Advancing Wound Infection Assessment by Utilizing pH-Sensitive Curcuma Longa, Phase II

Mukadam, Ishita (School: Maharishi School)

Wound care is an essential part of patient healthcare. However, infections worldwide are increasing at a record rate due to disease, microbes, and antibiotic resistance. Unfortunately, preventing such infections is challenging due to the lack of early warning assessment for wound health. To bridge this critical gap, a novel early-warning wound infection detecting system was developed that uses the natural pH-indicating properties of turmeric to indicate wound infection before it spreads to other parts of the body. Turmeric—a bioactive antibacterial compound—was used to change color in the bandage in response to varying pH environments. The color difference was measured using Red-Green-Blue Color Analysis. Infected wounds typically exhibit an alkaline pH of 9-10, distinct from the pH range of 6-8 in uninfected wounds. A rigorous litmus test involving 10 chemical substances and 9 pH levels was conducted, of which an alkaline compound emerged as the most suitable for simulating infected wounds, and an acidic compound was used to mirror the body's wound-healing response. Subsequently, three bandage materials were tested. Of specific interest was the finding of the RGB color analysis of materials, which revealed organic 100% cotton cloth as statistically significant over commercially used Band-Aid, exhibiting high observed absorbency and recorded color changes at pH 9 of 100% of the samples. This cost-effective and eco-friendly use of turmeric is the first-ever approach that provides healthcare professionals with a non-invasive assessment of their patient wounds that identifies infections before spreading while avoiding antibiotic usage. This bandage holds promise for reducing infection rates and drug resistance when combined with sanitation practices.

Awards Won:
Fourth Award of $500
Air Force Research Laboratory on behalf of the United States Air Force: Glass trophy and USAF medal for each recipient
Air Force Research Laboratory on behalf of the United States Air Force: First Award of $750 in each Regeneron ISEF Category,