

Plasticizers in Solvents

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MANY CLIENTS WHO ARE INVOLVED IN CRITICAL CLEANING tell us that they are on a perennial hunt for plasticizers. As consultants, we have to advise them that the likelihood of totally eliminating plasticizers is nil. We can, however, assure them (and you) that it is certainly feasible to minimize plasticizer contamination. Plasticizers (usually phthalates) are chemical additives that impart flexibility to polymers used in such equipment as laboratory squeeze bottles and hoses. Plasticizers dissolve in solvents to become a perennial contaminant of cleaning agents. Potentially, they can be deposited as non-volatile residue (NVR) on critical components [1] thus negating the critical cleaning application.

Solvent Storage

It is helpful to think of solvent storage and management as a process rather than a static situation, in that heat, agitation, and time, influence the amount of plasticizers dissolved. While specific management tactics are solvent-specific, a basic strategy involves minimizing sources of plasticizers in anything that comes in contact with the solvent. This effort begins with the vendor and continues at the user facility.

The Solvent Vendor

The first step is to have a vendor with an appreciation of plasticizers, a desire to minimize them, and a willingness to communicate with you. Transfer equipment and storage conditions impact the level of plasticizers. Pails, pumps, tubing, stirrers, all can introduce contaminants. One supplier we worked with found that plasticizers were leaching from "chemical resistant" tubing. They solved the problem by switching to stainless steel and glass transfer equipment.

Your Facility

Transfer equipment

Transfer equipment such as pumps should be selected to be as non-reactive with the solvent as possible. Facilities people need to be made aware of the requirement to use only the specified equipment; it is very tempting to make a random substitute based on cost or expediency.

Storage containers

For very high-end applications, with critical cleaning requirements, it is preferable to store solvents in glass; depending on potential reactivity of the solvent, dark glass may be preferable. This is particularly true for solvents used at the final cleaning stages. Even if the bottle is glass, there is a seal that can contain plasticizers. The choice of seal material can be a critical parameter.

Glass is preferable, even for bench top cleaning applications. Soft plastic bottles should certainly be avoided. For example, extraction of plasticizers into isopropyl alco-

hol stored in small plastic squeeze bottles is a recurrent problem, even if the alcohol in the squeeze bottles is totally replaced at periodic intervals.

Polyethylene is generally preferable to polypropylene. Plastics from different sources can show subtle variations; and there can be lot to lot variations. It is therefore reasonable to obtain detailed compatibility information from the solvent vendor and the supplier of the containers.

Commercial, prepackaged aerosol/sprays

Because they are used for a limited period and then replaced, prepackaged products avoid the issue of plasticizer buildup due to gradual degradation of spray bottles. They can be useful, if they are carefully selected and monitored. Again, this requires careful partnering with the supplier. Plasticizer contamination has been observed when a vendor substituted a new "nozzle extender." The problem was detected by routine FTIR; the vendor was notified, and appropriate substitutions were made.

Cleaning equipment

Every single time a different solvent is used in cleaning equipment, the non-metal components must be re-evaluated for compatibility with the new solvent. This is important to minimize plasticizer contamination and to avoid solvent loss. The seals used in cleaning equipment can leach into the solvent. Pump design may be an issue; some pumps are now designed without seals.

Further, if the equipment is operated at a higher temperature with the new solvent, unexpected reactivity may occur. Anecdotally, the presence of small, ovoid white objects in the cleaning sump of a degreaser was traced to seals that had dissolved in the solvent and re-precipitated on cooling. In this case, while no analysis was performed for plasticizers, one would suspect them to be present.

Monitoring, Reporting, Communicating

Someone must be in charge of the "plasticizer hunt" program.

Typically, low but tolerable levels of plasticizer are found in nearly all solvents. If you have not found any



plasticizers in your solvent, you probably have not looked diligently enough. A monitoring program using FTIR [2] is a relatively convenient means of tracking levels of solvent contaminants, including plasticizers. Batch or lot numbers should be included. If contamination increases significantly (a definition of "significant increase" is often set pragmatically or arbitrarily), the alarm can be sounded.

There must be ongoing observation, an "action level," and, of course, action has to actually be taken. Too often, it has been observed that FTIR may be performed, but contamination level is not actually tracked until a problem is observed. At that point, the old scans are resurrected. By this time, all too often, there are contamination problems.

In addition to scans, the Head Plasticizer Hunter needs to periodically audit or site-visit the production, storage,

and transfer areas to assure the proper containers and transfer equipment is used. Periodic communication with vendor/suppliers of solvent and containers is also desirable.

The most productive approach is to have a Head Plasticizer Hunter who is a benevolent dictator. "No-fault" communication should also be encouraged so that those in production and facilities can communicate early signs of trouble.

References:

- [1] B. Kanegsberg, M. Chawla. "In and out of the Cleanroom", A2G2 Magazine, (March, 2002).
- [2] B. Kanegsberg, E. Kanegsberg. "In and out of the Cleanroom", Controlled Environments Magazine, (January, 2006).

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