

## Institute for Stem Cell Science and Regenerative Medicine

### IMMEDIATE RELEASE

Contact:  
Communications Office ([commsoffice@instem.res.in](mailto:commsoffice@instem.res.in))  
or  
Praveen Kumar Vemula ([praveenv@instem.res.in](mailto:praveenv@instem.res.in))

### ***Kisan Kavach* to protect farmers from lethal effects of pesticides**

*iBRIC-inStem research team in collaboration with Sepio Health Pvt Ltd develops an anti-pesticide suit “Kisan Kavach®”, to prevent pesticide-induced toxicity and lethality*

Bangalore, INDIA – A team of researchers at the [Institute for Stem Cell Science and Regenerative Medicine](#), (iBRIC-inStem, Department of Biotechnology), in collaboration with [Sepio Health Pvt Ltd](#) (inStem’s spin-off company) has developed an anti-pesticide fabric capable of deactivating pesticides upon contact. This would prevent the myriad ill-effects of pesticide exposure on farmers’ health such as vomiting, breathing disorders, tremors, vision loss, muscle pain and weakness, loss of endurance and in some instances – death. These findings are reported in a research article in the latest edition of the journal [Nature Communications](#), where Dr. Praveen Kumar Vemula is a senior author, and Mahendra K. Mohan, the lead author of the work.

Farmers from India and developing countries are exposed to toxic pesticides that can enter the body through the skin and the nose while spraying in the field, especially since no protective gear is worn during the process. Most pesticides/insecticides are neurotoxins. Thus, getting exposed to them causes toxic and lethal effects. Millions of farmers suffer from pesticide toxicity, even if they cover their mouth and nose with cloth while spraying. Despite a pressing need, no technology exists to chemically deactivate pesticides before they enter into the body to protect farmers from pesticide exposure.

“Farmers are the backbone of India, and providing ‘first-in-class’ technologies to protect their health from pesticide-induced lethality is an impactful contribution to society. Kisan Kavach® will have an enormous impact on safeguarding farmers from pesticide toxicity,” said [Vemula, Associate Professor at iBRIC-inStem](#). “Kisan Kavach® fabric attacks the pesticide molecule and breaks it into non-toxic products. The pesticide is deactivated even before it reaches the skin surface” he added.

“Kisan Kavach® is washable and reusable fabric which can be used at least one year by the farmer. At Sepio, our efforts are focused on bringing Kisan Kavach® suit in an affordable manner. We anticipate that price of this suit will be equivalent to a normal dress a farmer wears on a daily-basis,” says Dr. Omprakash Sunnapu, a research scientist and Director at Sepio Health, co-author on the paper.

In the pre-clinical studies conducted on rats, the researchers tested the protection their anti-pesticide fabric could confer. The material of Kisan Kavach® successfully

prevented neuronal damage, loss of muscle function or endurance, and death. More importantly, it could detoxify the majority of commonly used pesticides in India, including the notorious organophosphates.

Organophosphates are a major class of pesticides that easily enter the body through the skin and nose. If exposure persists, it causes severe damage to nerves by inhibiting the Acetylcholinesterase (AChE) enzyme which plays critical role in the communication among nerve cells and between nerves and muscles. Inhibition of AChE enzyme interferes with these signaling processes, leading to learning deficits, suffocation, paralysis, muscle weakness, loss of endurance and even death. Vemula and team countered this effect through 'nucleophilic-mediated hydrolysis'. InStem's Kisan Kavach® is active against a wide range of pesticides, insecticides, and fungicides including commonly used commercial ones in India.

“The design of one nucleophile that can deactivate a wide range of organophosphates and carbamates was challenging. Also, optimizing the industry-friendly chemistry to covalently attach on the fabric is key in developing the anti-pesticide fabric,” says Dr Ketan Thorat, a former research student at inStem, and the co-author on the paper. Dr Thorat was also the lead author in the 2018 study by Vemula group that developed a topical gel which can be applied on the skin to deactivate pesticides. Those findings were reported in the journal [Science Advances](#).

[Sepio Health Pvt Ltd](#) is a spin-off company from iBRIC-inStem, founded by Vemula. Sepio has started the bulk manufacturing of Kisan Kavach® suits that could be launched in the market in the near future. Sepio also inviting the industry partners, NGOs and societies who can help in distributing these protective suits to the farmers. Sepio's mission is to protect every single farmer and farm workers in India protection from pesticide-induced toxicity and lethality. Together, this technology could have a broad social impact in India and developing countries.

This research was supported by extramural funding from the Department of Biotechnology to Vemula at iBRIC-inStem.