# Human eye inspires clog-free ink jet printer invented by MU researcher

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COLUMBIA, Mo. -- Clogged printer nozzles waste time and money while reducing print quality. University of Missouri engineers recently invented a clog-preventing nozzle cover by mimicking the human eye.

"The nozzle cover we invented was inspired by the human eye," said Jae Wan Kwon, associate professor in the College of Engineering. "The eye and an ink jet nozzle have a common problem: they must not be allowed to dry while, simultaneously, they must open. We used biomimicry, the imitation of nature, to solve human problems."

Kwon's invention uses a droplet of silicone oil to cover the opening of the nozzle when not in use, similar to the film of oil that keeps a thin layer of tears from evaporating off the eye. On the surface of the human eye, eyelids spread the film of oil over the layer of tears. However, at the tiny scale of the ink jet nozzle, mechanical shutters like eyelids would not work, as they would be stuck in place by surface tension. Instead, the droplet of oil for the nozzle is easily moved in and out of place by an electric field.

Kwon said this invention could make home and office printers less wasteful. To clear a clogged nozzle in most ink jet printers, a burst of fresh ink breaks through the crust of dried ink which forms if the machine isn't used constantly. Over time this cleaning operation can waste a large amount of expensive ink. Kwon's invention eliminates the need to waste that squirt of ink.

"Other printing devices use similar mechanisms to ink jet printers," Kwon said. "Adapting the clog-free nozzle to these machines could save businesses and researchers thousands of dollars in wasted materials. For example, biological tissue printers, which may someday be capable of fabricating replacement organs, squirt out living cells to form biological structures. Those cells are so expensive that researchers often find it cheaper to replace the nozzles rather than waste the cells. Clog-free nozzles would eliminate the costly replacements."

Similarly, rapid prototyping systems used by engineers and product designers emit streams of liquid plastic through nozzles like those on an inkjet printer. The thick, sticky liquid used in the devices can make it necessary to replace the whole nozzle when they become clogged. These specialty printer parts can cost thousands of dollars.

MU engineering doctoral student Riberet Almieda worked with Kwon on the oil droplet nozzle cover. A paper documenting the discovery was published in the *Journal of Microelectromechanical Systems*.

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