

New formula invented for microscope viewing, substitutes for federally controlled drug

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Researchers at Rutgers, The State University of New Jersey, and City University of New York have invented a proprietary new formulation called Visikol that effectively clears organisms to be viewed under microscopes. Visikol can be used in place of chloral hydrate, which is one of the few high-quality clearing solutions currently available but which is tightly regulated by the Drug Enforcement Administration (DEA) due to its use as a narcotic.

Clearing solutions, or clearing agents, are vital for viewing organisms under a microscope. Without them, microscope images become refracted and scattered, impairing the clarity of vision. Clearing solutions are used to identify specimens and examine their anatomy by "clearing" them, increasing the transparency of the specimen by rendering some components of a specimen invisible in order to better view other components of interest.

One of the most common clearing solutions is chloral hydrate, which is used for everything from studying plant <u>organelles</u> to authenticating herbal plant species for medicinal purposes. Its popularity in the research community, government, and industry stems from its high refractive index, which allows a high magnitude of light to pass through the medium and make specimens crystal clear under the microscope.

However, chloral hydrate is difficult and expensive to obtain, as it is



regulated by the DEA as a Schedule IV controlled substance. Chloral hydrate is prescribed medically as a <u>sedative</u>, depressant, <u>pain reliever</u>, and hypnotic, and overdoses can lead to serious health issues, including fatal heart conditions. Chloral hydrate has also found use as an <u>illicit</u> drug, and has been used in sexual assaults. Thus, possession of chloral hydrate requires costly, annual permits and time-consuming paperwork. Despite its advantages for research and industry, chloral hydrate is an impractical, and sometimes impossible, choice for scientists.

To replace chloral hydrate and alleviate the "red tape" associated with clearing solutions, university researchers invented Visikol, a polychlorinated alcohol mixture that is safer, cheaper, and not federally regulated by the DEA. Thomas Villani and Professor James Simon of Rutgers, The State University of New Jersey, with Professor Adolfina Koroch of City University of New York, developed and then tested the utility of Visikol alongside chloral hydrate to compare it as an effective replacement.

Villani and colleagues prepared samples of a broad range of fresh and dry plant material with either chloral hydrate or Visikol. They tested <u>plant species</u> that are important in plant biology and genetics research, botanical authentication and herbal pharmacology, and agriculture, including *Arabidopsis*, ginger, maté, lime basil, and oregano.

Visikol successfully cleared plant materials, creating transparent and detailed specimens of cells, tissues, and rhizomes, for viewing under a microscope light. Visikol also had a higher refractive index than chloral hydrate and served as an agent to mount tissues for microscopic identification. These results are published in the May issue of *Applications in Plant Sciences* and are the first report of a replacement solution for chloral hydrate.

Visikol was originally developed as a tool for botanical microscopy;



however, it will serve as a useful tool for teaching microscopy to students and professionals. "Since it is not regulated," comments Villani, "it will enable students to experience firsthand what they are taught on the chalkboard." Koroch adds, "It is often difficult for beginners to grasp microscopy, and Visikol's ease of use will help teachers engage and motivate students by allowing them to easily see biology in stunning detail."

In addition, Visikol's use extends far beyond research applications. "We expect Visikol to be especially useful in quality control, aiding in rapid screening for agricultural disease vectors," says Villani, as "small insects like mites are a common disease vector for agricultural crops and can be easily viewed within plant tissues using Visikol." Visikol is likely to be used as a general tool for specimens under the microscope, as it has wide application to all organisms and tissues.

More information: www.bioone.org/doi/pdf/10.3732/apps.1300016

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