.
Sodium Bicarbonate Media Blast Specially formulated baking soda powder propelled by air at the roll surface.	**Moderate to High** Prices vary widely by model, size, features and brand.	**Moderately High** Cleaning cycle is fairly quick. Doesn't work well on all inks.	**Low** Spent media is considered non-hazardous, however, media is good for only one cleaning cycle. Moisture causes media to clump and clog feed lines.	**Moderately High** Excessive and repeat exposure slowly deteriorates cell walls.
Plastic Powder Media Blast Plastic powder propelled by pressurized air at the roll surface.	**High** Over $15,000	**Moderately High** Cleaning cycle is fairly slow.	**Low** Media can be reused. Spent media is considered non-hazardous.	**Low** Media does not appear to damage cells.
Cryogenic - Dry Ice Media Blast Dry ice pellets propelled at the roll surface,	**Not available**	**Moderately High**	**Extremely Low** Media warms and transforms into CO_2 gas.	**Extremely High** Excessive system pressure damages cell walls

Author Information
David Lanska is the Narrow Web Sales Manager / Technical Manager for Stork Materials Technology – Stork Cellramic, Inc. David has served with Stork for over 20 years in various anilox production, quality assurance, technical support, marketing, and sales functions. A long- standing member of the FTA's Environmental Committee, David is a frequent speaker at industry technical events. His many articles have covered a wide range of topics related to improving the profitability and reducing the environmental impact from a printing operation. He can be reached by phone at 1-800-545-7895, by fax at 414-357-0267 or by email at david.lanska@stork.com

Written: February, 2004

Note: Reasonable effort has been made to review and verify information in this document. Neither PNEAC and its partners, nor the technical reviewers and their agencies, assume responsibility for completeness and accuracy of the information, or its interpretation. The reader is responsible for making the appropriate decisions with respect to their operation, specific materials employed, work practices, equipment and regulatory obligations. It is imperative to verify current applicable regulatory requirements with state and/or local regulatory agencies.