NEW WATER TREATMENT TECHNOLOGIES

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MATRIC

Chemical and Environmental Technologies
Health and Life Sciences
Advanced Engineering Systems

Life-Changing Innovation
WATER CONSERVATION, PURIFICATION AND RECYCLING (CPR)

- Water pollution and shortage problems are almost worldwide on the planet and can negatively affect the quality of life of a growing number of people.

- One of the major themes for MATRIC is to provide practical and economical solutions to combat these problems.

- Two new developments will be discussed here, and a few others will be mentioned.
MATRIC’S THREE STEP APPROACH TO TECHNOLOGY COMMERCIALIZATION

1. Do the necessary research, development and engineering to define the technology, process or product.

2. Develop an intellectual property (IP) package which defines the technology, process or product, and if warranted, develop and carry out a patent strategy.

3. Either start up a new company to carry out the commercialization or license the IP, receiving royalties for its use. Eight new companies have been started up so far.
THE SELENIUM REMOVAL BUSINESS

MATRIC has developed the lowest cost process for removing selenium from polluted water streams. Source of the pollution: Most often run-off from mining operations. Limit: 5 parts per billion (5x10^-9)!

Six months ago, MATRIC formed Liberty Hydrologic Systems to develop a business around this technology.

Status of the business today: 4 customers, 15 installations, 113 basic units (“totes”).
CHARACTERISTICS OF THE SORPTION SYSTEM

- No energy is required.

- The selenium concentration in the outflow is usually down to 1/10 to 1/100 of the feed concentration.

- The sorbent material is easily replaced when it is spent.

- The process is built up in modules, making it simple to scale up.
PREPARATION OF THE SORBENT

- Reticulated foam is produced from polyurethane foam which is “exploded” by igniting a mixture of hydrogen and oxygen inside the foam. This blows out the side walls, leaving only the thick struts.
- The exploded foam is then cut into the desired shape.
- The Fe⁰ reactive adsorbent is coated onto the foam surface.
- The coated foam is mounted into a “tote,” – a 1.1 meter cubic container fitted with inlet and outlet pipes.
- This geometry provides a tortuous but low pressure drop pathway for the liquid.
Field Pilot Plant, modular design
Selenium Removal Pilot Plant in Idaho

Performance under adverse conditions
TECHNOLOGY EXTENSIONS

● Demonstrated preliminarily: other metal ion removals such as Cr(+6), Hg (desired removal down to 5 parts per trillion!!), As, Cu, Zn, Pb, Al and Fe.

● Likely: TCE, PCE, PCBs, etc.

● Possible extensions to gas streams.

● Extensions to metallic foams or even ceramic foams.

● A useful extension to microchannel reactor thinking.
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A company was formed to develop and commercialize MATRIC separation technology for treating polluted water from gas well drilling and production.

Products separated from the polluted water:
- Drinkable water,
- Dry salt or highly concentrated salt solutions,
- Organic compounds used in fracturing solutions, such as surfactants, solvents, etc.

Processing units can be moved easily from one cluster of wells to another.
MARCELLUS FLOWBACK WATER TREATMENT – BLOCK DIAGRAM
NGPure Water Separation Unit, High Pressure
Field Test Unit, High Pressure, 172 bbl/d
NGI: PRESENT AND FUTURE STATUS

● The technology package has been proven out at a much larger scale than shown above, and a number of patent applications have been applied for.

● In the future these units will likely be controlled from a centralized control room with individual units connected by telemetry.

● Crystal salt and brine solutions from the process have been qualified by the State of West Virginia for use in snow and ice removal.

● Purified water has been approved for irrigation and return to rivers, and can be further purified to pass all drinking water standards.
OTHER SEPARATION CENTER OF EXCELLENCE PROJECTS

- A new electrolytic process for neutralizing acid mine drainage,
- New separation technologies which reduce the energy usage for recovery of fuel-grade ethanol and byproducts by over 50 percent,
- A “green” crystallization process for purifying bioproducts from crude mixtures.