Volume 2: Edition 9 – New Technologies and Innovation in Water Sep 30, 2022

Dear Water Warriors,

Over the months the readers have suggested us to cover a few new Technologies in our edition. We have by now covered the basic technologies and can focus on some new developments.

Several new ideas have provided the opportunity to use an alternative method to more conventional know how.

This issue of '**Waughter**', the knowledge available may not have many references in Indian context, but shall be used for more projects to benefit Industry.

Nidhi Jain – Civil Engineer

New technology and Innovation….!!

As the global population hurtles towards 9.7 billion people by 2050, it has never been more important to produce more with less Innovation. And technology have a vital role to play in scarcity and safety, water efficiency, utility operations, monitoring and treatment and data & analytics.

The remote sensing of water, which can help with water accounting, non-revenue water remediation and much more; the internet of things, water quality control, and which, when coupled with new computing capacity, allows us to develop complex models for water management.

Increasing environmental and public health concern have led to more stringent wastewater regulations.

Why New technology …..?

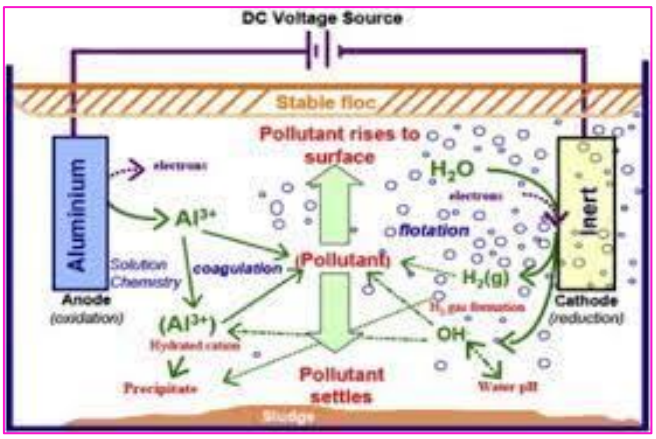
New technology is needed because it helps us stand out. Water treatment and water technologies are an essential line of defence to remove contaminants and bacteria before the delivery of clean, potable water supplies for consumption.

There are many new technologies that have been introduced in recent times. These are:

- Electro Coagulation
- Ballasted Sand Flocculation
- Auto Self-Cleaning Filters
- Electro deionization
- Up-Flow Biological Aerated Filters

Electro Coagulation

Electrocoagulation is the process of destabilizing suspended, emulsified, or dissolved contaminants in an aqueous medium by introducing an electrical current into the medium.



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Pure Water Makes Life Better

PureCODe™

COD REDUCTION MEDIA

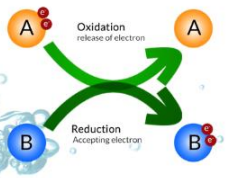
PureCODe is an absorbent media for the **lowering of recalcitrant COD** (Fine polishing of tough to treat COD) which subsequently helps in meeting stringent discharge norms in various industries such as textiles, chemicals, pharmaceuticals, etc. **This media is also regenerable on-site.**

PureCODe specialty media - helps in **lowering COD significantly** to meet stringent discharge norms and **recycle maximum amout of water.**

WORKING PRINCIPLES OF THE MEDIA:

ABSORPTION
(INSIDE THE MEDIA)

ADSORPTION
(SURFACE OF MEDIA)



REDOX
(OXIDATION REDUCTION)

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The reaction chamber containing multiple anode and cathode pairs through which the contaminated water passes. The electrodes can be designed as plates, perforated plates, or tubes. They can be composed of different materials, including aluminium, iron, stainless steel, and titanium.

The electrical system, composed of control electronics. Typically, direct current (DC) is required. Further, A system to dewater the precipitated /coagulated solids is added in downstream of EC. This system could be like any conventional chemical precipitation processes.

Electrocoagulation is an alternative to chemical precipitation for the removal of dissolved and suspended matters in aqueous solution. The quantity of sludge produced is lower in comparison to conventional Chemical Treatment. The floc generated are larger and heavier and settles out better than in conventional chemical precipitation processes.

The effluent generated by electrocoagulation contains no added chemicals and is often of better quality, containing TDS and less colloidal particulates.

Although electrocoagulation requires energy input, it requires only low currents and can be operated using green technologies such as solar or wind power.

Challenges are many: Electrode Life and replacement. Need of Tests before large system, Polarity Reversal, and safe gas release (H_2) and finally very high Capex – on per m3 basis.

Thus, we use EC only when we are sure nothing else is working.

Ballasted Sand Flocculation

The ballasted sand flocculation process is a very compact, but simple, physio-chemical treatment process which permits efficient removal of impurities e.g., suspended solids, phosphorus, and COD.

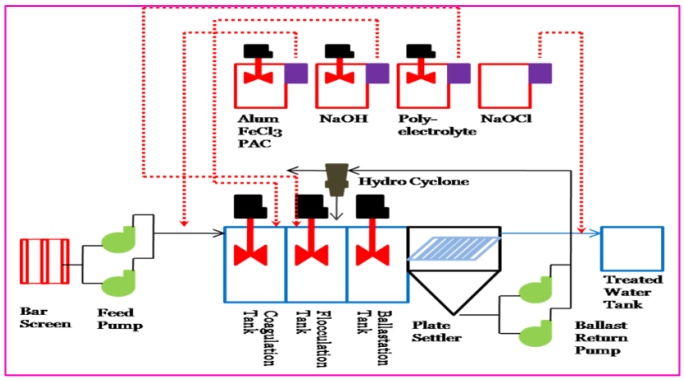

Fig:1.2

It is based on a process developed by combining chemical precipitation and lamella settling with a new technique involving attachment of weight to floc - i.e., weighted settling.

The artificial weight can be any wettable particle like Carbon, Calcite, or Quartz Sand. Rapid settling combined with very short reaction times make the process extremely compact with a total hydraulic retention time of only approx. 15-18 minutes.

If we use ordinary quartz sand the grain size of approx. 100 - 150 µm is enough. One shall always do pilot to generate the data for plant level implementation.

Another must is the polymer that binds the Microsand and the primary particles to large settleable flocs. This flocculation is performed during slow mixing, as broken flocs must be avoided. If you cannot use Flocculant this technology cannot be used.

The technology finds several applications in Primary, Secondary & Tertiary Clarifications. It is also useful in Rain Water Purification and artificial Discharge to water bodies.

The Ballasted Floc is conveyed to the lamella separator. Here, the flocs settle rapidly owing to the Microsand, which makes them much heavier than in conventional precipitation systems.

This implies an up-flow velocity in the lamella separator which is 30-80 times higher than in conventional clarification plants. Typical up flow velocities of the BSF process for wastewater treatment are 40-100 m/h.

Sludge and Microsand are withdrawn from the bottom of the lamella separator and pumped back to a sand separator. One can use screens or cyclone separators to recover clean sand for reuse many times, whereas the sludge is led to separate treatment.

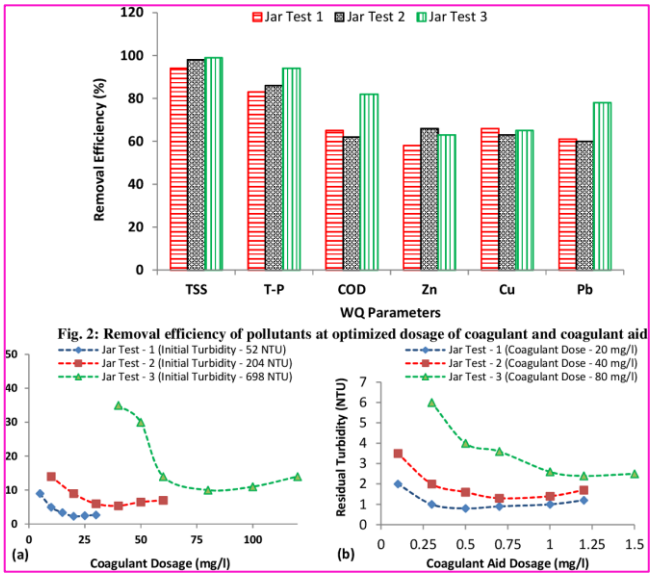

Fig. 2: Removal efficiency of pollutants at optimized dosage of coagulant and coagulant aid

Typically, one can have following advantages:

a. Lower Foot-Print Up-to 10 times reductions Viz a Viz HRSCC,
b. Lower Chemical Consumption – 20% Poly Saving.
c. Quick Start-up as the overall HRT is < 20 mins

Care shall be required for:

a. Proper dosing rate control as variations need adaptations quickly < 20 mins
b. Sludge has aggressive added media that is abrasive so design Sludge line & Pumps properly.
c. Right mixing energies – ballasted floc shall reach Lamella clarifier and not settle in Flocculation Tank.

Auto Self Cleaning Filters

A self-cleaning strainer (or self-cleaning filter) is a type of water filter that utilizes system pressure to clean itself.

In a self-cleaning filter, a rigid cylinder screen strains particles from a water source, trapping debris on the inside. This layer of build-up causes differential pressure across the inlet and outlet. A controller monitors the filter and opens a flush valve when it senses adequate differential pressure.

It removes unwanted particles from a water source in the 5-4,000-micron range. This technology carries many advantages like as mentioned below:

Range	:	50-1000	m^3/h
Filtration Degree	:	50-100	µm

In case of installation, it can be installed easily in pipeline horizontally or vertically as required. The major advantage of this technology is that unit is not stopped during backwash.

This application is best for side stream Cooling Tower, Tertiary treatment, and irrigation.

Also, it is advised not to use the unit if turbidity is major concern in effluent.

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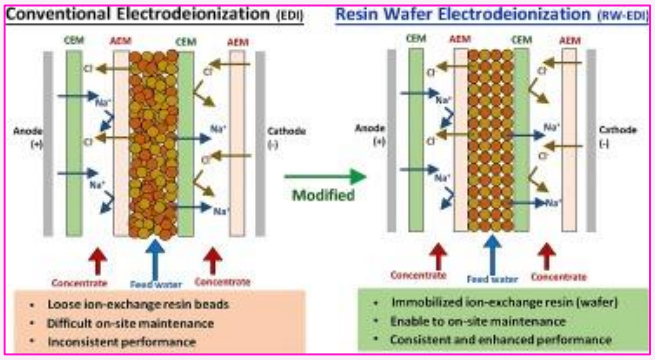
Electro deionization

It is a water treatment technology that utilizes electricity, ion exchange membranes, and resin to deionize water and separate dissolved ions (impurities) from water.

It differs from other water purification technologies in that it is done without the use of chemical treatments and is usually a polishing treatment to reverse osmosis (RO).



EDI is a continuous process. The ion exchange resins are being continuously being regenerated by the DC electric field.

There is no “breakthrough" of ions as happens in conventional ion exchange operations, therefore the quality of the water remains at a constant high level of purity. The electric field also provides a bacteriostatic environment inside of the EDI cell, inhibiting the growth of bacteria and other organisms.

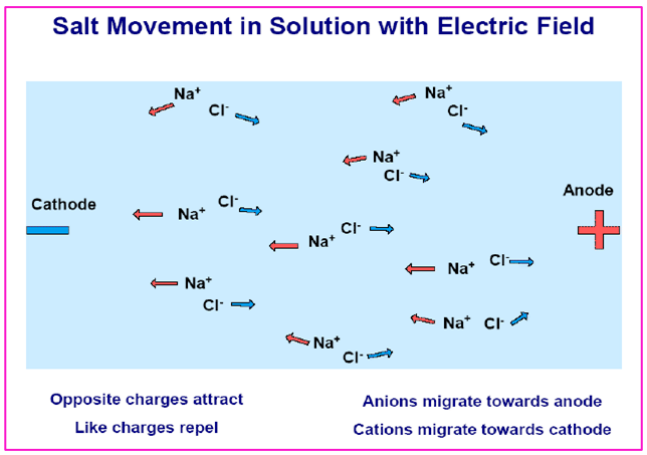
Resin wafer electro deionization can improve energy efficiency to greater than 35% in comparison to reverse osmosis (normally ~12%) for impaired water desalination.

Also, the energy consumption of resin wafer electro deionization has been found to be 0.35–0.66 kWh/m3 with productivity of 20.1–44.7 L/h/m^2 (i.e., 5.3–11.8 gal/h/m^2) for brackish water desalination.

Most Pharmaceuticals and Semi-conductor manufacturing units use EDI. Power Plants are also showing interest in this Technology to get rid of Mixed Bed and hence HCl & NaOH.

A typical EDI device contains alternating semipermeable anion and cation ion-exchange membranes. The spaces between the membranes are configured to create liquid flow compartments with inlets and outlets.

A transverse DC electrical field is applied by an external power source using electrodes at the ends of the membranes and compartments.



When the compartments are subjected to an electric field, ions in the liquid are attracted to their respective counter-electrodes.

The result is that the compartments bounded by the anion membrane facing the anode and the cation membrane facing the cathode become depleted of ions and are thus called diluting compartments.

The compartments bounded by the anion membrane facing the cathode and cation membrane facing the anode will then trap ions that have transferred in from the diluting compartments.

Since the concentration of ions in these compartments increases relative to the feed, they are called concentrating compartments, and the water flowing through them is referred to as the concentrate stream (or sometimes, the reject stream).

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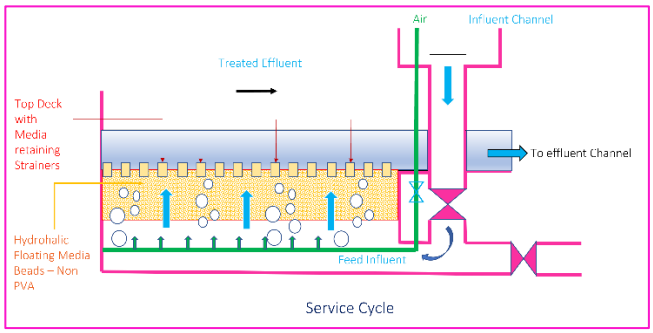
Up-Flow Biological Aerated Filter

Biological Aerated Filter is simple and innovative process as an extension to the ancient trickling filter knowhow. The difference lies in engineering know how to convert the "Chocking" to it's advantages and the fundamental innovation is:

Up-Flow

It can remove all biological pollution at minimal operating costs. It is adapted to the highest discharge standards. Further it is easy to operate.



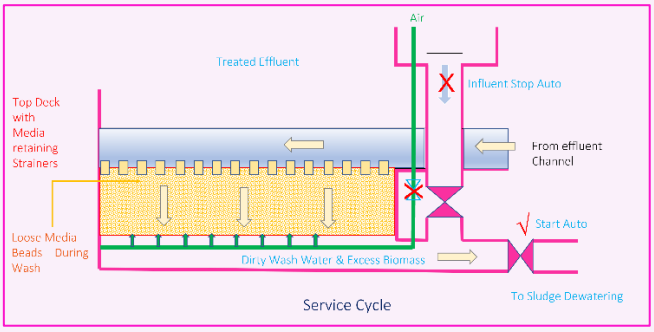
Biomass grows on the media (Such as Polystyrene Beads usually 3 – 7 mm) and forms a compact bed due to up-flow of effluent. Constant air supply means the aerobic growth of the biofilm. And then pollutants are reduced to form biomass again.

The media is retained in a compacted bed below the filter nozzle floor providing an effective filter to trap particles and biomass.

Effluent passes through floating media and get separated above filter and clean filtrate gets discharged.

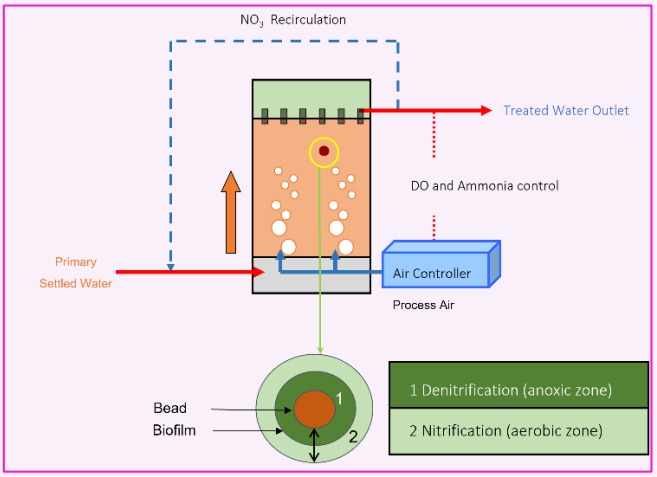
The light floatable media bed allows a backwash under gravity using treated water retained above the filter nozzle floor - no backwash pumping system is required.

Downward flow expands filter bed and ensures elimination of excess biomass and particles. Hence little energy is required for backwash.



The solids accumulated in the filter are eliminated regularly (every 12 to 24 hours). The backwash water containing biomass is thickened and the excess sludge is discharged.

The unique feature of the Up-flow Biological Aerated Filter is ability to conduct Nitrification and De-nitrification simultaneously on bead.



The air flow controller is optimized to provide Air, sufficient to maintain DO required for Nitrification. The NO_3 thus produced are recirculated back to beads to encourage NO_3 diffusion in biofilm and obtain de-nitrification.

Process needs close monitoring of NO_3 recirculation and DO to obtain < 15 mg/l BOD & < 10 mg/l TN.

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Water & Women..

United Nation's Development Program in it's Point 6 of 17 advocates to "Ensure availability and sustainable management of water and sanitation for all" Our Simran has a different story to tell. As a child, young adult, mother & more..

Simran @ 6 Years

Something wrong
with *Chinna* or Water!
he's in pain and I suffer
must visit health center
with Medicines;
Prey God he'll be better !

Simran @ 12 Years

that's me
the little Indian Barbie
look at my School
that's where I wish to be
but I walk to fetch water
Alas, am the only one free !

Simran @ 25 Years

time flies
but not the plight
my dreams follow my footsteps
wished her education and more
I miss work and she my time
Wish can stop this crime.

Simran @ ∞ Years

that's tolerance
the ordeal continues
it's gender bias or fate
or just another shadow of violence
whatever is the burden of water
we bear in this dawn of silence.

Aktion Waughter is committed to do it's part and ensure a helping hand in the Vision of UNDP. We have joined Mission "PiYO TechJal" and shall take our UF based Purifier to all the population of the world.

Whatever you can support on this mission, please speak to us at +91 95585 55227.

जल जीवन जननी !!

Our World is Waughter

The technical knowledge share attempt of Aktion Consultancy and the contents in the magazine shall be qualified by Sanjeev Srivastava our Technology Lead.

Our next edition focuses on: "Drinking Water Treatment – Small Community to Large Municipality"

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