Development of a quantum dot molecularly imprinted polymer sensor for fluorescence detection of atrazine

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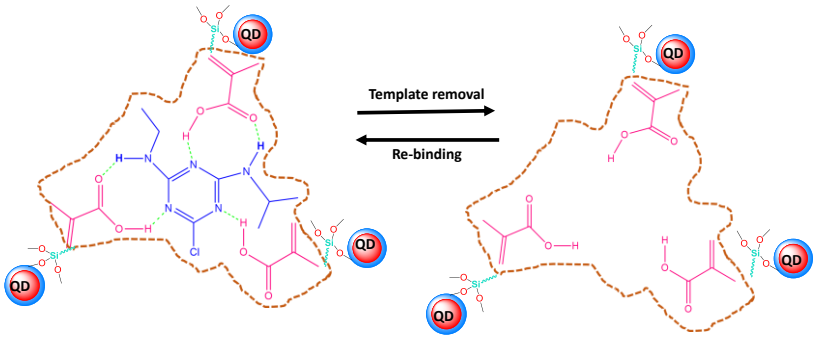
Introduction

Quantum dots (QDs) have attractive optical properties which have allowed them to find application in pesticide sensing[1]. Atrazine is a common pesticide used in agriculture for controlling various weeds, but has been reported to widely occur in surface drinking water, making it an environmental pollutant of concern[2]. Coupling of QDs to molecularly imprinted polymers (MIPs) has been shown to offer excellent selectivity and sensitivity in sensor development for target analytes[3]. In this work we show the development of a QD-MIP fluorescence sensor and its application towards atrazine detection in water.

Materials and Methods

Highly fluorescent CdSeTe/ZnS QDs were fabricated using the conventional organometallic synthesis approach. The QDs were further encapsulated with MIP in order to offer selectivity. Atrazine was used as a template while methacrylic acid (MAA) and ethylene glycol dimethacrylate (EDMA) were used as monomer and cross-linker, respectively. Further, a non-imprinted CdSeTe/ZnS@NIP, was fabricated in the same way but without atrazine as template. The CdSeTe/ZnS@MIP sensor was characterized using TEM, FT-IR, XRD, Raman, UV-vis and fluorescence spectroscopy. The materials were then applied towards atrazine sensing with 5 min interaction time for analyte binding.



Sheme 1: Interaction of atrazine with the QD@MIP

Results and Discussion

The synthesized CdSeTe/ZnS QDs showed excellent fluorescence properties, with a strong emission peak at 619 nm, and stability that was retained after encapsulating with MIP following removal of the atrazine template. The interaction between the QD@MIP and atrazine was likely through hydrogen bonding on the MAA units (Scheme 1), which led to linear quenching of the QD@MIP fluorescence with increasing atrazine concentration. Atrazine analogues are used demonstrate selectivity of the sensor and finally, the sensor was used the detect atrazine in real water samples.

Conclusion

The developed QD@MIP fluorescence sensor has potential application in atrazine monitoring in water and may be used as a simple and cheaper alternative to conventional analytical methods.

Bibliography

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