**An *E. coli* Based Formaldehyde Detector: An Economical and Effective Solution for Safe Air Monitoring**

 Formaldehyde is a common colorless gas found in the production of preservatives, building materials, and vaccines. Prolonged exposure to the gas causes severe eye and respiratory irritation and increases various cancer risks. Therefore, determining formaldehyde concentration in the air and regulating it to a safe level becomes a priority for places with potential formaldehyde exposure risks. Current detection methods, including using a mechanical detector, conducting lab samples, and smelling, are often unreliable, expensive, and dangerous. Our previous design is an economical and effective detector based on the ΔfrmR strain of *Escherichia coli*. The detector will be yellow by default and turns red when formaldehyde is present. We will construct the formaldehyde-detecting plasmid based on the R0010 (pLacI)\_AB plasmid backbone and transform it into cells. Using a *Pfrm* promoter, the detector reacts to formaldehyde at levels around 100 micromolar. We then utilize the *Plac-lacI* repressor system as a genetic switch: with the presence of formaldehyde, *lacI*, a *Plac* repressor, is expressed to deactivate the yellow pigment and turn the cell red. The bacteria will be cultured in lactose-rich media to ensure the constitutive expression of the yellow pigment under *Plac*. Moreover, the *frmA* and *frmB* genes in the construct remediate formaldehyde in the solution. As the concentration of formaldehyde decreases through *frmAB* in the detector solution, the detector reverts to yellow, making the detector system reusable when provided with sufficient nutrients.

Keywords: formaldehyde, formaldehyde detector, ΔfrmR strain, *Escherichia coli*, *Pfrm*, *Plac-lacI*