Ecomagination: Advanced Waste Water Treatment Technologies

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What is Ecomagination?

Ecomagination is a GE business initiative to help meet customers' demand for cleaner and more energy-efficient products and to drive reliable growth for GE. Ecomagination also reflects GE's commitment to invest in a future that creates innovative solutions to environmental challenges and delivers valuable products and services to customers. At the heart of this standard is GE's belief that "green is green" — that by investing in and developing environmentally advanced products and services, GE will deliver solutions that increase customers' ability to compete and win.

Water scarcity impacts one billion people every day. Ecomagination products from GE help our customers — and our own facilities — conserve global water resources, achieve reductions in water use, improve water reuse and increase the availability of usable water. Our impact spans countries, geographies and industries, ranging from agriculture and mining, to manufacturing and power, to homes and municipalities.

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Why Ecomagination?

In developed economies, 60 % of fresh water is used for industrial purposes and in developing economies the figure is around 20% and rising exponentially. This places industrial wastewater as the main source of wastewater discharge into the environment. Though the prevailing laws have instituted standards requiring primary or secondary treatment, it does not render the water fit for reuse or recyclable into the natural water cycle, since it has residual organic and suspended solids, nitrogenous oxygen demand (NOD), nutrients and toxic materials that need tertiary treatment for complete removal.

In this era of dwindling resources where water is poised to become "the new oil" and as the world faces the reality of decreasing supply of clean water, advanced water technologies present a huge opportunity to enable reuse and create an alternative source of clean water. Despite this grave concern and huge opportunity that exists, reuse is practiced minimally and is largely restricted to regions that are facing acute scarcity of fresh water, while other regions continue to drive themselves to scarcity by depleting or polluting their water resources.

So the question remains, as to what are the key factors that prevent reuse to become a standard operating procedure? The answer being, treatment must be consistent and reliable in the long term and economical in the immediate term if it has to be viable.

The focus of this talk is to provide an overview of advanced technologies which are in development and application phases for Tertiary treatment of waste water and evaluate their reliability and economic co efficient. These include Advanced Membrane Solutions using biological processes, nano technologies, closed loop waste water systems using evaporators advanced biological metals removal process (ABMet) and electrolytic water treatment. A brief description on each of the technologies is presented below.

Advanced Membrane Solutions:

Membrane Bioreactor with ZeeWeed Ultra filtration Membranes and the Integrated fixed film Activated sludge process (IFAS) followed by Ultra filtration lead the advanced membrane solutions story for treatment of high and low strength industrial waste waters.

One of China's largest polyvinyl chloride and ion membrane caustic soda producers, Elion Chemical Industry Co. Ltd. in Erdos City, Inner Mongolia will virtually eliminate its wastewater discharge to the Yellow River using advanced water reuse membrane solutions and wastewater evaporation system.

Advanced Biological Metals Removal:

ABMet (Advanced Biological Metals Removal) is a simple, cost-effective technology to protect the environment from excess levels of nitrate, selenium and other heavy metals found in wastewater streams from power plants, mines and agricultural sites.This simple, low-energy system uses beds of granular activated carbon, inoculated with selected strains of naturally occurring, non-toxic and non-pathogenic microorganisms, to produce treated water that exceeds the world's most stringent regulatory standards for selenium removal.

Nano Technologies for Water Treatment:

The potential application of nanoscience to solve technical challenges associated with the removal of water contaminants have gained recognition and offer more affordable approaches to be more effective, efficient and durable, to removing specific types of pollutants from water. A range of water treatment devices that incorporate nanotechnology are already commercially available and others are in advanced stages of development. These nanotechnology applications include:

- Nanofiltration membranes
- Attapulgite clay, zeolite, and polymer filters;
- Nanocatalysts;
- Magnetic nanoparticles; and
- Nanosensors for the detection of contaminants.

Conclusions:

While most developing and developed economies treat less than 5% of the waste water to reuse standards today, the good news is that, there is an increasing trend by policy makers to go towards total reuse. China recently announced a target to increase industrial water reuse to 70% by 2010 while a new Australian regulation prohibits disposal of coal seam gas production water to tailing ponds.

However, what is needed on a long term basis is a solution as stated in the Summary of EU Directive 96/61/EC concerning Integrated Pollution Prevention and Control.

The "Integrated Pollution Prevention and Control" (IPPC) Directive is based on several principles, namely

(1) an integrated approach,

(2) best available techniques,

(3) flexibility and

(4) ***public participation***

Important research work within this framework is:

- Development of integrated water treatment systems which combine the advantages of different technologies operating on renewable energy sources making it cost effective.
- Development of small modular techniques for small enterprises.
- Cost effective Treatment Technologies for sludges.

The end goal is to develop and implement new, reliable, cost-effective water technologies which enable the availability of sufficient water quantities of the right quality at all times, and more importantly that can help Minimization of water consumption based on sound water management concepts.