RadTech Energy Curing Users Resource Group: Recent Questions & Answers

With much thanks to the RadTech Energy Curing Users Resource Group (ECURG), we welcome your questions on UV+EB technology. We have compiled some of the questions that we have received, along with our ECURG answers. Please note that some answers may contain responses from multiple ECURG members.

Q **How do you best communicate to employees working in UV+EB the newer hazards that we are seeing assigned to some of the workhorse chemicals in our space?** e.g. TMPTA being labeled as a carcinogen, TPO and other PIs being labeled as repro hazards, etc.

My company already has a robust internal hazard communication program and workers are wearing appropriate PPE, and most of the potential exposure only happens incidentally. While we recognize the need to communicate with the team about the newer hazards associated with these chemicals, we don't want to cause alarm/panic given the new hazards are carcinogenicity and reproductive toxicity, which never sounds good.

We would appreciate recommendations regarding how to communicate with employees so that they aren't alarmed.

A It is best to work with your safety coordinator to educate employees on the risks of chemicals and ways to minimize those risks through good chemical handling, engineering controls, and PPE. One of the key items to discuss regarding new or revised hazard warnings is that the chemical hasn't changed; the hazard warnings are based on new information and/or regulations. Risk assessments, like the RadTech one for TMPTA, can also help with educating employees on the actual risk.

Q **I am working on a conductive UV ink project, and am looking for product recommendations (ionic liquids...conductive salts)?** I need the wet ink itself to be slightly conductive rather than the applied, cured film. I've had some success with ionic liquid, but the one I evaluated disrupted my stability. Any suggestions would be greatly appreciated!

A Quaternary Ammonium Salts can provide a degree of conductivity. Stick to the chloride versions or carbonate/Bicarbonate versions. Cetyltrimethylammonium chloride or DDAC or similar. Sulfoquats are bad for conductivity. Ionic liquids based on imidazolines (Unamine O or C from Arxada).

Q **With the concerns about TMPTA*, and the potential to detect free amounts of it in under-cured coatings, what are the test methods to measure "good cure"?**

A The first step to ensure proper cure is to practice good maintenance of UV/LED/EB equipment. LED and EB are low maintenance (but not "no maintenance"), and UV lamps are high maintenance. Old bulbs, dirty reflectors or quartz windows, substrate web out of focus and/or poorly functioning power supplies can all contribute to reduced UV energy output which in turn results in under-cured coatings, inks and/or adhesives.

For testing, there are three basic methods, please see Cure Test Methods: UV/EB/LED Coatings & Inks.

Other considerations include:

- Residence time for the product being cured. For printing operations, this translates into press or coater speed. It needs to be evaluated to ensure that the coating is not over-cured or under-cured.
- Maintenance of equipment (e.g., printing press or coating unit) is also important to make sure that the proper amount of coating is being applied to the substrate and that the substrate is being transferred correctly through the curing area.
- Ensure that the coating application equipment has been properly set up to make sure the proper amount of coating is being applied to the substrate. Too much coating on the substrate could cause curing problems.

** RadTech has developed a No Significant Risk Level (NSRL) for TMPTA and studied likely exposure scenarios. This work shows that human exposure to finished UV+EB products is well below the NSRL, for the products tested. Please contact RadTech for more information.*

Q **A printer is asking about 1-Vinyl-2-pyrrolidone (CAS 88-12-0) and they wanted to know if there were any restrictions or regulatory limitations on using this chemical in inks.**

A "This question kicked off a good discussion in our lab." There seems to be no regulation that prohibits the use of NVP. It is interesting now that VCAP was reclassified, and its use is now more restricted by EuPIA than NVP. But EuPIA Exclusion Policy does not apply nor is it restricted by Nestle. The two areas of emphasis in use would be Odor and Migration. It is Swiss A listed and has a No Detect for Migration. So, it probably limits the amount of use in a formula rather than exclusion.

Q We have a prospective customer who is concerned with potential migratory components in UV ink, post-cure for paper-based personal care products. We are looking for technical literature regarding migration, extraction analysis, etc. Concerned about skin contact...any potential component migration from their product to the consumer. **Is there a qualified 3rd party lab to perhaps perform extraction analysis?**

A Here are a few links to commercial testing labs that are familiar with the FDA Food Contact Substances testing protocols:

https://www.smithers.com/home
http://www.intertek.com/packaging/testing/migration-and-food-contact/
https://www.qima.com/testing/food-packaging-and-containers
https://foodinnovation.rutgers.edu/what-is-fic/thomas-hartman-bio/

This is a bit of an unusual inquiry. The question asks about "personal care products." Migration in packaging of this sort does not normally contact the product. Many personal care products are regulated under "Cosmetics" of the Food, Drug and Cosmetics Act (FDCA). Info on personal care products is regulated by FDA.

If the company is worried about potential migration and safety, they can do testing. They could also do a risk assessment based on the ingredients and some worst-case assumptions for migration, but ultimately there is no threshold for safety with cosmetic packaging nor would there be the same amount of rigor required for the risk assessment for a cosmetic package as would be done for food packaging, which requires contaminants be less than 50 ppb to be considered "safe".

You must comply with the Federal Food, Drug, and Cosmetic Act (the Act). Section 601 of the Act, which deals with cosmetics, states that a cosmetic is adulterated if it "has been prepared, packed, or held under insanitary conditions whereby it may have become contaminated with filth, or whereby it may have been rendered injurious to health" or if "its container is composed, in whole or in part, of any poisonous or deleterious substance which may render the contents injurious to health." In other words, the packaging material must be sufficiently clean so that it does not contaminate the skin care product." https://www.packaginglaw.com/ask-an-attorney/what-are-requirements-skin-care-packaging-materials

Q My press operators are generally concerned about UV curable coatings. **What are the concerns and how may I address them?**

A Ensure that the press operators are diligent about avoiding exposure to UV chemicals. Do they wear adequate PPE (long sleeve shirts and pants, impervious gloves, chemical resistant disposable sleeves, safety glasses/goggles, face shields, etc.)? Do they wash chemicals off their skin quickly if skin contact does occur, using warm water and soap? Solvents or pumice soap can increase the risk of skin absorption.

If liquid materials get on clothing, remove clothing, and wash separately from normal clothes or have them cleaned in commercial laundry. Leather items that are contaminated should be discarded.

If the coating is misting during application, that would be a health concern for exposure. Misting can appear like steam which may lead some people to not recognize the risk it poses.

Many UV chemicals have an odor which can sometimes be unpleasant. That doesn't necessarily equate to negative health effects.

Resin 3D printing is gaining in popularity for people crafting at home, and I've read many comments about the odor it generates. People are starting to be exposed to UV/LED chemicals in their homes which can increase the risk of sensitization. I frequently share the link to RadTech's 3D printing chemical safety poster with crafters on social media.

https://radtech.org/safe-handling-of-3d-printing-resins/

Q **My question is in relation to incident reactions to a run-away reaction of an ink/monomer.** We are trying to come up with a standard procedure on what we should do as a company when one of these reactions happens. We know there is a difference between an incipient stage reaction and a full blow over reaction.

A The first step is to evaluate the area, let the reaction finish and contact the appropriate emergency responders. We would not advise having any employees attempt to handle the container due to safety concerns.

The response depends on the scale of the reaction. Usually, the reaction tends to generate a heat spike and polymerize into a solid chunk of plastic. In a typical lab scale, it is often sufficient to close the hood or position additional shields around the reaction setup and move out of the room for a few minutes and let the reaction run its course. We would caution against ever moving the reaction to an outside or safe area due to the risks while moving to both the person moving the runaway reaction and to the environment on the way to the safe location.