cerahelix

High Flux Ti Nanofiltration Membrane

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This presentation does not contain any proprietary, confidential, or otherwise restricted information.

Project Objective

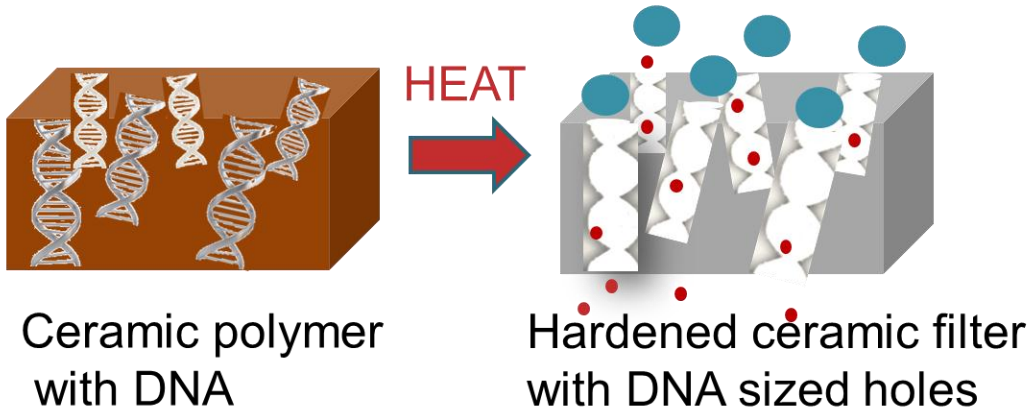
To develop a ceramic filter that can separate complex mixtures at high temperature and low pH. Unique nanoscale features of the filter will enable it to perform faster, while using less energy and less pretreatment chemicals compared to competing technologies. The benefits include the production of higher purity products and cleaner water using less energy. Targeted industries include Unconventional Oil and Gas, Biofuels, Fine Chemicals, and Biopharma.

Technical Approach

Harsh condition separations are performed either by modifying the process stream so that polymer filters can be used or by using energy intensive processes.

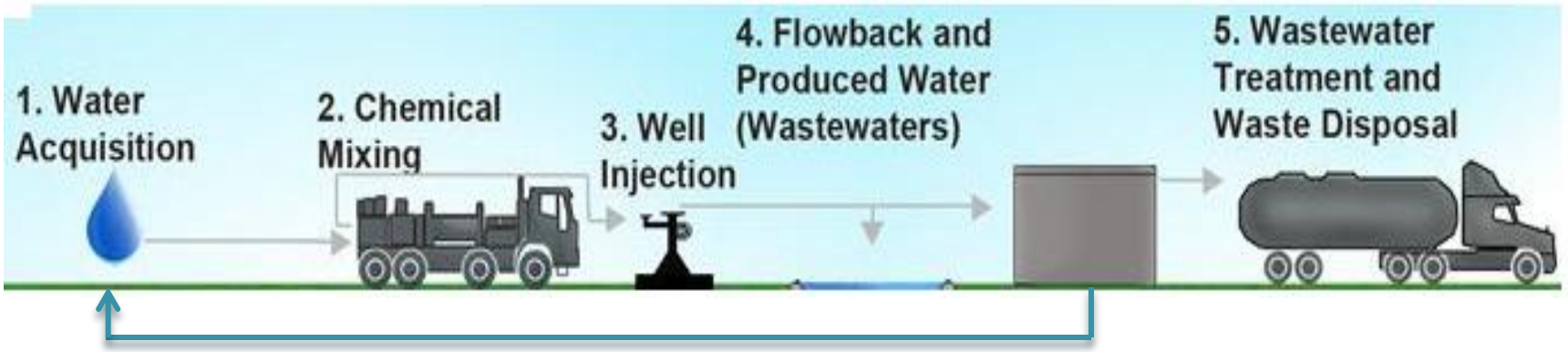
Ceramic filters have the ability to operate under harsh conditions but the current commercial ceramic filters have pore sizes limit of 1 -2 nanometers.

Cerahelix uses a patented template approach where we use DNA to form the subnanometer (0.6- 0.8nm) pores.



Transition and Deployment

Unconventional Oil and Gas produces millions of gallons of contaminated "produced" water annually. Treatment and disposal costs >$2.5 billion in North America alone, thus justifying the potential of fracture flowback water recycling and reuse



Cerahelix solution: treating produced water for reuse or for disposal for under $1/bbl vs current $2 - $17/bbl

Initially Cerahelix will deploy filtration systems to prove the technology and build traction- in time the company will produce filter modules only and/or license the technology

Measure of Success

Successful development of the Cerahelix filtration technology will reduce costs associated with the treatment and re-use of water in industries like Oil and Gas and Biofuels. The unique combination of high durability and high purity separation enables the removal of critical contaminants that cause scaling and other issues that prohibit the re-use of industrial water.

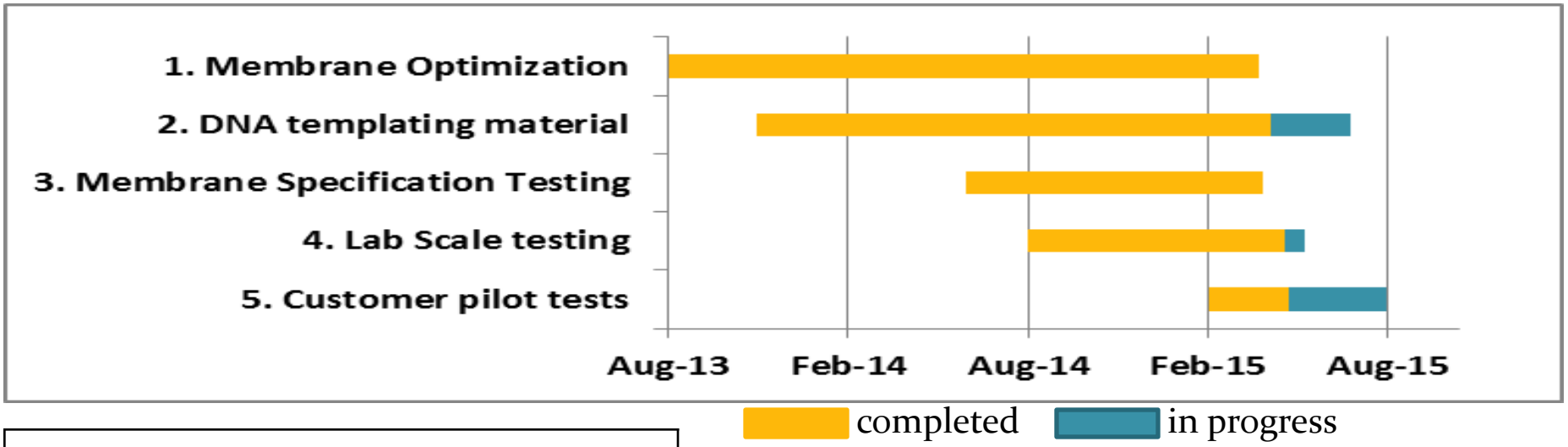
In biofuel production the Cerahelix filters can dewater sugar from biomass at 95% less energy than thermal evaporation. In Oil and Gas they can filter water at >150 degrees C which eliminates the need for heat exchangers.

Success would lead to a US-manufactured high performance nano-ceramic coating that could be exported and contribute to the growth of the US manufacturing sector of the economy.

Project Management & Budget

Progress is determined by meeting performance metrics.

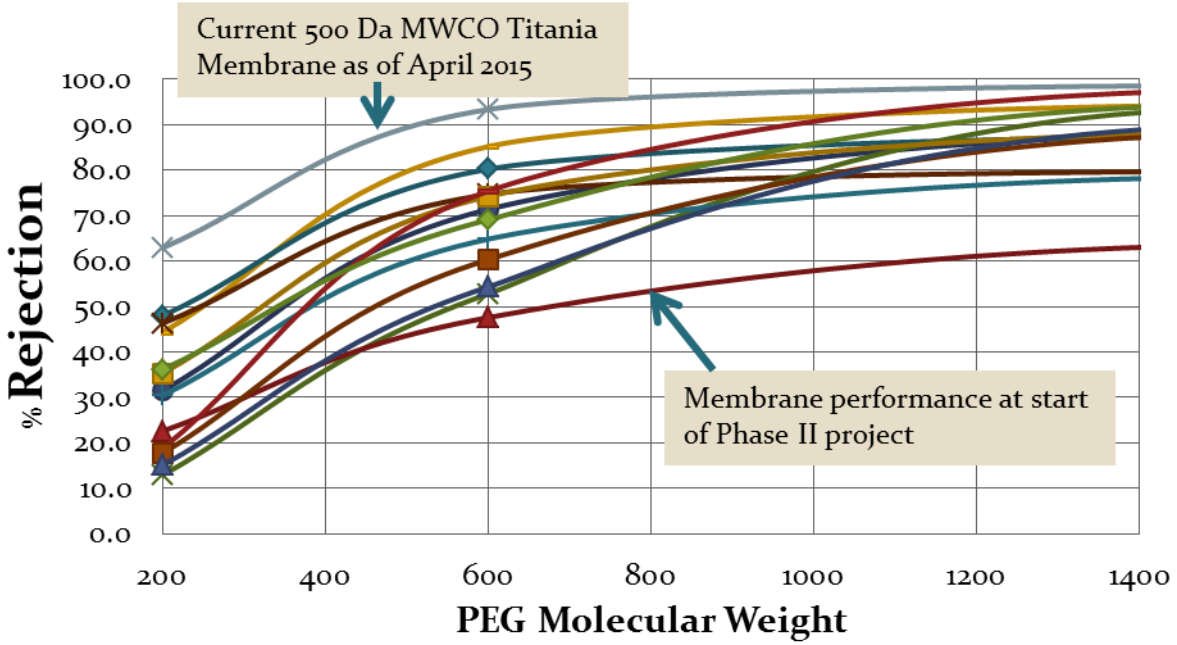
- Cutoff (filtration purity) of <500 Daltons
- Flux (filtration speed) of 1- 5 lmh-bar
- Customer specific separation targets



Total Project Budget	
DOE Investment	$1,00,000
Cost Share	$0
Project Total	$1,000,000

The two year project is due to be completed in August 2015. The final quarter is focused on customer testing and optimizing DNA materials for production scale-up

Results and Accomplishments



Test Compound	Size (Daltons)	% Rejection	Industry
Benzene	78	73.2	Oil and Gas
Toluene	92	58.7	Oil and Gas
Barium Sulfate	233	77	Oil and Gas
Glucose	180	87	Biofuel

Improving size rejection for the membranes to desired result (<500 Daltons).
Flux > 1 lmh-bar has also been achieved, and customer testing is ongoing with oil and gas partners looking for ways to clean produced water at high temperature for recycling and re-use.