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Low-VOC and Zero-VOC Paints

The paint-manufacturing industry has undergone notable shifts over the past 50 years in response to consumer health concerns: Lead-based paints, for example, were outlawed in 1978 (Buday et al., 2010, p. 4); heightened awareness of volatile organic compounds (VOCs) helped move the interior-paint market from oil-based to water-based paints; and now we are in the midst of further transition towards paints containing low or near-zero levels of VOCs.

At the fundamental level, paint is comprised of solid polymer binders dispersed in a liquid solvent. When the paint is applied to a surface, the liquid phase evaporates, and the binder particles coalesce into a solid film. Pigments are added for color, and other additives are included to improve flow, resist mildew, prevent bubbles, etc ("Chemistry", n.d.). In solvent-based (also called oil-based) paints, the liquid phase is a volatile organic solvent. As a consequence, VOCs comprise 30-40 weight % of oil-based paints, which continually off-gas into the air even well after the paint has dried (de Hek et al., 1998, p. 14). These VOCs are under scrutiny due both to their potential health risks to consumers and their role in environmental pollution via ozone formation (Buday et al., 2010, p. 2).

To reduce the concentrations of VOCs in paints, the vast majority of these organic solvents were replaced with water to form conventional water-based latex paints. However, some sources of VOCs still remain in water-based paints as coalescing agents, thickeners, and defoamers (Brettner et al, 1998, p. A-261). Pushing the VOC levels even lower, many companies now carry "low-VOC" and "zero-VOC" paint options. A paint labeled as "low-VOC" must contain less than 200 grams of VOCs per liter, and "zero-VOC" paints cannot exceed 5 g/L (Buday et al., 2010, p. 2-3). These reductions in VOC levels could provide important health benefits for people with asthma; in a double-blind study by Beach et al. (1997), a group of asthmatics with sensitivities to paint fumes reported decreased symptoms of wheeze and breathlessness while painting with a "VOC-free" paint than compared to painting with a conventional water-based latex paint.

However, an important distinction must be made that "low-" and "zero-VOC" do not always mean that the paint will be healthier or have low odor (Bohling et al., 2010, p. 378). In fact, some VOCs found in paint can have significant or noticeable odors even at concentrations lower than 1 ppm in the air (Bohling et al., 2010, p. 381). Furthermore, in a study of "low-VOC" paints, Chang et al. (1999) discovered significant emissions of formaldehyde (classified as a hazardous air pollutant and probable carcinogen) from two of the four tested paints (p. 256). Also among "low-VOC" and "zero-VOC" paints, dark colors require more pigment and, thus, contain slightly higher levels of VOCs than the white or lighter-colored counterparts (Buday et al., 2010, p. 2).

Although commercially-available paints still have plenty of room for growth, important strides have been made towards reducing the public's exposure to volatile organic compounds and improving the indoor air quality of homes, businesses, schools, hospitals, and many other painted buildings.

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