

# Development of Polymer Microspheres and a Cysteine based Ligand for the Extraction and Sensing of Arsenic.

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Arsenic contamination of drinking water is a major health problem in many areas of the world. An investigation of Bis(2-ethylhexyl)ammonium bis(2-ethylhexyl)-dithiocarbamate (BBDC) as an extractant for As(III) was conducted. Liquid/liquid trials demonstrated the potent extraction ability of BBDC at low pHs. BBDC was successfully incorporated into PVC membranes and microspheres. These polymer matrixes also demonstrated significant extraction ability. BBDC was found to decompose over time, restricting its use as an extractant.

The ability of Tri-n-butyl-phosphate (TBP) to extract As(III) was examined as a comparison to that of BBDC. The compound was found to perform well, both in liquid and PVC matrix supported extractions. The extreme conditions required for effective As(III) extraction limits its applications. TBP was confirmed to be an excellent plasticiser for PVC.

The use of a cysteine scaffold as the basis of a novel extractant for As(III) was investigated via a number of reaction schemes involving thiol and amine protection. Synthesis of the desired product, 2-Amino-N,N-bis-(2-ethylhexyl)-3-mercapto-propionamide (AEHMP), was not without difficulty. The compound produced was shown to be an effective plasticiser for PVC matrixes and demonstrated some extraction of As(III) in liquid/liquid trials.

A new method with increased consistency and reproducibility for the production of microspheres was developed. This method eliminates the need for expensive apparatus and significantly reduces the volume of organic solvents required. Microspheres produced were between 70 – 150  $\mu\text{m}$  in diameter and displayed an excellent spherical shape as confirmed by microscope photography. Further modifications to glassware are expected to enable production of smaller microspheres.

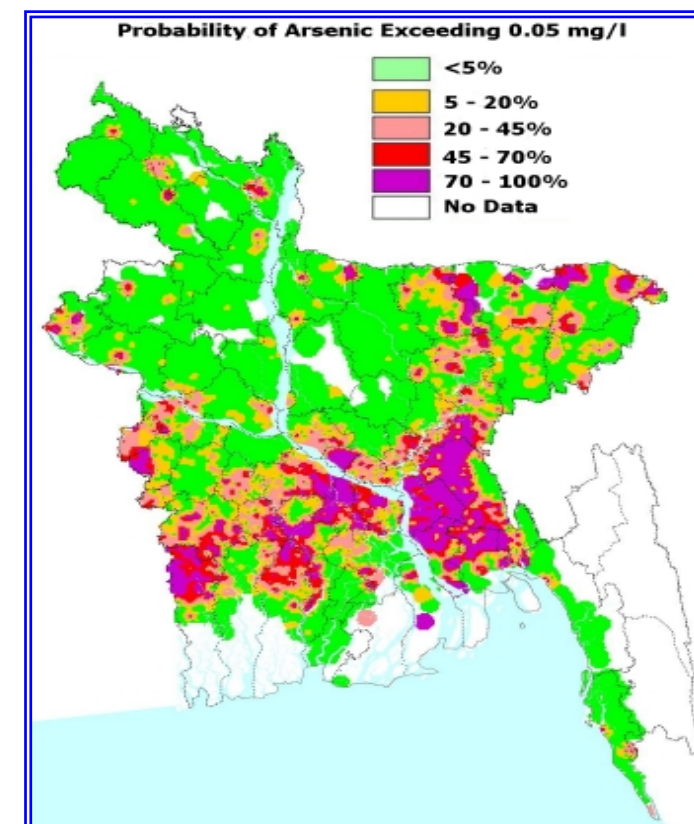


Figure 1. Map of Bangladesh showing percentage of wells with arsenic levels exceeding 50  $\mu\text{g/L}$ .

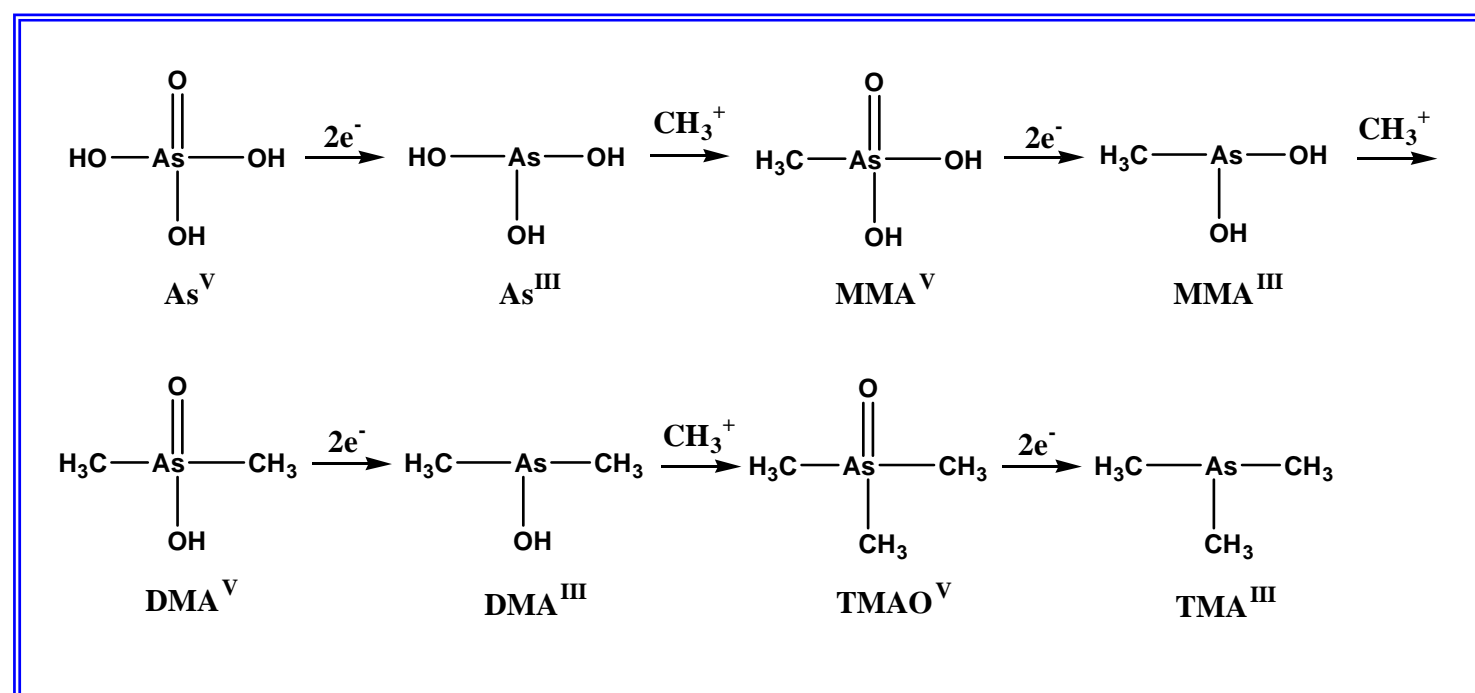


Figure 2. Biomethylation pathway for conversion of inorganic arsenic species to methylated organic arsenic species.

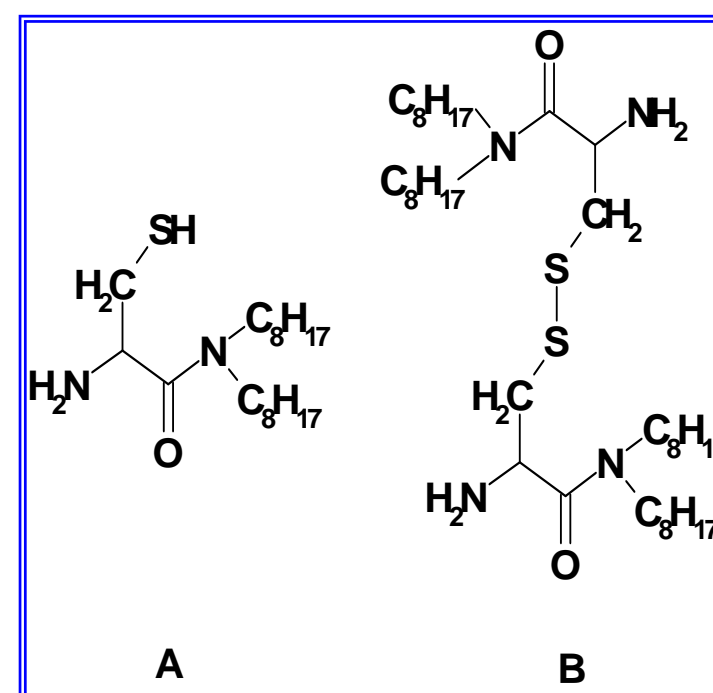


Figure 3. AEHMP (A) and dimer (B).



Figure 4. 80%(w/w) PVC & 20% TBP microspheres of 70-150  $\mu\text{m}$  diameter.