



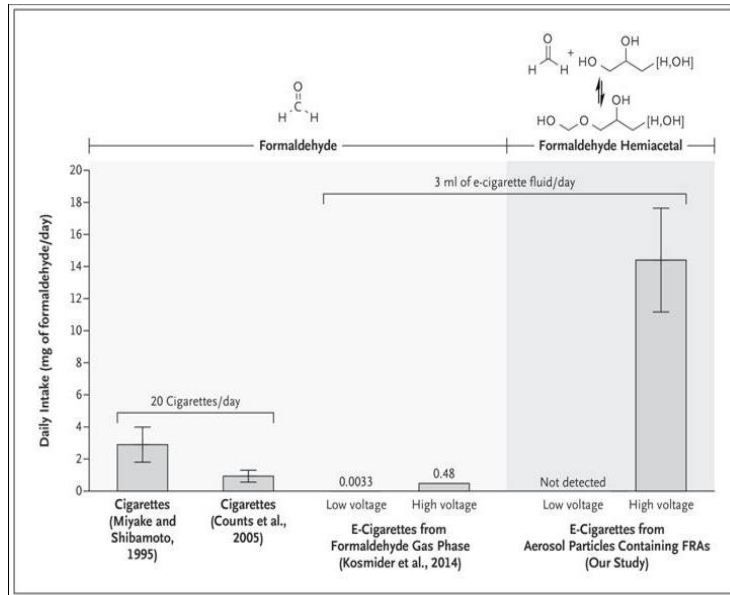
**CellPath**

A STATLAB COMPANY

# All you need to know about formaldehyde

To the histologist, formaldehyde is undeniably the gold standard in tissue preservation, forming cross links with proteins and converting sols to gels. By protecting tissues from the denaturing effects of the ravages of subsequent processing and staining, the histologist is able to produce stained sections of tissues that have been preserved close to their natural state. But what exactly is formaldehyde and where is it found? In its basic form, formaldehyde is a gas which readily dissolves in water. It occurs naturally in the atmosphere but is also released into the environment as a result of natural processes such as forest fires, exhaust fumes, tobacco smoke and natural decay. However, it does not accumulate there because it is broken down within hours by sunlight and bacteria found in the soil and water. Any formaldehyde that does become absorbed into the body is quickly metabolized to formic acid which escapes from the body via the urine or is subsequently converted to carbon dioxide and water.

Outside of the laboratory, formaldehyde has numerous uses, ranging from photography (where it is used in the development of photographic film) through to the textile industry, where formaldehyde-based resins are used in the making of crease-resistant fabrics. For those who smoke cigarettes, it is estimated that up to 3 milligrams of formaldehyde is released into the air from a standard pack of cigarettes. There are problems too, for e-cigarette users. Although nicotine and flavouring are standard components of e-cigarettes, the liquids often contain propylene glycol and glycerol which react during vaping to produce formaldehyde as a degradation product. One recent study estimated that e-cigarette users who vape 3ml of liquid a day inhales between 10-18 mg of a formaldehyde component (Figure 1).

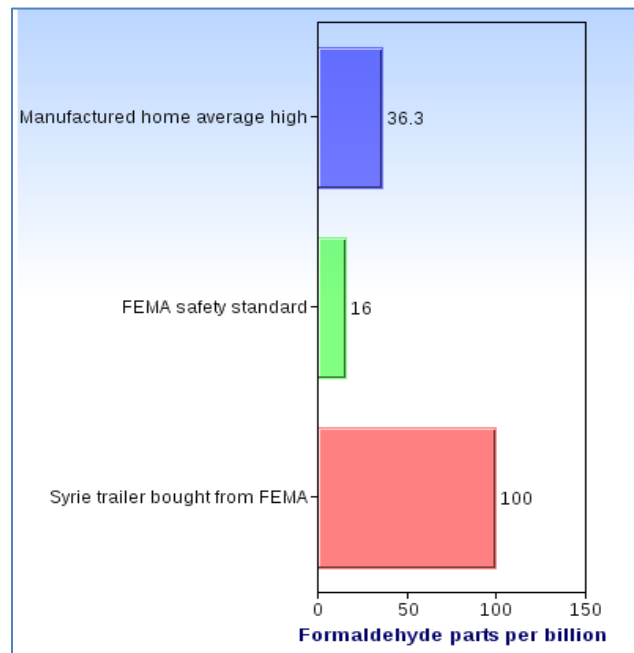


**Figure 1. E-cigarettes and formaldehyde content**

In the automotive industry, formaldehyde is also used in the manufacture of cars and components such as engines, electrical systems, door panels and brakes. In the home, formaldehyde can be found in paper tissues, kitchen towels, paints, disinfectants and insulating foam. In addition, personal hygiene products such as topical creams, hair sprays and cosmetics also contain formaldehyde as an active ingredient since it prevents the growth of potentially harmful bacteria. But undoubtedly, the most extensive use of formaldehyde around the home is in products of the woodworking and cabinet-making industries. Urea-formaldehyde is a component of the glues that are used for bonding together the particle boards and ply woods that are often found beneath wood veneers and plastic laminates in household furniture. Factors such as room temperature and humidity can elevate formaldehyde levels from these materials, and they are found to be highest when the building is first used.

This was notably illustrated in the aftermath of hurricane Katrina that devastated New Orleans during the summer of 2005. In order to help the residents that had been displaced by the disaster, the Federal Emergency Management Agency (FEMA) provided new residential caravans and homes. These had been manufactured using formaldehyde-based resins and sometime later, the new residents began to complain of health problems such as breathing difficulties, nosebleeds and persistent headaches. The United States Centre for Disease Control and Prevention (CDC) later announced that potentially

hazardous levels of formaldehyde had been found in many of the trailers and manufactured homes provided by the agency. In fact, raised levels of formaldehyde were still present several years following manufacture and residents were later relocated into replacement temporary homes (Figure 2). As a result, many lawsuits were filed against FEMA as a result of the exposure and in the United States a bill was passed in 2010 which limited the allowable amount of emissions of formaldehyde in particle board and ply woods.



**Figure 2. Formaldehyde content of FEMA trailers**

In the laboratory, workers are only too aware of the dangers of formaldehyde. It is a toxic agent and exposure to it has become a significant concern for human health. The International Agency for Research on Cancer (which is part of the World Health Organization) has recognized the carcinogenic potential of formaldehyde and only strict compliance to safe levels of exposure to it will enable a secure environment for all those who work in the histology laboratory.

### **Further reading**

1. Formalin as a tissue fixative [www.tissuesampling.weebly.com](http://www.tissuesampling.weebly.com)

2. Hidden formaldehyde in e-cigarette aerosols  
<http://www.nejm.org/doi/full/10.1056/NEJMc1413069#t=article>
3. Formaldehyde content in FEMA trailers  
<https://thelensnola.org/2011/11/30/fema-trailers-test-toxic/>

**Dr Phil Bryant**

**August 2017**