MOLECULARLY IMPRINTED POLYMERS- APPLICATIONS IN ANAESTHETIC MONITORING

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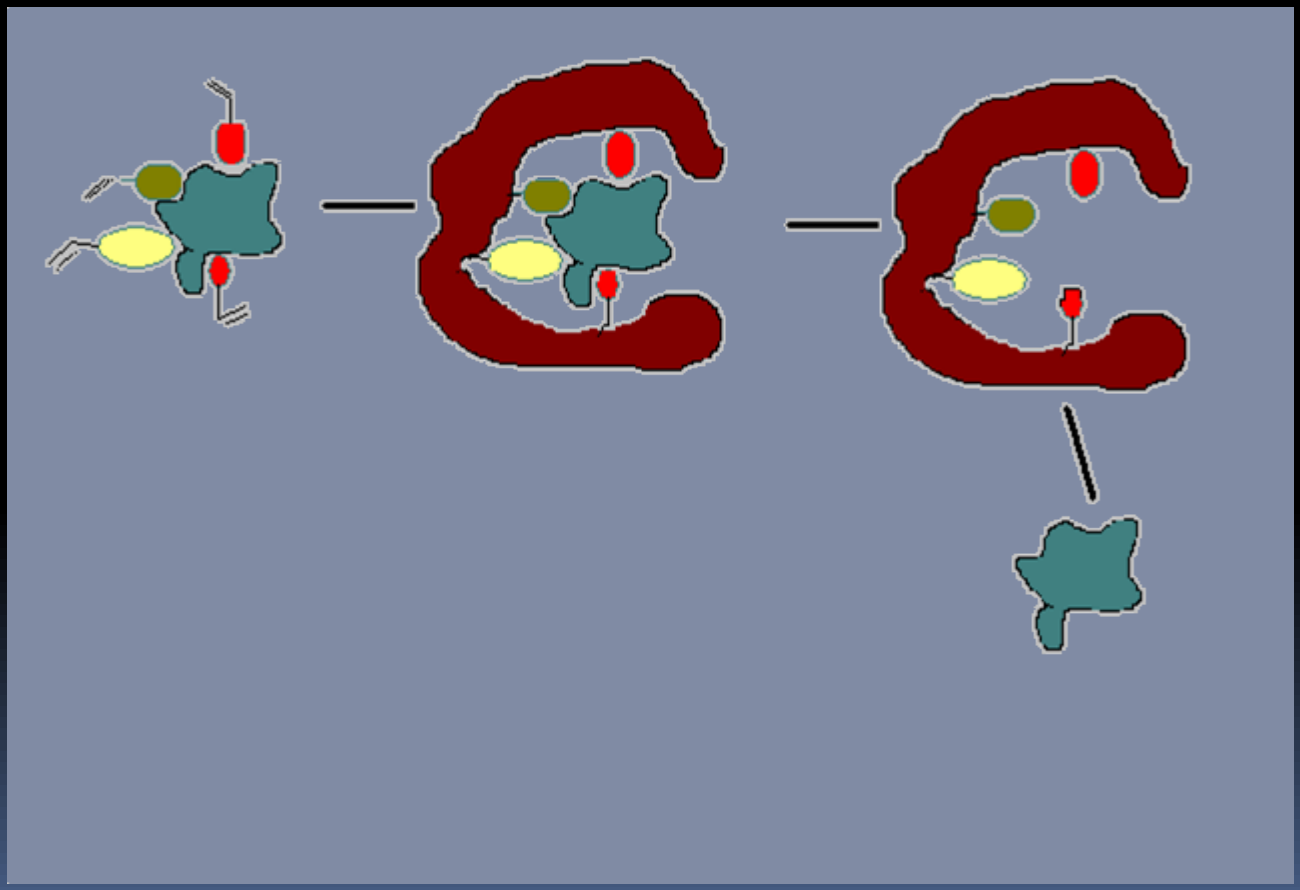
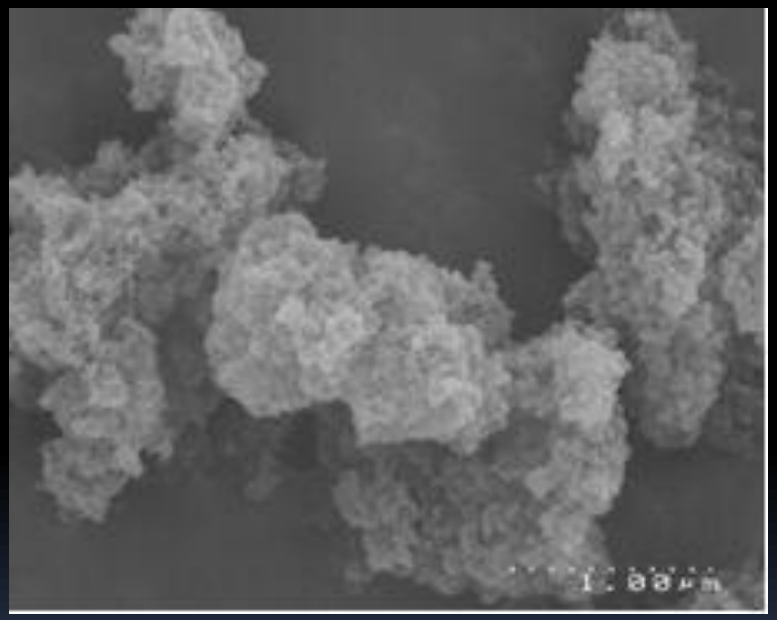
Overview

- Molecularly imprinted polymers
- Applications
- Anesthetic monitor development
- Problems encountered when marrying the chemistry and engineering

Molecularly imprinted polymers (MIPs)



MIPs



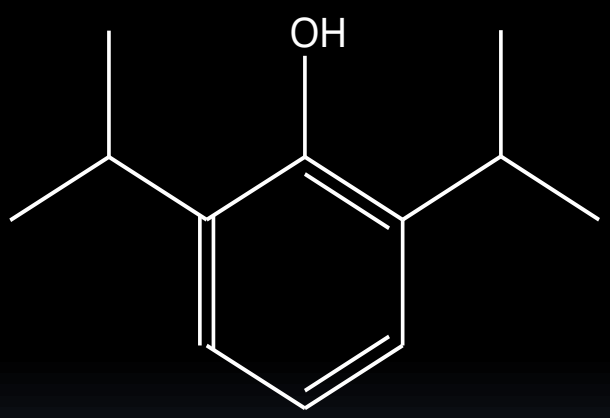
- Highly porous- specific and non-specific binding
- MIP vs. Blank binding

Applications

- Biosensors
- Catalysis
- Chromatographic separations
- Purification

- Commercially available from small European companies and Sigma-Aldrich since last year

Propofol

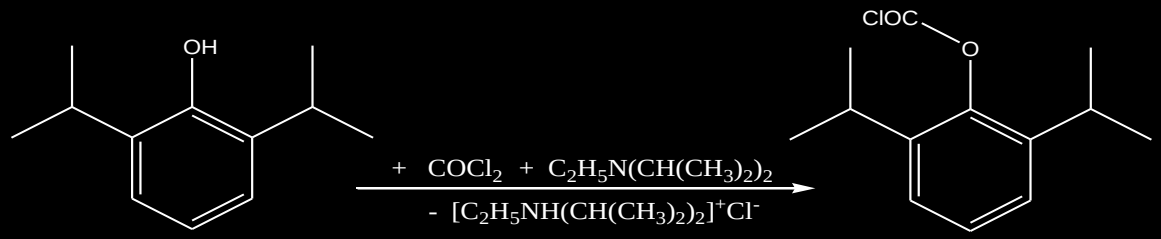


- Active ingredient in anesthesia
- No side-effects
- Fast acting
- Used commonly in elderly patients and children
- Antibodies – not sensitive enough

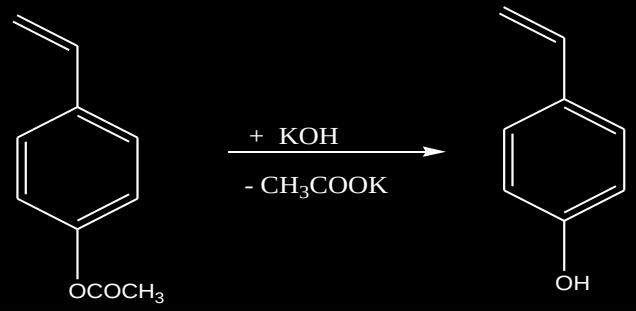
MIPs for propofol- problems

- Small molecule
- Steric hindrance
- Highly lipophilic
- Non-covalent interactions not sufficient

MIPs for propofol

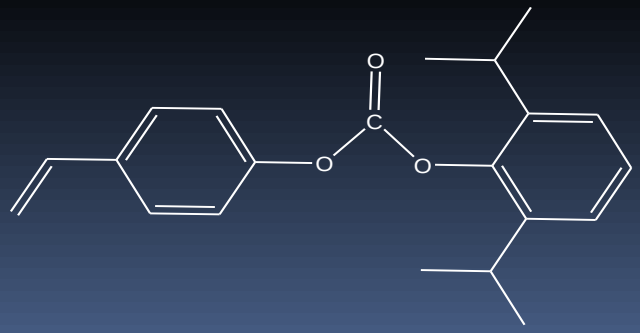


1

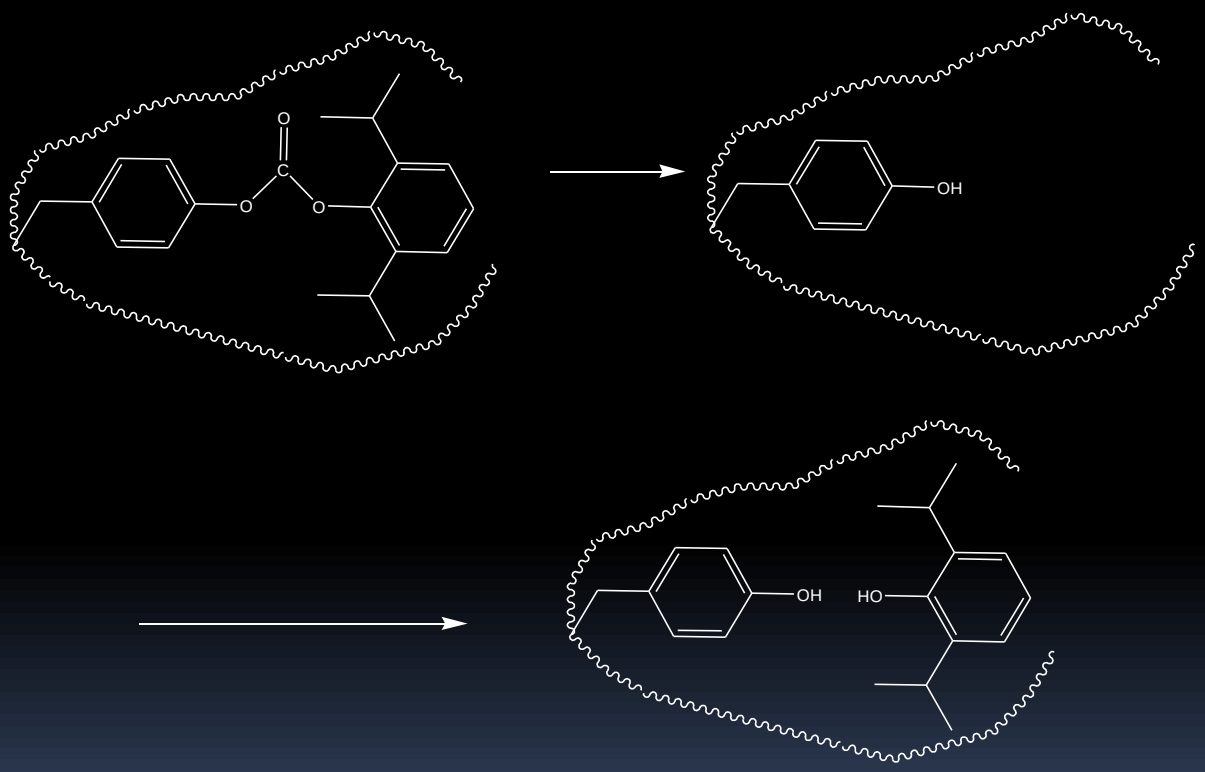


2

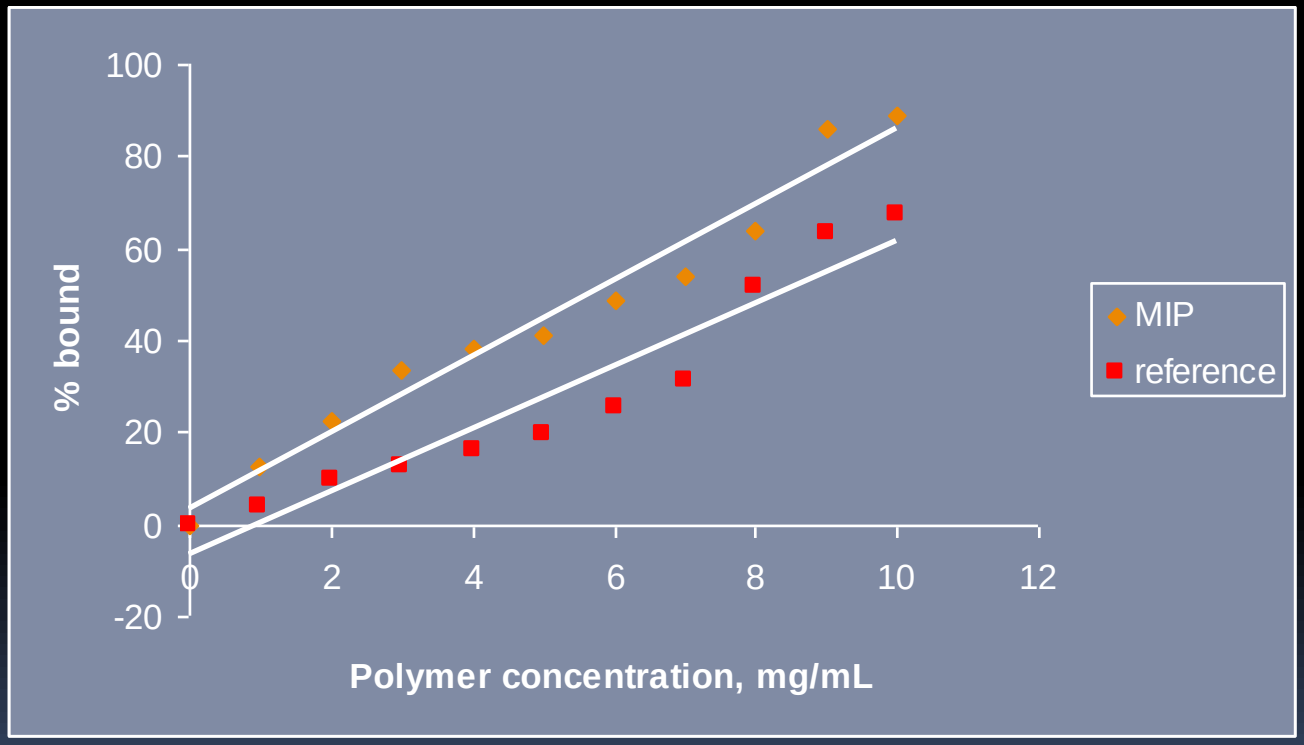
1 + **2** + $C_2H_5N(CH(CH_3)_2)_2$ - $[C_2H_5NH(CH(CH_3)_2)_2]^+Cl^-$



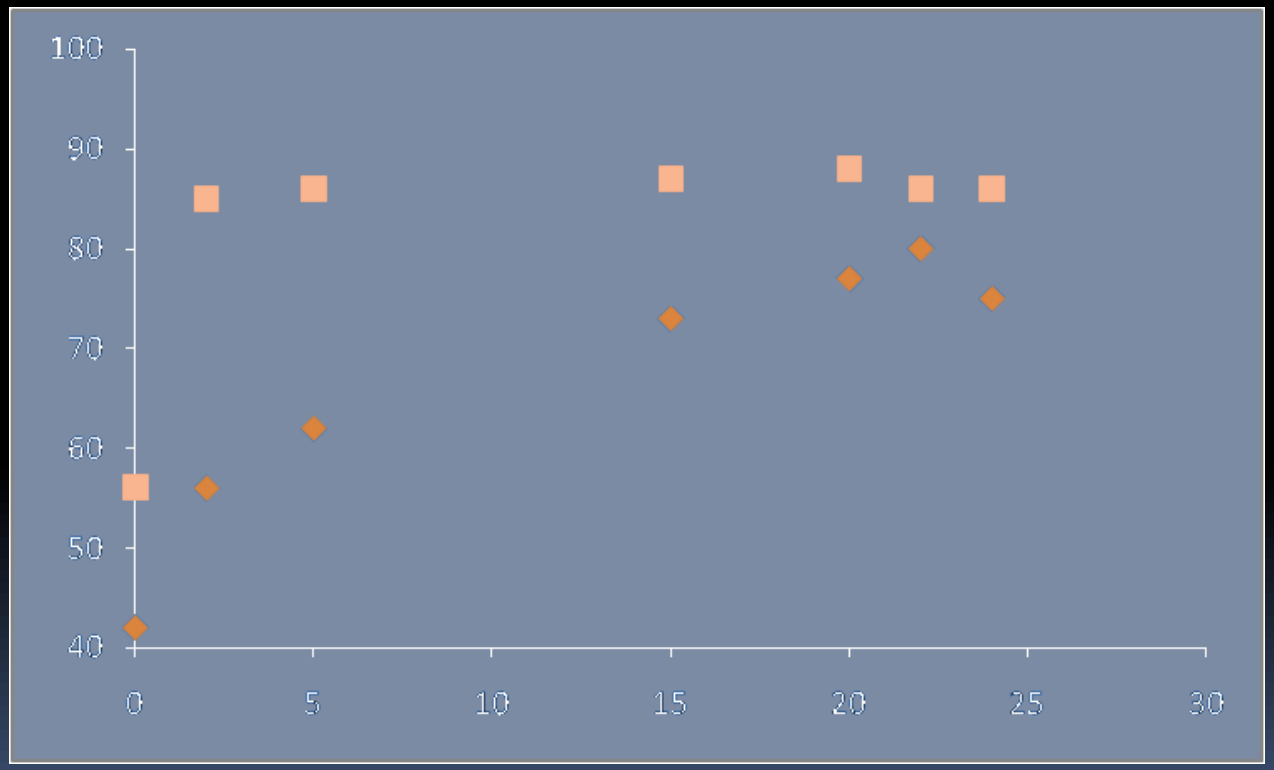
MIPs for propofol



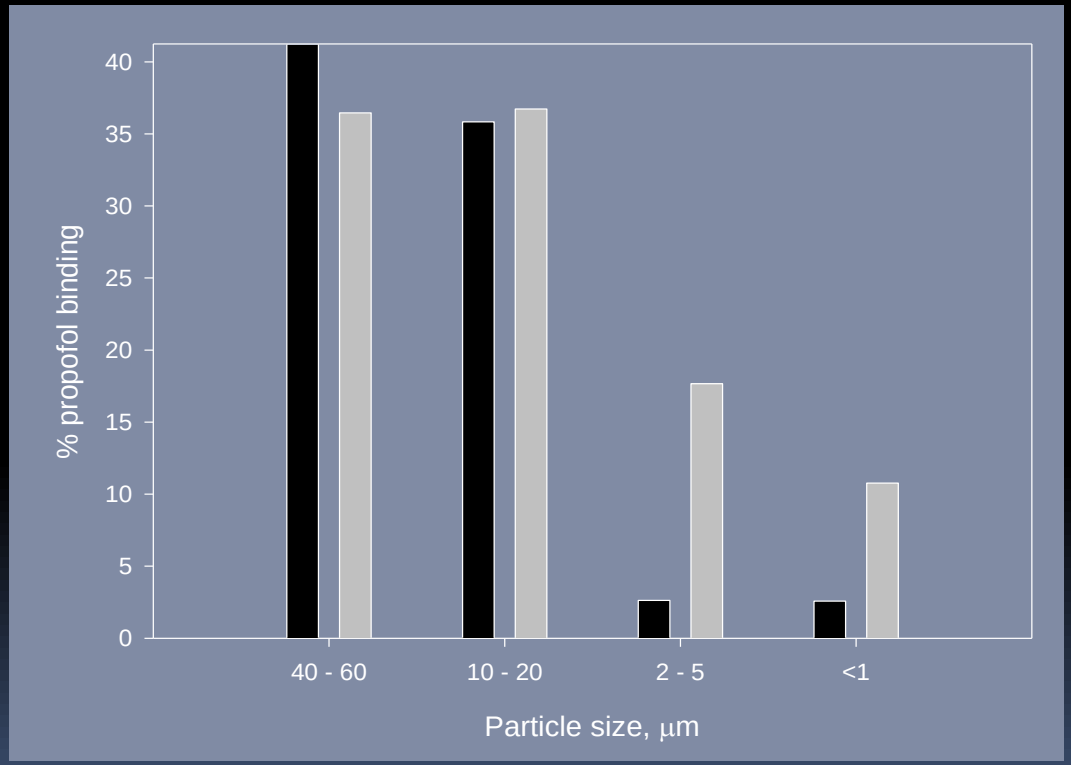
Tests- linearity



Tests- dynamics



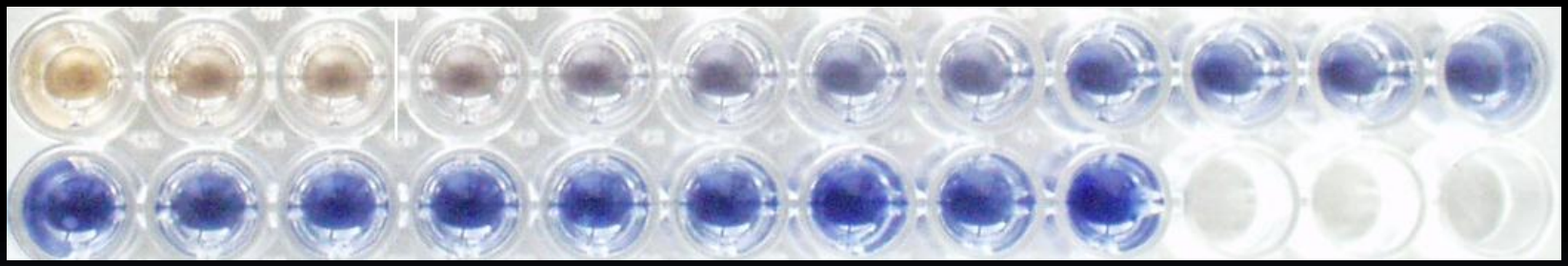
Lowering non-specific binding



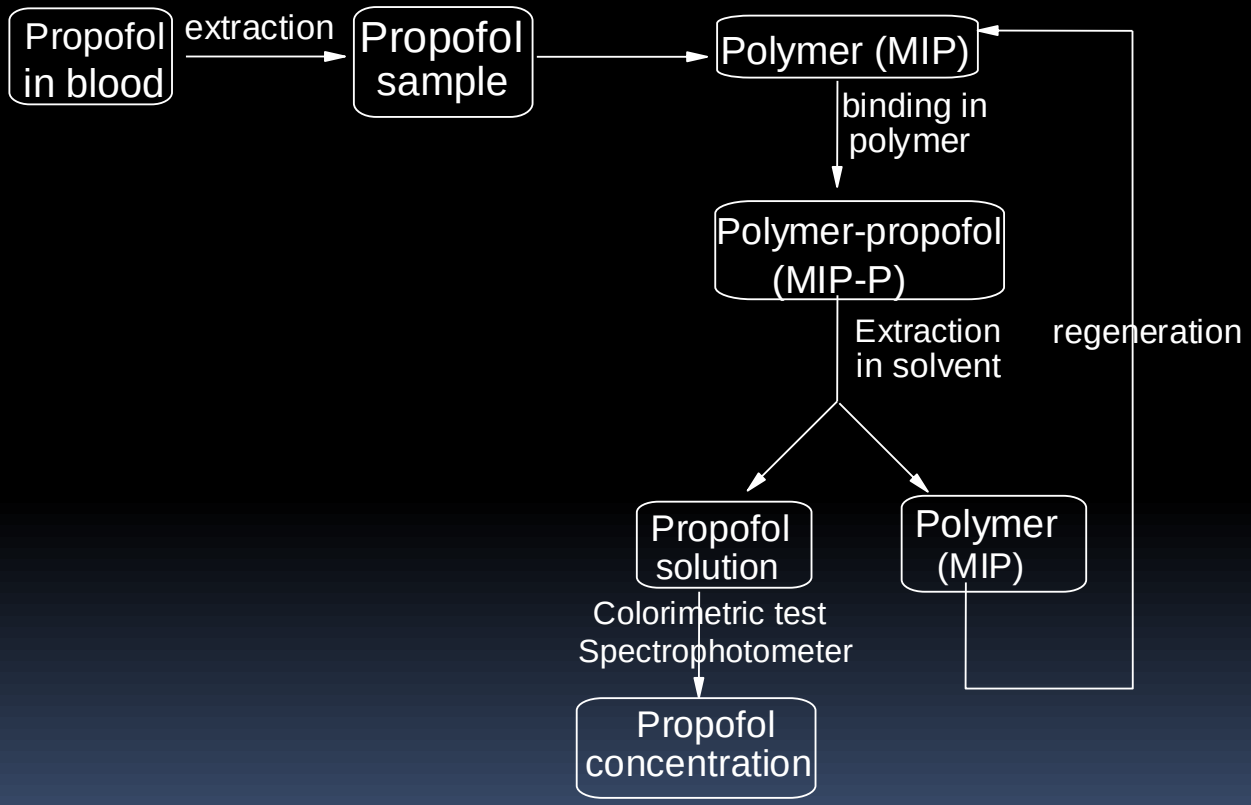
Tests

- Under 5 min
- Very specific
- Polymer picks up propofol in blood
- NEED- a quick detection test

Detection test (Gibbs)



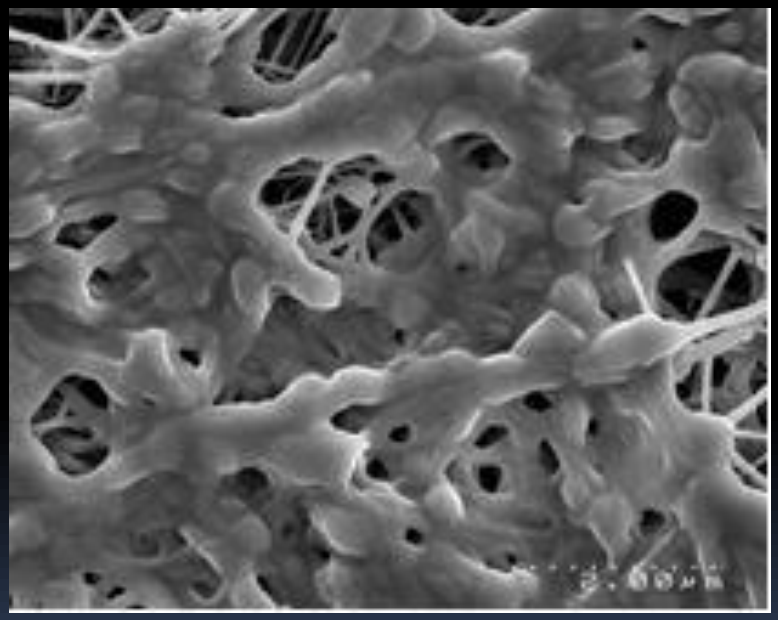
Monitor development



Tests in monitor

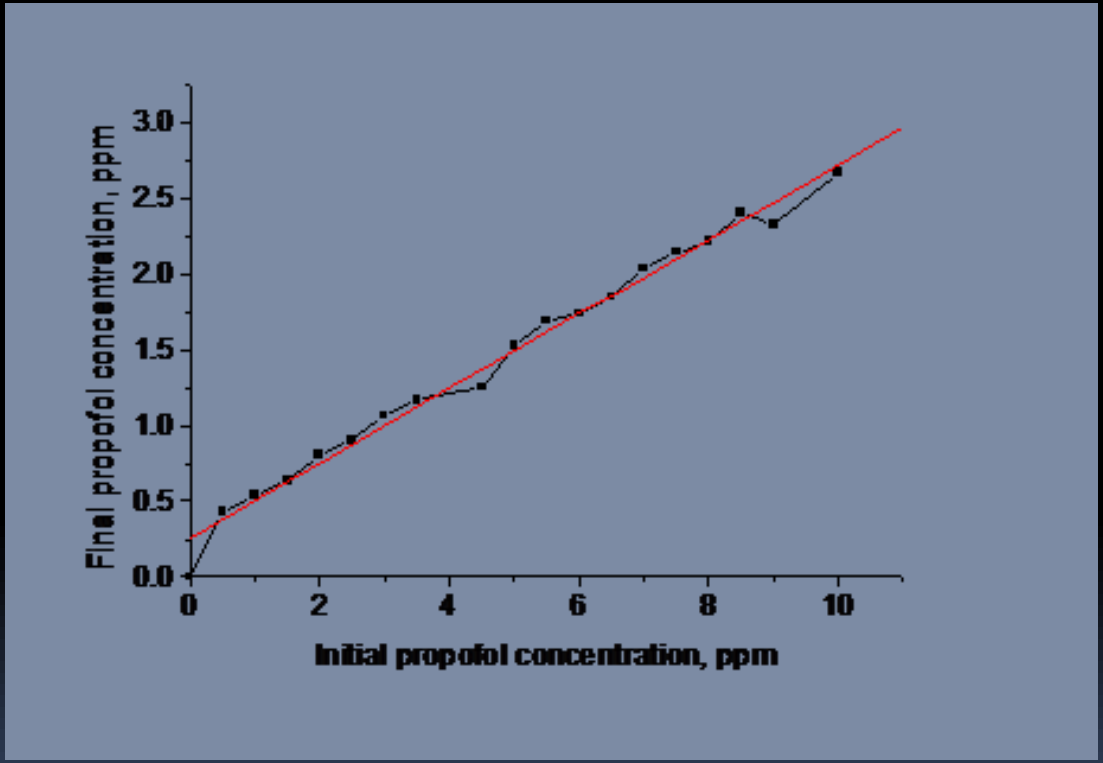
- Blockages
- Browning effects
- Backpresssure problems
- Polymer not compatible with the monitor format

Thin film polymers



- Keep Teflon properties
- Coat membrane with polymer
- Advantages- flexible films, on support, behaving like small particles

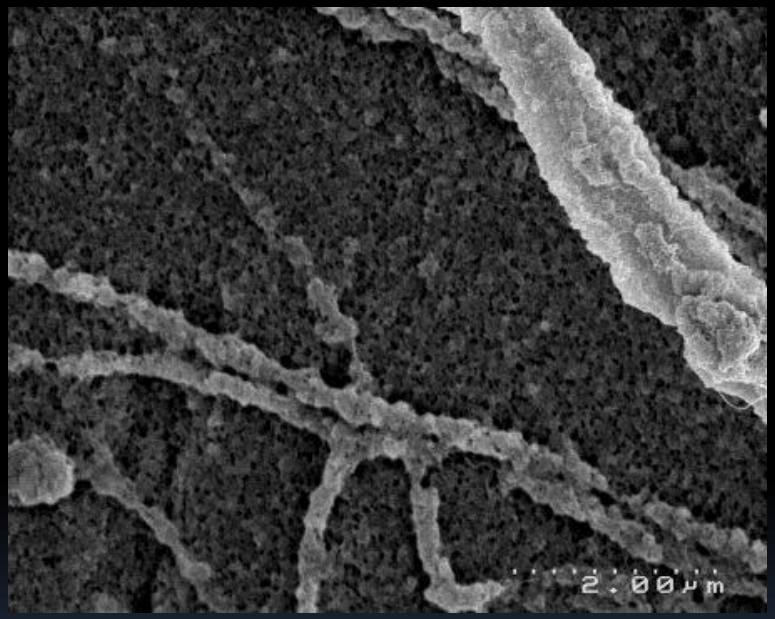
Linearity tests

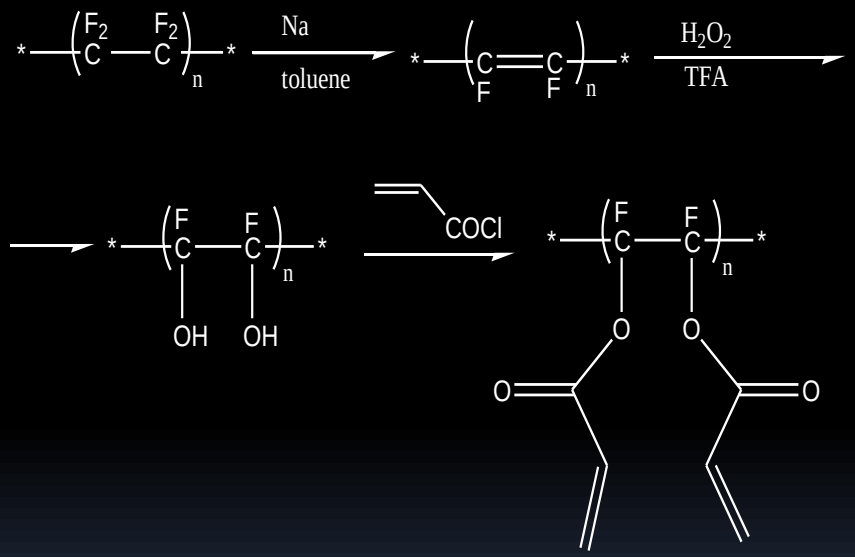


Tests in monitor

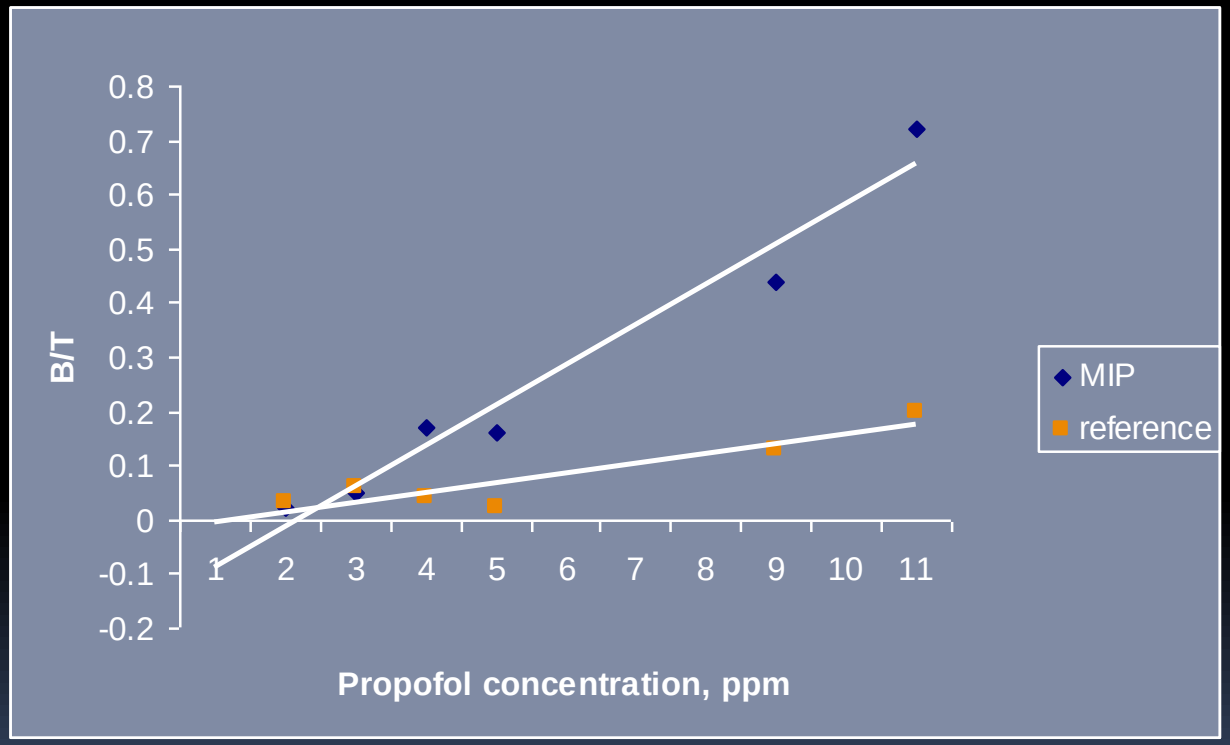
- Unreliable
- Membranes flaking off after a number of cycles
- Pockets of liquid trapped in membrane cartridges
- Shredded membranes lost polymer

Covalently modified thin films





Linearity tests



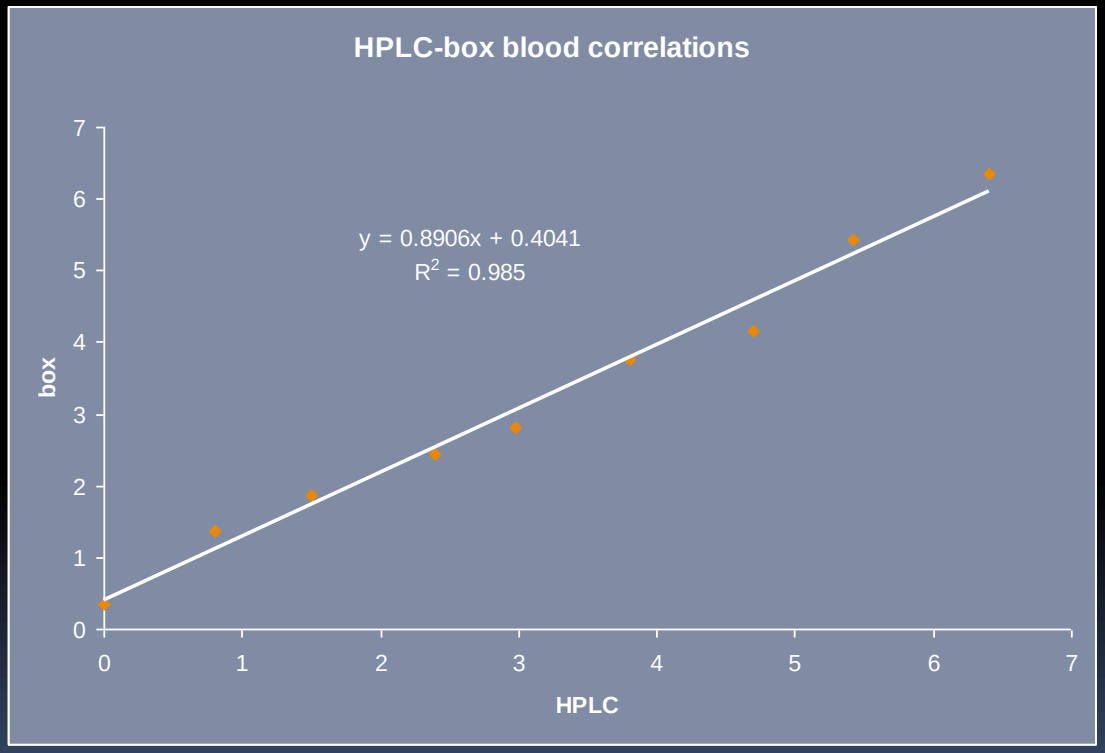
Tests in monitor

- Uniformity
- Channeling of liquid in the cartridge
- More browning effects
- High CVs

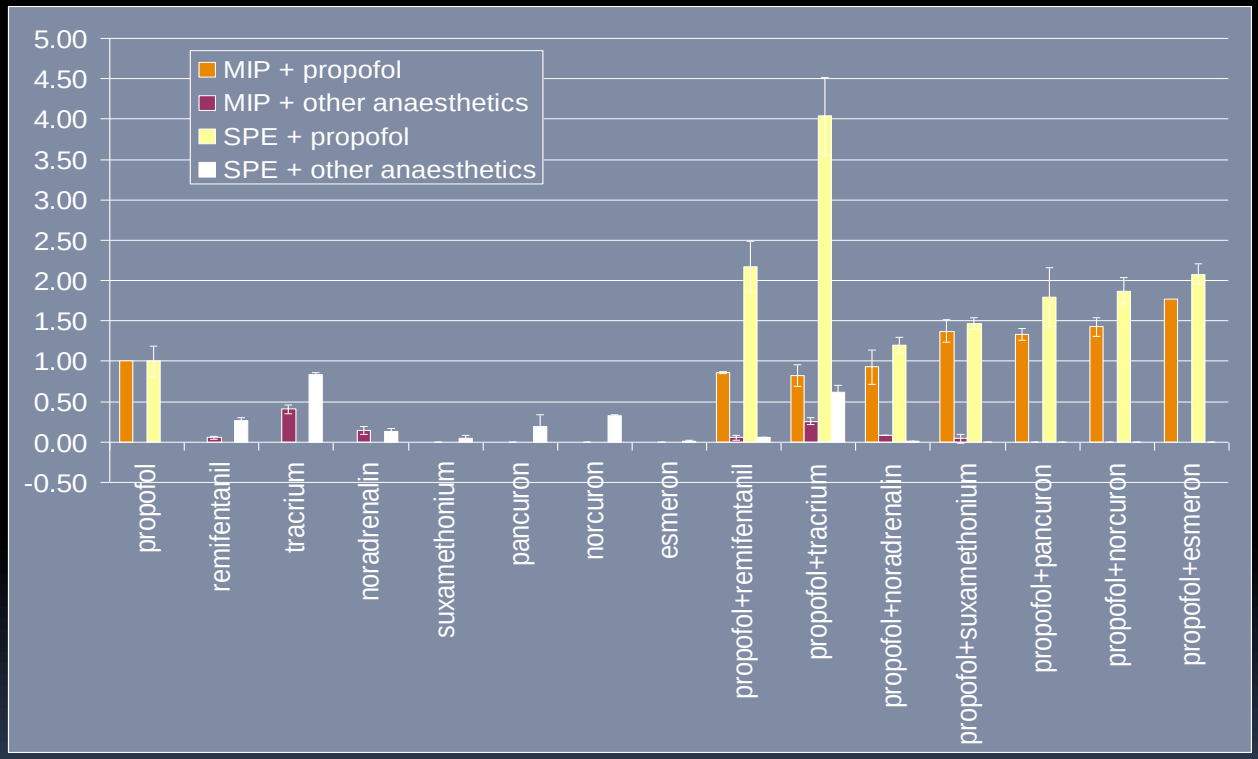
Final polymer particle format

- 38-150 μm particles packed in cartridge
- No backpressure
- Rinse cycles had to be changed to remove the larger amount of nonspecific binding
- Same samples were tested via prototype and HPLC to double check results

Prototype- HPLC correlations



Tests in blood-crossreactivity



Conclusion

- Test under 5 minutes
- Specific binding in specified set of conditions
- Linear down to 0.1 ppm (under awake threshold)
- Not affected by other drugs
- Performs very well in spiked blood
- Next steps?

Acknowledgments

- FRST and Fisher&Paykel
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