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# A Holographic Sensor based on a Biomimetic Affinity Ligand for the Detection of Cocaine

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## Highlights

- A low-cost sensor for the detection of cocaine is proposed
- The sensing mechanism is based on a designed Ugi ligand
- A combinatorial library of synthetic Ugi ligands was evaluated
- The holographic transducer is a hydrogel embedding gold nanoparticles
- The colour change in the presence of cocaine is instrumented by a smartphone app

## ABSTRACT

The increasing consumption of illicit drugs has become a worldwide social and medical problem. Eradicating the supply and use of these drugs requires the development of devices that provide a fast, selective and simple response in seized powder samples. This paper describes a novel strategy for the design and development of a holographic sensor modified with a rationally designed receptor for the detection of cocaine. The receptor was designed by reviewing protein–cocaine interactions, particularly those of human carboxylesterase-1 and catalytic monoclonal antibody GNL7A1, and constructing a four-component Ugi library of putative cocaine-binding ligands. A hybrid hydrogel of poly (2-hydroxyethyl methacrylate–co-ethylene dimethacrylate-co-methacrolein) was used as the carbonyl source for the Ugi reaction. A Bragg diffraction grating comprising gold nanoparticles was fabricated in the polymer gel and the replay wavelength of the combinatorial library of Ugi-modified holographic sensors measured via a spectrophotometer in response to cocaine as a function of pH and ionic strength. A smartphone-based

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