

# Development of Polymer Microspheres for Metal Extraction and Sensing Applications.

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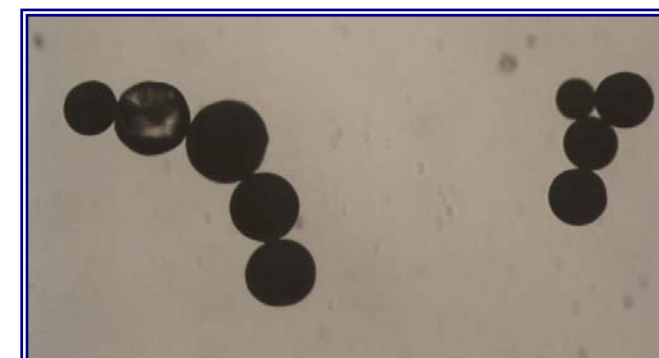
Supported and polymer inclusion membranes (SLMs and PIMs) have recently been studied for the extraction of metals, such as copper and gold, from aqueous solutions. Advantages of liquid membranes compared with traditional solvent extraction methods include: low cost production and operation, a single step process, and reduced use of organic solvents. Unfortunately, both SLMs and PIMs encounter problems of the extractant leaching from membrane pores into the aqueous phase. This results in decreased extraction efficiency and reduced membrane lifetimes.

Microspheres of poly(vinyl chloride) (PVC) incorporating Aliquat 336 were investigated as an alternative to liquid membranes for metal extraction. They were produced from a mixture of 33%(w/w) PVC, 66% Aliquat 336 and 1% xylenes, all dissolved in THF. A syringe pump was used to add the mixture dropwise from a glass syringe while a stream of air was blown across the needle tip to create an aerosol. The THF in the polymer aerosol droplets was readily dissolved in a collection solution of nanopure water and 3% Triton X-100, thereby producing microspheres with a yield of 66%.

Contacting 100 mgs of microspheres with a 0.1M HCl solution containing 50 mg/L of gold for 24 hours gave an extraction of 51% of the available gold. This compared favourably to PIMs of the same composition and the commercial TEVA resin that extracted 39% and 99% of available gold, respectively.

Studies were performed on incorporating the copper sensing reagents 1-(2-pyridylazo)-2-naphthol (PAN) and 4-decyloxy-2-(2-pyridylazo)-1-naphthol (DPAN) into PVC/Aliquat 336 membranes. Results indicated that PAN is incompatible with PVC membranes, while DPAN formed very stable, transparent red membranes that turned blue upon sensing of copper.

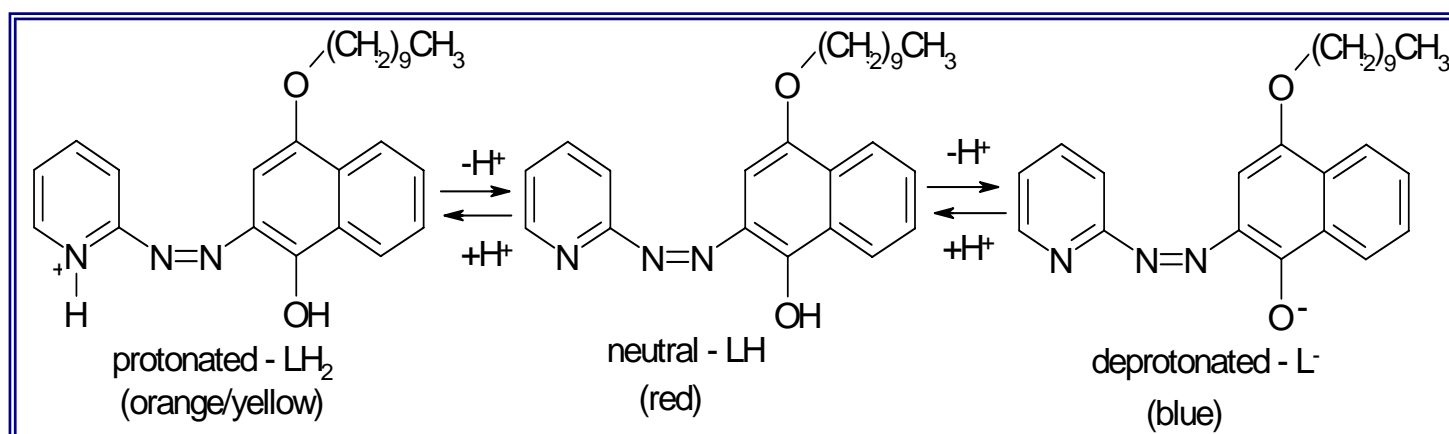
Problems with Aliquat 336 leaching from the PVC matrix were encountered. A methyl methacrylate (MMA)-decyl methacrylate (DMA) copolymer was thus produced and investigated for use as a replacement polymer matrix. Unfortunately, Aliquat 336 was incompatible with this polymer. Acorga P50, however, proved to be readily incorporated into the copolymer matrix. Further work will involve preparing microspheres incorporating Acorga P50 and DPAN from the MMA-DMA copolymer. These will then be trialed in copper sensing experiments.



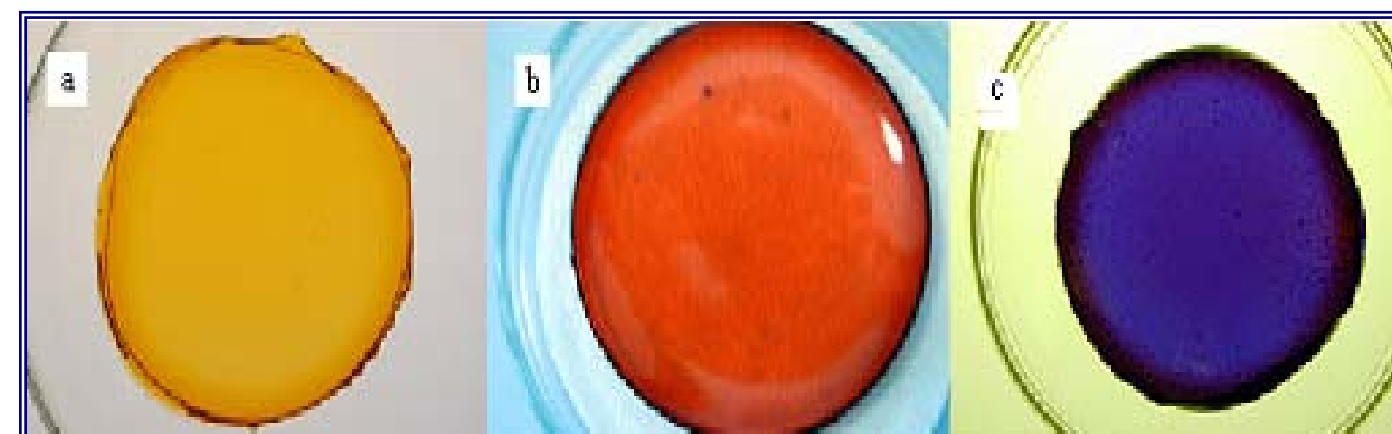
**Figure 1. Polymer microspheres of diameter 70 – 150 microns**



**Figure 2. Production equipment**



**Figure 3. Possible forms of DPAN. Form in the membrane depends on the pH of the solution in contact with the membrane.**



**Figure 4. DPAN membranes used to sense copper corresponding to stripped (a), initial (b) and sensing (c) steps of the experiment.**