Research into outdoor and protective clothing seeks to shake off fluorochemicals

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The hazard symbol for carcinogenic chemicals in the Globally Harmonized System. Image via Wikipedia.

Rain-repelling fluorochemicals used in waterproof clothing can and should be phased out as unnecessary and environmentally harmful, textile researchers argue.

And yet they remain the only effective option for medics and emergency service personnel.

New research demonstrates how waterproofs using highly fluorinated chemicals are over-engineered for consumers, building in unnecessary resistance to oil and other stains, when only resistance to rainwater is required.

Publishing their findings today in the *Journal of Cleaner Production*, the team – from Leeds and Stockholm – say effective alternatives to harmful fluorochemicals used in durable water repellents (DWRs) for waterproof clothing are readily available.

Dr. Richard Blackburn, who heads the Sustainable Materials Research Group at the University of Leeds' School of Design, said: "Environmentally-friendly and biodegradable solutions are available, but are being resisted by some manufacturers and retailers."

The reasons for this were unclear, he said, putting it down to a lack of information and appropriate technical research demonstrating the effectiveness of sustainable alternatives, as well as a lack of engagement with consumers.

In the new research, a survey of 300 outdoor clothing users revealed that most consumers only look for water repellency from their gear, not stain resistance.

"Non-fluorinated alternatives are a viable option in all cases where stain repellency is not an essential function," Dr. Blackburn added. "These alternatives provide excellent rain protection, and there are long-term ecological benefits from phasing out the highly fluorinated chemicals."

Fluorochemical repellents were shown to be the only effective option for clothing worn by medical staff to protect against infection spread by bodily fluids, and by military, firefighting or oil and gas industry personnel seeking protection against chemical contamination.

The study's co-author Philippa Hill, a Ph.D. researcher from the School of Design at Leeds, said there was still room for innovation when it came to eliminating fluorochemicals from protective clothing worn by people in hazardous circumstances.

"Currently, only fluorinated chemicals can provide the high levels of protection needed from other types of liquids such as oils, chemicals, and bodily fluids, so there is a major opportunity for future innovation in that area," she added.

In this collaborative research – the most detailed study of its kind – Ms Hill from Leeds and co-author Steffen Schellenberger, a fellow Ph.D. researcher, from Stockholm University, developed an innovative new testing method and applied different waterproof finishes to test fabric before measuring resistance to a wide range of fluids – water, orange juice, red wine, olive oil, synthetic blood and gastric fluid, and cough medicine.

Fabric treated with non-fluorinated repellents was shown to be resistant to water-based stains such as orange juice and red wine, but gave no repellency to oil-based stains.

When it came to medical fluids, non-fluorinated repellents showed some resistance to synthetic blood and cough medicine, but none for gastric fluid.

The researchers' innovative "roll-off" method assessed repellency with movement, which more accurately reflected clothing as it is worn.

The paper points out that the textile and clothing industry uses a quarter of all chemicals produced globally and is known to be a large contributor to environmental pollution.

Concerns have been raised about waterproofing fluorochemicals finding their way into the environment during their production, as well as during the life of a garment – through washing and microfibre shedding – and when it is disposed of.

All highly fluorinated chemicals are extremely persistent in the environment, and some have been associated with health problems in humans.

"We want to help textile producers and retailers to develop better garments that also have minimal environmental impact," said co-author Professor Ian Cousins from Stockholm University. "It is important to look into the necessary functionality and durability, otherwise people won't buy the greener alternatives."

More information: Steffen Schellenberger et al. Highly fluorinated chemicals in functional textiles can be replaced by re-evaluating liquid repellency and end-user requirements, *Journal of Cleaner Production* (2019). DOI: 10.1016/j.jclepro.2019.01.160

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