Development of a Rapid, Portable Lateral Flow Assay for the Detection of Microplastic-Drug Interactions

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Various recent findings indicate that several tissues and muscles in the human body contain nano/micro-plastics; including the brain, acting similar to a sponge- absorbing the highest concentrations of nano/micro-plastics compared to any other tissue in the human body. The majority of us are also taking medications for various conditions and diseases, in some cases requiring multiple medications per day. However, we don't know whether nano/micro-plastics in tissues, muscles, and the blood circulation have the ability to bind to these medications, either preventing their effectiveness or forming a different chemical compound altogether. Recently, there has been significant research using molecular dynamics simulations to understand the molecular interactions. The goal of my project is to perform a molecular dynamic simulation and a real-world validation of nano/micro-plastics (specifically styrene, a monomer of polystyrene) and a pharmaceutical drug (broad-spectrum antibiotic ciprofloxacin or 'cipro') interaction, and then to develop a novel detection method using a lateral flow assay. I used NetLogo and the Molecular Operating Environment (MOE) and concluded that styrene and cipro can interact and bind. A size-based membrane filtration and a lateral flow assay (LFA) validated the results from the computer simulations. I am finalizing a novel method for capturing and detecting this interaction using a lateral flow assay. Lastly, a colored sensor connected to a Raspberry Pi model is being used to capture different concentrations of each nano/ micro-plastic styrene sample stained with iDye pink after each membrane filtration.

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