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Cost-effective paper-based diagnostic using split proteins to detect yeast infections

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ABSTRACT

The common yeast infection, vulvovaginal candidiasis, affects three out of four women throughout their lifetime and can be spread to their child in the form of oral candidiasis (thrush). This disease is caused by the fungal pathogen *Candida albicans*, which is also a major cause of systemic candidiasis, a rarer but deadly disease with up to a 49% lethality rate. Current widely-used diagnostic methods include cell cultures, pH tests, and antibody detection, to assist effective treatment. Despite availability of various diagnostic methods, there is no inexpensive, rapid, and accurate way to detect *C. albicans* infection. This project aims to develop a paper-based diagnostic test for *C. albicans* that is, cost-effective, quick, and precise. The test detects the specific biomarkers farnesol and tyrosol produced by *C. albicans* by binding them to the split proteins pqsR and tyrosinase, respectively. Upon binding, a split horseradish peroxidase catalyzes and produces an amplified colorimetric signal by oxidizing the substrate tetramethylbenzidine (TMB) turning the paper blue. This test will produce a colorimetric output for a simple-to-understand diagnosis without any infrastructure. We predict that this device can give a response in under 2 minutes while costing around an estimated 10 cents per device This test may provide a way for an easy and cheap way to diagnose candidiasis worldwide, reducing the abuse of antifungals and provide an accurate way to treat vulvovaginal candidiasis and systemic candidiasis.

KEYWORDS

Yeast Infections, Paper-based Diagnostics, Split Proteins, Cheap Diagnostics, Synthetic Biology, Biotechnology, Biological Engineering, Biomedical Engineering