

Explanation of chemicals from Toyobo Printight MSDS by Dr. Richard Peltier

Caprolactam is a mildly toxic, non-carcinogenic chemical typically used as a precursor to nylon production. Most of the toxicology studies are based on oral consumption in animal models; doses in these models were fairly high (10's of mg/kg/day), and typical effects seen were reduced body weight in offspring, and some nephropathy (kidney disease) were observed. It should be noted that this was in a rat, and not in human observations. It is possible to be exposed by inhalation, but there is limited research that looks at this exposure. An extrapolated reference dose (RfD) - which is a dose that is extrapolated from animal based research to determine safe levels for human - is 0.5 mg/kg/day - for a 60 kg person, one would need to be exposed to 30 mg/day of caprolactam to approach a level that may have an effect. Theoretically, one can have up to 13 mg/m³ of caprolactam in the air (under worst-case scenarios, likely highly over estimating what you see in your environment). But assuming 13 mg/m³, a typical 60 kg person would have to breathe continuously in this environment for about 4 hours to reach that RfD.

Methanol -

Methanol is a volatile alcohol similar in structure to ethanol, but is more significantly more toxic. The most common health effect observed from methanol poisoning is blindness, and it can be fatal. Surprisingly little toxicity information is available, though this compound is currently undergoing extensive review by the US EPA. The most common route of entry for methanol is orally, though in your case inhalation exposure will be typical. The extrapolated reference dose methanol is also 0.5mg/kg/day, or about 30mg/day for an average person. Ambient air concentrations are difficult to estimate because they are highly sensitive to temperature and other organics present in the solution. But a reasonable guess here is that your concentration is in the range of a 5-10mg/m³, so you'd have to spend 4-5 hours exclusively breathing these vapors. Also, keep in mind the context - your plates are <3% methanol, but your winterized windshield fluid is about 40% methanol.

Methyl Acrylate (MA) and Methyl methacrylate (MMA)-

These chemicals are similar in structure and function; methyl acrylate is a compound that is commonly used in the manufacturing of carpeting and textile fibers, and methyl methacrylate is used in PVC glues and other plastics. They are quite toxic, and are not a likely carcinogen. These compounds are probably responsible for the plasticky feel on your plates. They are only slightly soluble in water, so even though it is a significant component of your process, only a fraction is dissolved in your wash water. MA is more soluble than MMA. Once in solution, it has a relatively low vapor pressure, meaning it is not likely to easily evaporate. Though some small fraction does evaporation and is detected as a fairly acrid odor. Methyl acrylate has very limited toxicity data available, though

methyl methacrylate has been better studied. Reference doses for MMA via inhalation is in the range of 0.7mg/m³ for a 6h/day, 5d/week exposure .