Combating Viral Outbreaks: Rapid and Selective Detection of Viruses Using Inexpensive Polymer Films

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Viral diseases are a leading cause of death worldwide. Methods currently used to diagnose viral infection take too long and are lab-based and expensive. An urgent need exists for a tool to detect viral pathogens rapidly, selectively, at the point of care, and at low cost. In this study, a virus imprinted polymer (VIP) was produced by curing a prepolymer in the presence of a template of the target virus. The template was subsequently removed, leaving on the surface cavities (mean size 120±4 nm) that were complementary in shape and could specifically capture the target virus. Two inactivated viruses with similar shape, Influenza A (HK68) and Newcastle Disease Virus (NDV), were employed as model strains. The VIP has distinct advantages over existing viral detection methods: it captures a target virus from aqueous suspension of ultralow volume (5 μL) after only 1 min of contact, detects viruses at concentrations found in influenza infections, and is sensitive to 8 fM. The polymer film, first imprinted with HK68 and exposed sequentially to suspensions containing fluorescently labeled NDV and HK68, was able to preferentially bind HK68 at a capture ratio of 1:8.0. When the procedure was reversed and the polymer was imprinted with NDV, the ratio was 1:7.6. These results were obtained within 20 min of static exposure. Production of VIPs can be readily scaled to large quantities and yields a disposable, simple-to-use device for rapid and selective detection of viruses at the point of care, without electricity, and in line with World Health Organization guidelines.

Awards Won:
Second Award of $2,000