Metals in water

- Transition metals in water present a problem and an opportunity
- Magpie Polymers combine clean-up and purification
  - Clean-up may be required from health and safety or environmental point of view
  - Purified heavy metal streams have high market value

Removing dissolved metals from water

- Precipitation
  - Cheap
  - Produce sludge waste
- Ion-exchange resins
  - Effective for many metals
  - Limited selectivity at higher price
- Reverse Osmosis
  - Low residual concentrations
  - High energy consumption, limited selectivity

Properties and Advantages

High selectivity
- Effective in water with high Total Dissolved Solids
- Obtain metal of interest in high purity

Magpie 101
- Copper, Nickel, Palladium, Chromium, Platinum
- Not captured: Sodium, Calcium, Magnesium

Magpie 102
- Gold, Lead, Zinc, Cadmium, Uranium, Gallium
- Under development

Magpie 103
- Under development

Transparency to Calcium
- Copper capture in the presence of Calcium run with 7 different samples containing between 0 and 1000 ppm of calcium and 100 ppm of copper.
- \( V = 20 \, \text{cm}^3, \, \text{pH} \, 6.0, \, 200 \, \text{mg}\) of polymer, for 30 min.
Stepwise metal removal: Copper Cadmium

polluted water in

Magpie 101

Magpie 102

84.3 ppm Cu, 25.2 ppm Cd

70% Cu capture
0% Cd capture

clean water out

Magpie 102

6 ppb Cu, 4 ppb Cd

99.9% Cu capture
99.9% Cd capture

Periodic system

Properties and Advantages

- High capture capacity and fast kinetics
- Smaller bed size, lower pressure drop, cheaper regeneration
- High stability and active at low pH
- Stable in pH 0-14, <200 °C and organic solvents, active at pH > 2
- Low residual concentrations (from 100s ppm to ppb)

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Market opportunities

- Magpie Polymers act at three levels:
  1. Metal removal
  2. Metal recovery
  3. Process improvement

- Ongoing market study to define 1-2 niche markets:
  - microelectronics
  - chemical industry
  - surface treatment
  - nuclear recycling
  - catalysis
  - waste treatment
  - mining
  - mining

Conclusion and future prospects

- Capture characteristics of Magpie Polymers unique
- We are able to produce different polymers on large scale

- Expand our product understanding
- Test with model and real solutions
- Define value proposition and start market development

Road-map

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