Towards the Development of a Novel Electrochemical Sensor for the On-Site Detection of Illicit Drugs

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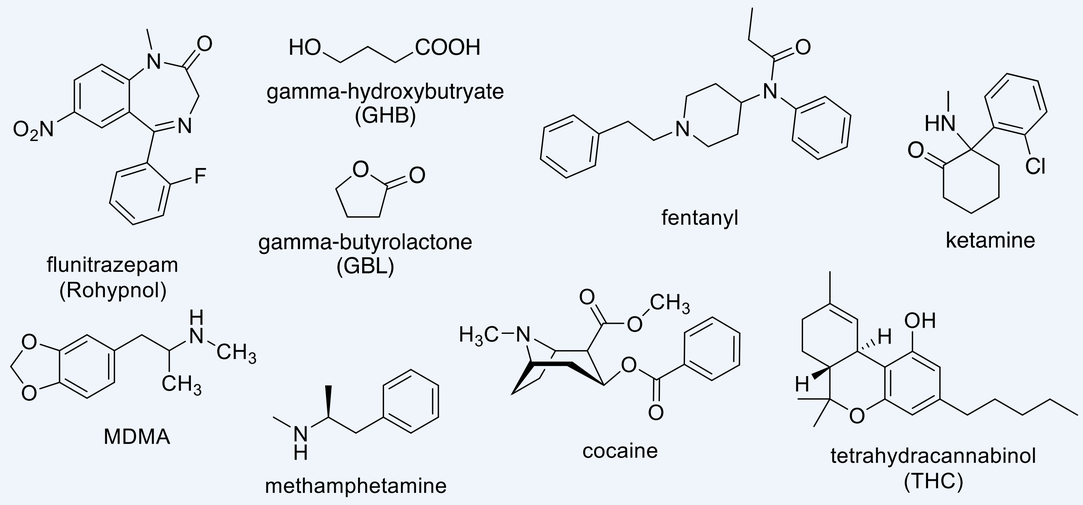
Background

Rapid, on-site sensors for the detection of illicit drugs in liquid samples are urgently needed.

These sensors would be of great use in detecting of substances used in **drug-facilitated sexual assault**, instantaneously screening for drug misuse (e.g., **roadside drug tests**), **and identifying hazardous cutting agents in recreational drugs** (e.g., checking for fentanyl at festival drug screening stops).

Current tests are **unreliable at best, and non-functional at worst.**

Target Analytes



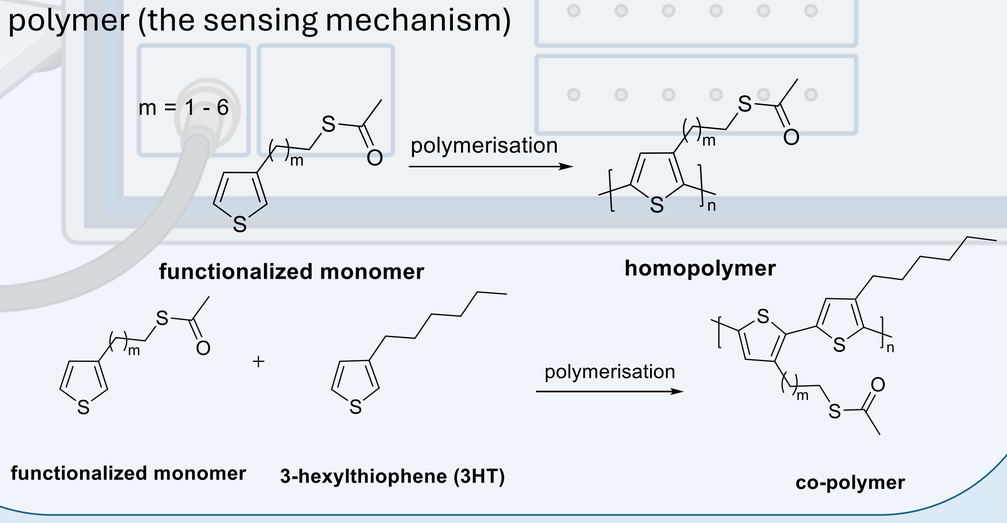
Research Aims

Overall aim: to develop a conducting polymer based sensor to detect **Target Analytes** (illicit drugs) via the proposed **Attachment Mechanism**

1) Synthesis of a series of thiol (SH) **functionalized monomers**

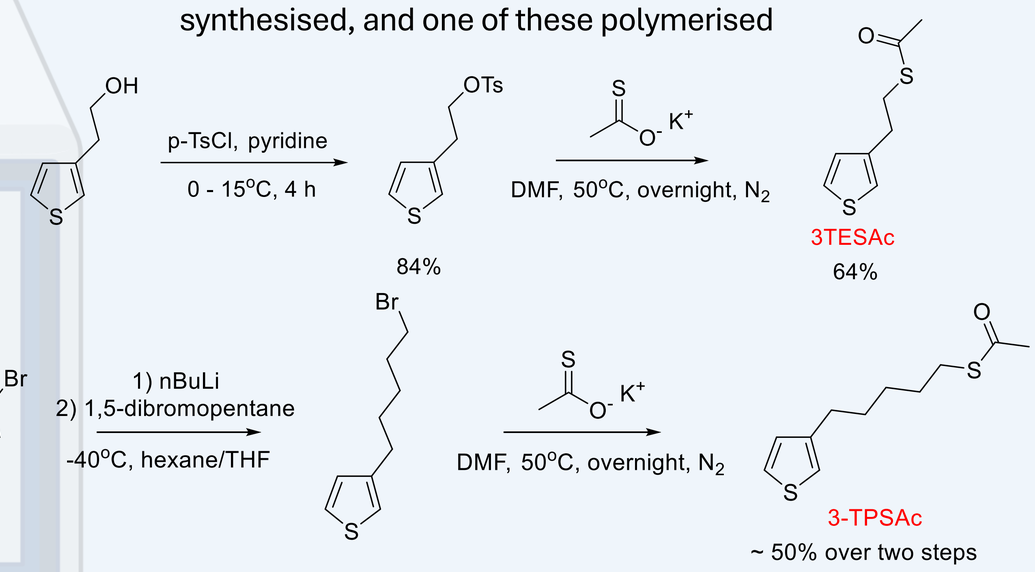
2) Chemical and electrochemical **polymerization** of monomers, as homopolymers and as **co-polymers** with 3-hexylthiophene (3HT)

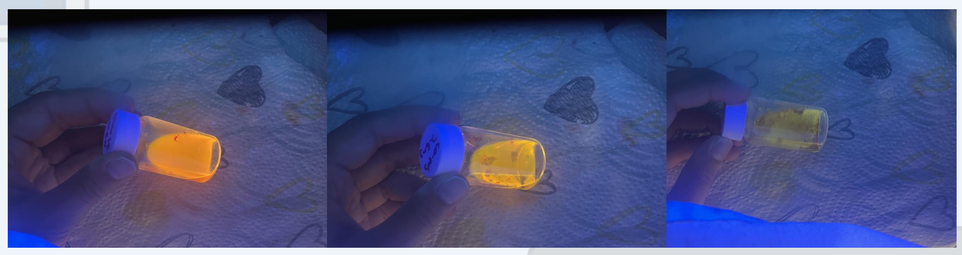
3) Assessment of **attachment** of thiolated **drug target analytes** to the polymer (the sensing mechanism)



Synthesis

Research aim (1) is underway, with two monomers in the series successfully synthesised, and one of these polymerised

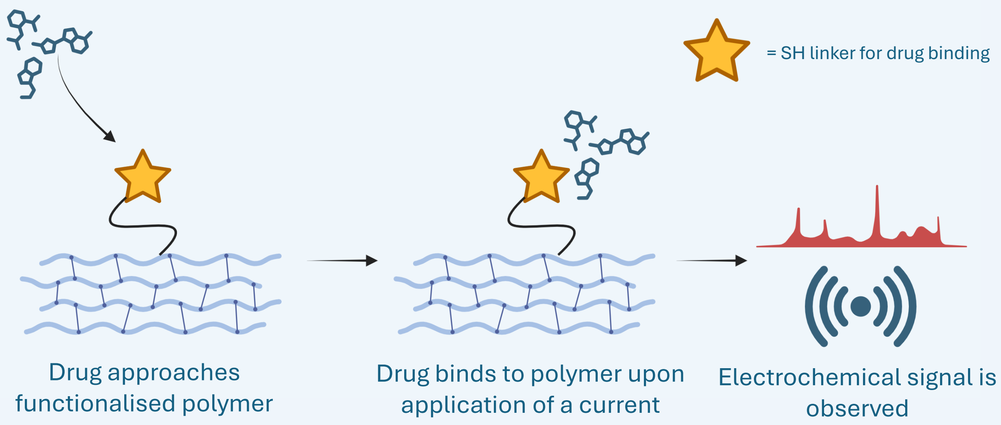




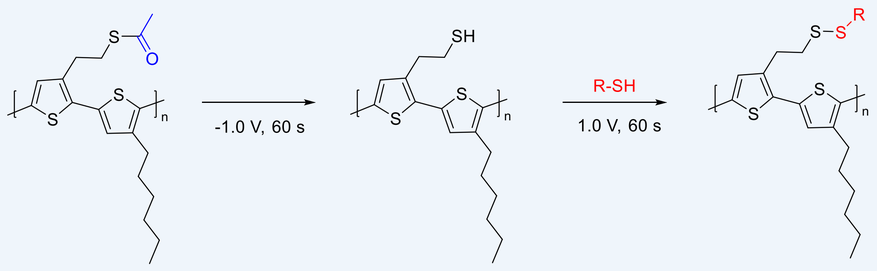
Left to right: poly-3HT, poly-3HT-co-3TESAc, poly-TESAc dissolved in chloroform

Attachment Mechanism

Our novel **conducting polymer** is capable of binding to a range of drugs (**target analytes**) when immersed in solution and exposed to an **electric current.** Once the drug has bound, an **electrochemical signal** will be observed.



We can achieve this by chemical oxidation between a **thiolated drug molecule** (R-SH) and our **functionalized polymer**.



Impact and Next Steps

A sensor capable of differentiating between drugs as described in this project would be **invaluable to law-enforcement.** It will also aid in **protecting the public** from the dangers presented by unknowingly consuming hazardous substances.

To achieve this, next steps for this research include:

- Synthesis of the other target functionalised monomers, and polymerisation of these
- Derivatization (addition of SH to enable attachment to polymer) of drugs and subsequent attachment
- Assessment of sensor performance in complex samples

Acknowledgements

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References

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(2) Zhu, B.; Bryant, D. T.; Akbarinejad, A.; Travas-Sejdic, J.; Pilkington, L. I. A Novel Electrochemical Conducting Polymer Sensor for the Rapid, Selective and Sensitive Detection of Biothiols. *Polym. Chem.* **2022**, *13* (4), 508–516. https://doi.org/10.1039/D1PY01394G.