

Virus Recognition Using Molecularly Imprinted Polymer Hydrogels

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Molecular Imprinting Process

- MIPs: materials that specifically bind to a target molecule.
- Recognition properties similar to antibodies and enzymes.
- Versatile in targeting a wide range of molecules.
- Can remain stable in wide range of conditions.
- Can be reused.
- Applications: catalysis, pharmaceuticals, separations, and sensors.

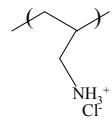
Template : Tobacco mosaic virus



- Concentration: 1 mg/mL
- In water

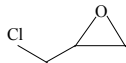
Materials

Polymer : Poly(allylamine hydrochloride)



- 25% (w/v) solution
- Mw ~ 15,000
- pH (solution) ~ 9.0

Crosslinker : Epichlorohydrin

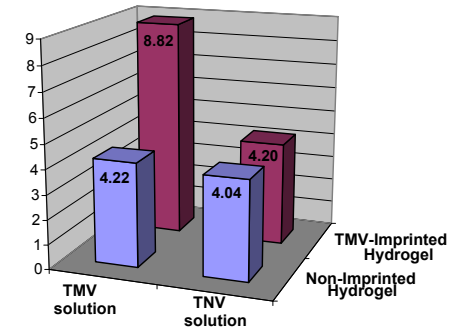


- 99+% solution

Synthesis of Virus Imprinted Polymer Hydrogels



Results of Binding Analysis

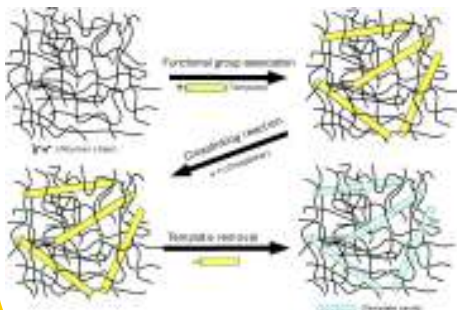


Hydrogel Type	TMV Binding Capacity (mg virus / g polymer)	Imprinting Factor
TMV-Imprinted	8.82 +/- 0.92	2.09
Control (Non-Imprinted)	4.22 +/- 1.22	

Hydrogel Type	TNV Binding Capacity (mg virus / g polymer)	Imprinting Factor
TMV-Imprinted	4.20 +/- 0.43	1.04
Control (Non-Imprinted)	4.04 +/- 0.36	

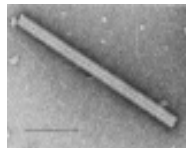
Molecular Imprinting with Tobacco Mosaic Virus

- Functional groups on polymer chains associate with groups on template through non-covalent interactions.
- Non-associated functional groups of polymer chains are covalently bonded using crosslinking reaction.
- Removal of template creates cavities within polymer matrix with shape, size, and functional group arrangement complementary to the template/target molecule.



Viruses Used for Binding and Selectivity Studies

Tobacco Mosaic Virus



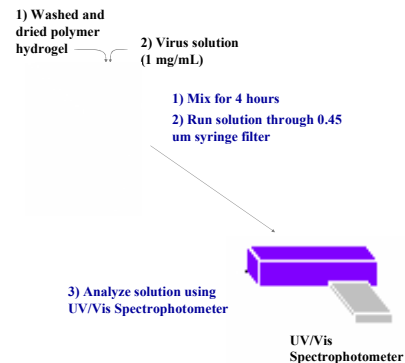
- Wildtype
- Cylindrical
- (300 nm length x 18 nm diameter)
- Non-enveloped
- 2130 protein subunits
- subunit contains 158 amino acids
- pI (isoelectric point) = 3.5

Tobacco Necrosis Virus



- Wildtype
- Icosahedral
- 26 nm diameter
- Non-enveloped
- One type of protein containing 268-275 amino acids
- pI (isoelectric point) = 4.5

Setup for Binding Analysis



Conclusions

- Results have shown that molecular imprinting technique increased the binding of targeted molecule to the polymer hydrogel.
- Results also demonstrate selection based on shape of targeted molecule.
- Uptake of non-targeted molecule was due to non-specific binding.

Acknowledgements

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