

FORMALDEHYDE

APPLICATIONS IN SCIENCE AND PRESERVATION

Formaldehyde is a versatile chemical compound that has various applications in science and preservation across different fields. Some common uses of formaldehyde and formalin (a solution of formaldehyde in water) include:



1 Biological Research

Formaldehyde is utilized in various molecular biology techniques, including DNA and RNA cross-linking. This is crucial for studying protein-DNA interactions, chromatin structure, and gene expression. It is also used in the preparation of specimens for microscopy. It aids in preserving cell structures, allowing researchers to study cellular morphology and other characteristics.



2 Histological Exams/Microscopy

Formaldehyde is widely used to preserve biological tissues for histological examination. It works by cross-linking proteins, preventing their degradation, and maintaining the structural integrity of tissues.¹ It is considered a widely used fixation method² that results in low levels of shrinkage and good preservation of cellular structure for a wide range of cells and tissues and does not appear to result in significant structural changes to proteins.



3 Vaccine Production

Formaldehyde is used in the production of certain vaccines. It can inactivate toxins or viruses, rendering them non-infectious while still maintaining their ability to stimulate an immune response. This includes the flu shot, used to inoculate against seasonal flu variants which according to the CDC,³ sickened as many as 54 million Americans in 2022-23.



4 Disinfection and Sterilization

Formaldehyde has disinfectant properties and can sterilize equipment and laboratory surfaces. According to the CDC,⁴ formaldehyde is used as a disinfectant and sterilant in both its liquid and gaseous states. The aqueous solution is a bactericide, tuberculocide, fungicide, virucide, and sporicide. It helps in preventing the spread of contaminants and ensuring aseptic conditions.



5 Taxidermy

Taxidermy preserves elements of an animal for study or display after the animal has died.⁵ Formaldehyde or formalin is preferred for injecting and fixing specimens whenever possible. It effectively preserves the tissues, preventing decomposition and maintaining the lifelike appearance of the taxidermy specimen over time. Its properties make it an ideal fixative for taxidermists aiming to create long-lasting and high quality displays.⁶



6 Preservation of Zoology Specimens in Museums

In museum collections, it is common for zoology specimens to be preserved in a formaldehyde and water solution known as formalin. For example, at the Florida Museum of Natural History's Division of Ichthyology, fish specimens are fixed by immersion in a solution of 10% formalin.⁷

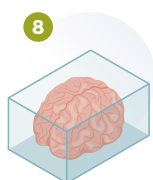
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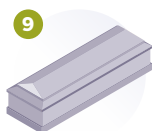
7 Preservation of Botanical Specimens

Most plants will deteriorate after two or three days if they are not dried or preserved in some fashion. If they are refrigerated, they can be kept a day or two longer. According to the Missouri Botanical Garden,⁸ a 30% formaldehyde solution is used to help preserve specimens before drying. Preserved plant specimens provide us with important information about plant diversity and distribution.⁹



8 Anatomical and Forensic Studies

Formaldehyde is used for embalming and preserving cadavers such as bodies donated for science. During an autopsy,¹⁰ formaldehyde solution is used to determine if the person was breathing at the time of death. This process helps in studying anatomy, conducting medical research, and forensic investigations.¹¹



9 Funeral Services

Formaldehyde is still the primary preservative in the majority of embalming fluids today and is preferred by funeral service professionals due to its ability to accomplish the three primary purposes of embalming: preservation, sanitation, and presentation of human remains to families. Formaldehyde use is essential for veterans where the current wait time for the burial at Arlington National Cemetery or national cemeteries can be up to and over six months. There are no other known preservatives that would work appropriately for this length of time. Also, some northern states like Maine are unable to do ground burials during the winter months so some deceased must be embalmed. This allows mourners to pay their last respects and say their goodbyes while the body is still preserved.

¹ Srinivasa, Savita, et al. "Formaldehyde cross-linking and structural proteomics: Bridging the gap." *Methods*, vol. 89, 2015, pp. 91-98. <https://doi.org/10.1016/j.ymeth.2015.05.006>.

² Hobro, Alison J., and Nicholas I. Smith. "An evaluation of fixation methods: Spatial and compositional cellular changes observed by Raman imaging." *Vibrational Spectroscopy*, vol. 91, 2017, pp. 31-45. <https://doi.org/10.1016/j.vibspec.2016.10.012>.

³ Centers for Disease Control and Prevention. 2023-2024 U.S. Flu Season: Preliminary in-Season Burden Estimates. www.cdc.gov/flu/about/burden/preliminary-in-season-estimates.htm.

⁴ "Chemical Disinfectants." *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 18 Sept. 2016. www.cdc.gov/infectioncontrol/guidelines/disinfection/disinfection-methods/chemical.html.

⁵ Natural Sciences Collections Association. *Taxidermy and Skins*, www.natsca.org/taxidermy.

⁶ Kiernan, Robert. "How to Taxidermy: Formaldehyde and Preservation Techniques Explained." *Meaningful Spaces*, 3 Nov. 2023. www.meaningfulspaces.com/how-to-taxidermy-formaldehyde/

⁷ Florida Museum of Natural History's Division of Ichthyology. *Ichthyology Collection Standard*. www.floridamuseum.ufl.edu/fish/collection/standards/.

⁸ Missouri Botanical Garden. "Preserving Plants Before Drying." *MBG Field Techniques Book Preserving before Drying*. <https://www.mobot.org/MOBOT/Research/library/liesner/preserve.html>

⁹ Fort Worth Botanic Garden. *Plant Collection and Preservation*, 23 June 2021. fwbg.org/research/herbarium/plant-collection-and-preservation/.

¹⁰ Mlblevins, Science Struck. *Formaldehyde Uses*, 13 Nov. 2009. sciencestruck.com/formaldehyde-uses.

¹¹ Takayasu, T. "Toxicological analyses of medications and chemicals in formalin-fixed tissues and Formalin Solutions: A Review." *Journal of Analytical Toxicology*, vol. 37, no. 9, 2013, pp. 615-621. <https://doi.org/10.1093/jat/bkt0>