ZERO DISCHARGE in BD Textile Sector

ETP Realities & applications

Impact on BAT Membrane Technologies

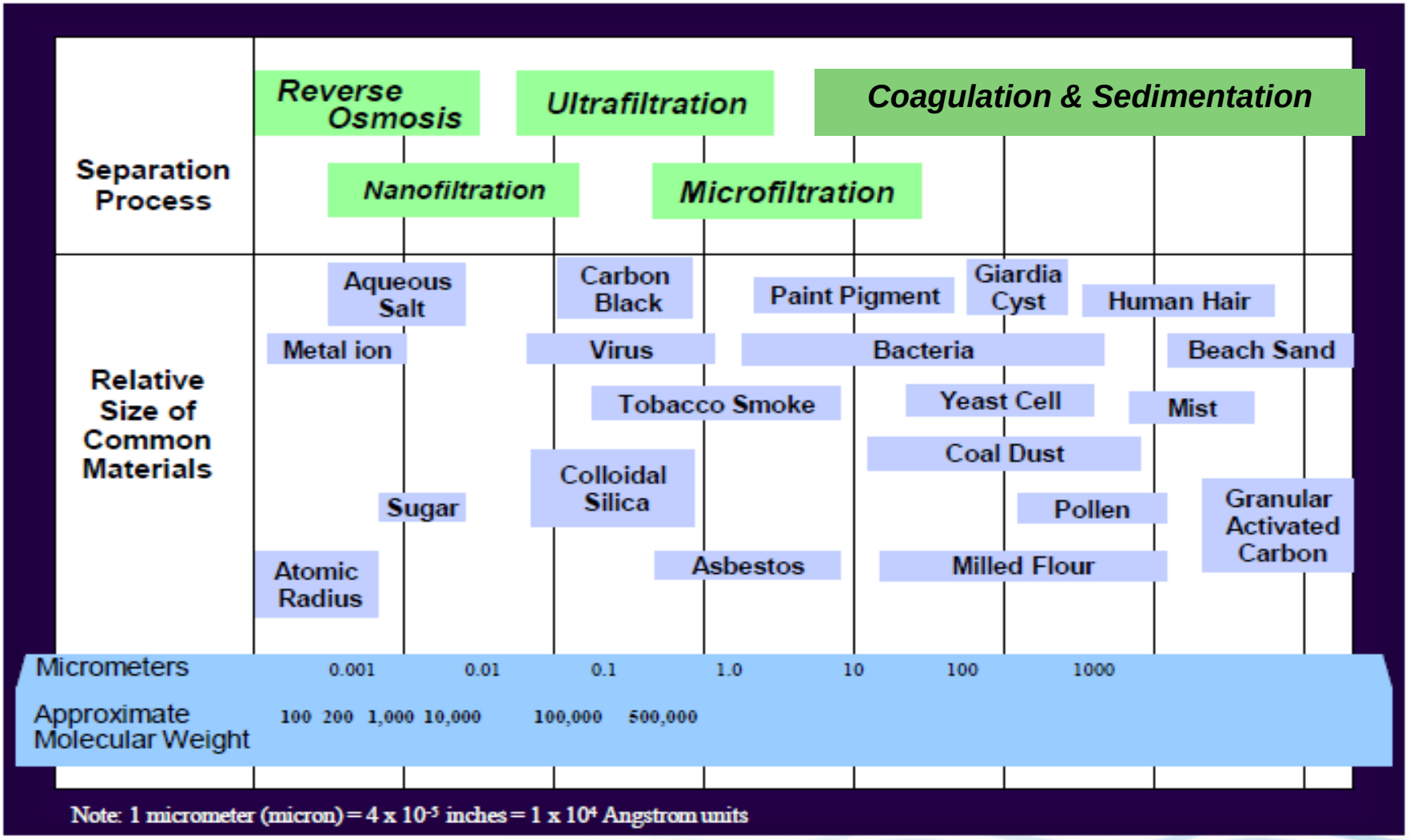
FLAGSHIP DHAKA CETP (BD) Ltd.

Environment and Water Solutions

Using Membrane Technologies by:

hydromaster

TECHNOLOGY based SEPERATION PROCESS



FOLLOW the SCIENCE

SWEDEN TEXTILE WATER INITIATIVE

GUIDELINES

ellos

Filippa K

FJÄLL RÄVEN

Gekås Ullared

odd molly

Boomerang

RNB RETAIL AND BRANDS

JC POLARN O. PYRET BROTHERS SISTERS

HAGLÖFS

KappAhl

SIWI

tpc TEXTILE PRODUCTION COMPANY

Gekås Ullared

K&US STOCKHOLM

Snickers WORKWEAR

H&M

wesc

ginatricot

The Global
Apparel Value Chain Environmental Requirements on Suppliers

Higg Index – Environmental Retail Score Card

Outlets

SYNDICATED BUYERs
ETP COMPLIANCE
Is not enough!

Sustainable Apparel Coalition

SAVE
Sustainable Action & Vision for a better Environment

Department Stores
Specialty Stores
Mass Merchandise Chains

ACCORDE

Discount Chains
Off-price Factory Outlet, mail Order, others

ALLIANCE

Yarn Spinning
Fabric (weaving Knitting, Finishing
Synthetic Fibres

Export Networks

Next 15 Years

- Water Projections (2030)
  - ***GREEN "A"***
  - ***"B"***
  - ***"C"***
- Product Supply (country?)

BSR

Sustainable Water Group

Water Quality Guidelines

Revised June 2010

SAMPLING AND TRADITIONAL PARAMETERS

Parameter	Limit Value
Sampling:	
Temperature	≤37°C
pH, Standard Units	6.0-9.0
Traditional Parameters:	
Total Suspended Solids (TSS)	≤ 30 ppm
Biological Oxygen Demand (BOD)	≤ 30 ppm
Chemical Oxygen Demand (COD)	≤ 200 ppm

Bangladesh DOE Requirements	
TSS	150 ppm
BOD	50 ppm

TEXTILE Wastewaters

Woven , Knit, Printing , Washing

REWE GROUP Group Detox Program

Waste Water and Sludge Testing

DETOX PRIORITY – 11 – GROUPS

- Akylphenols & Ethoxylates
- Phitalates
- Brominated and Chlorinated Flame Retardents
- Azo Carcinogenic Dyes
- Organotin Compounds
- Poly & Perfluorinated Chemicals
- Chlorobenzenes
- Chlorinated Solvents
- Chlorophenols and Other Phenol
- Short-Chained Chlorinated Parafins
- Heavy Metals
- Color

BUYER Memberships

- **BSR**
- **DETOX**
- **GREENPEACE**
- **HIGGS Index**
- **STWI**
- **PaCT**
- **others**

International BUYERS

DEMAND Legal Discharge Guidelines

Which lead To Resource Conservation And REUSE

STWI -Target values and test methods of wastewater

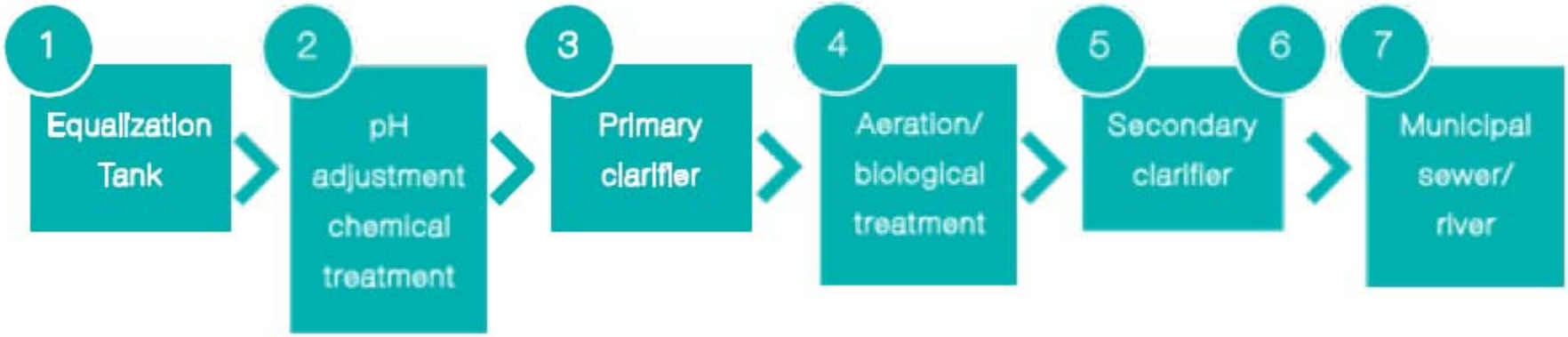
Parameter	Target Value	Test Method ISO, EU and national standards
pH	6-9	ISO 10523
Temparature	37˚C	dIn 38404-C4
Total suspended solids (TSS)	30 mg/l	ISO 11923, dIn en 872
BOd5	30 mg/l	ISO 5815-1, -2 dIn en 1899-1
Cod	160 mg/l	ISO 6060:1989, dIn 38409-H41
Colour	150 aTMI or 150 CO-PT	en ISO 7887 target 436 nm: <7/m, 525 nm:<5/m, 620nm: <3/m
Bacteria	400/100ml	
Foam	no visible discharge of floating	Solids or persistant foam
Antimony	0,5 mg/l	
Cyanide	0,2 mg/l	ISO 6703-1, -2,-3, dIn 38405-d 13-1
Mercury	0,01 mg/l	ISO 5666, dIn en 4183
Cadmium	0,01 mg/l	ISO 5961, en ISO 11885
Lead	0,1 mg/l	dIn 38406, ISO 8288, en ISO 11885
Arsenic	0,01 mg/l	en ISO 11885
Copper	0,25 mg/l	dIn 38406, ISO 8288, en ISO 11885
Nickel	0,2 mg/l	dIn 38406, ISO 8288, en ISO 11885
Chromium	0,1 mg/l	dIn en 1233, ISO 9174, en ISO 11885
Cr total/ Cr vI	0,5/0,1 mg/l	
Zinc	0,1 mg/l	ISO 8288, en ISO 11885
Cobalt	0,02 mg/l	ISO 8288, en ISO 11885
Total nitrogen	10 mg/l	
Total phosphorus	2 mg/l	
Oil and grease	10 mg/l	
AOX	1 mg/l	
Pesticides	0,05-0,1 mg/l	
Phenol	0,5 m/l	
Sulphide	1 mg/l	
Ammonia	10 mg/l	
Toxicity e.g. fish eggs (T.U 96 h)	2 nonylphenol/	
Nonylphenol/ nonylphenol ethoxylate	20-100 mg/kg	

Test methods are also called for inflowing water.

Effluent Treatment Plant (ETP) Steps and Sampling

According to :

BUYER "ACHEIVER" Objectives as per Swedish Textile Wastewater Initiative :



ETP Designs Must meet STWI Guidelines

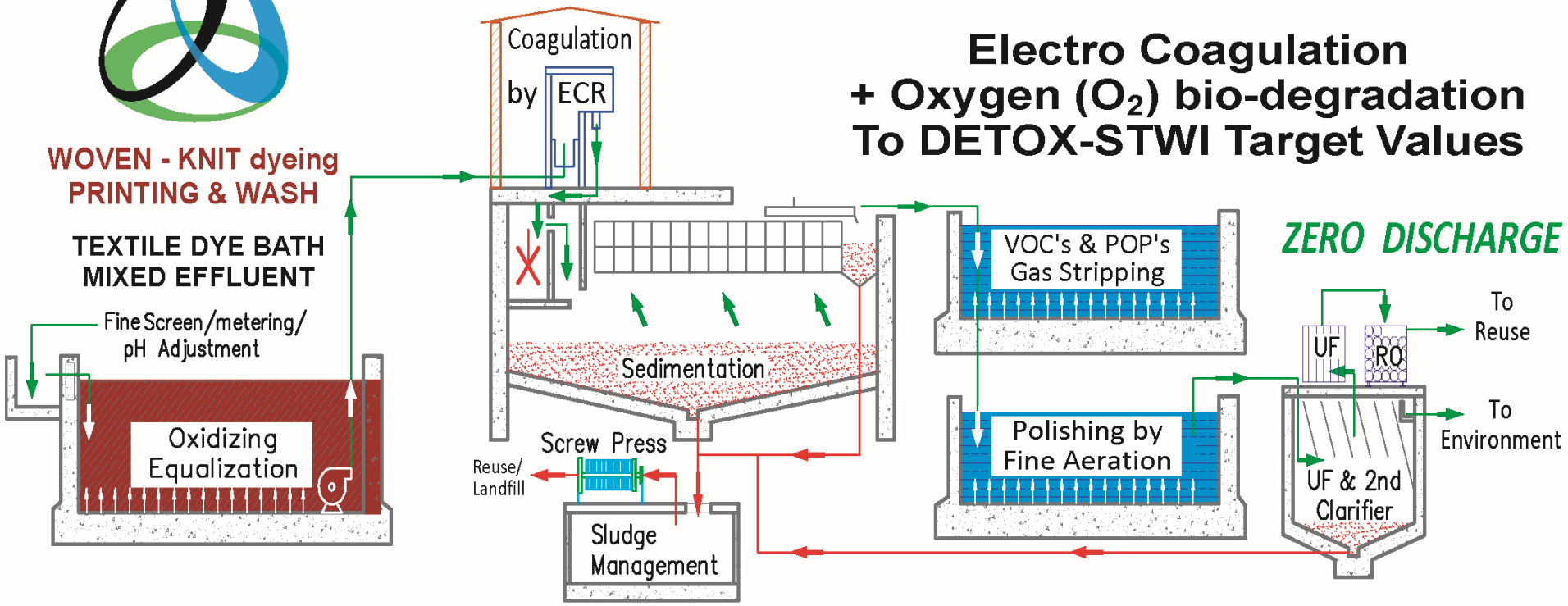
INDUSTRY and COUTNRY Demand & need for

ZERO DISCHARGE

Water Recovery is "ACHIEVER" Status

ECR O2 ETP & RECOVERY Process Flow

Electro Coagulation
+ Oxygen (O_2) bio-degradation
To DETOX-STWI Target Values

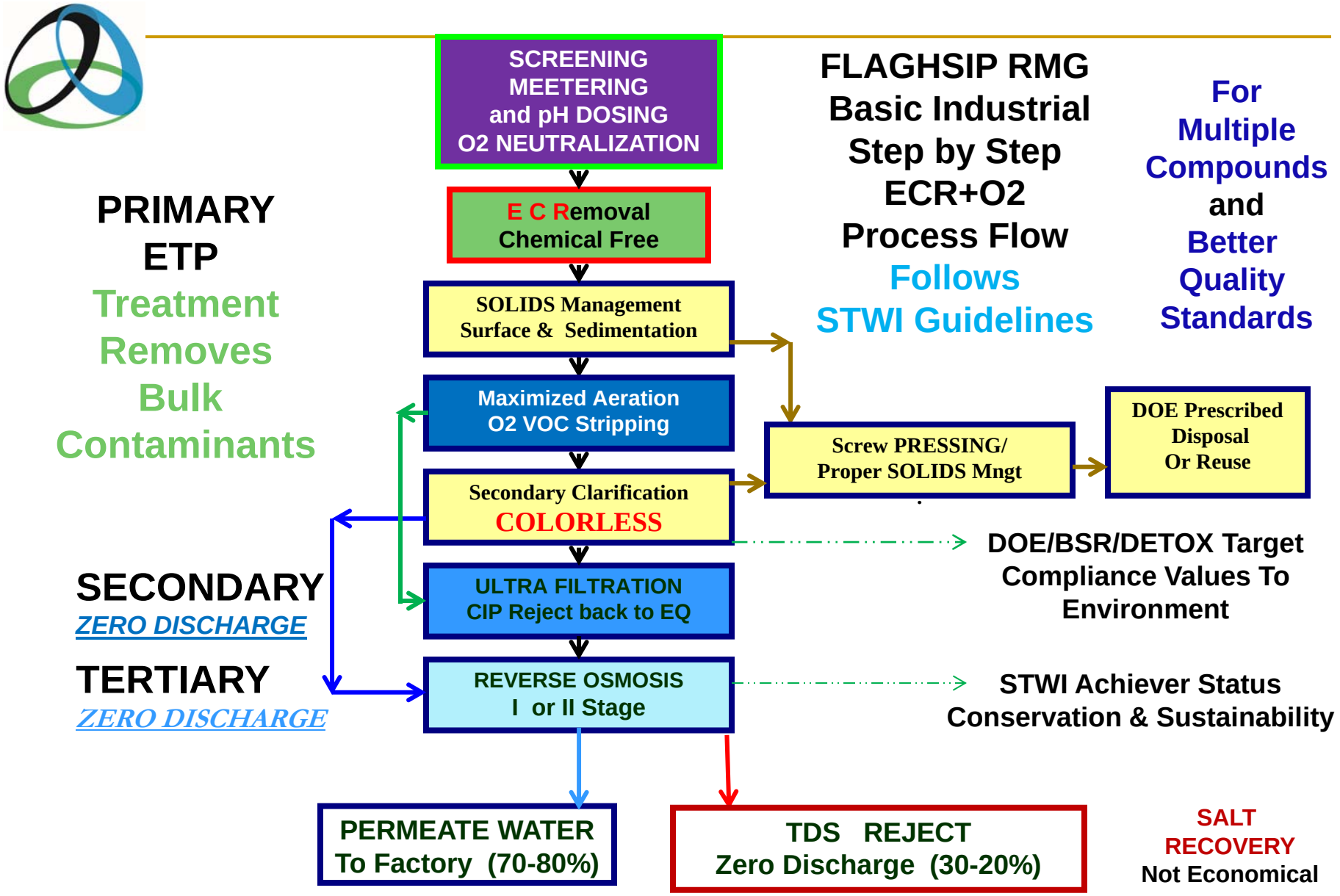


ULTRA FILTRATION

Secondary Treatment

REVERSE OSMOSIS

Tertiary Treatment


SCREENING
MEETERING
and pH DOSING
O2 NEUTRALIZATION
E C Removal
Chemical Free
SOLIDS Management
Surface & Sedimentation
Maximized Aeration
O2 VOC Stripping
Secondary Clarification
COLORLESS
ULTRA FILTRATION
CIP Reject back to EQ
REVERSE OSMOSIS
I or II Stage
Screw PRESSING/
Proper SOLIDS Mngt
DOE Prescribed
Disposal
Or Reuse
PERMEATE WATER
To Factory (70-80%)
TDS REJECT
Zero Discharge (30-20%)
FLAGHSIP RMG
Basic Industrial
Step by Step
ECR+O2
Process Flow
Follows
STWI Guidelines
For
Multiple
Compounds
and
Better
Quality
Standards
PRIMARY
ETP
Treatment
Removes
Bulk
Contaminants
SECONDARY
ZERO DISCHARGE
TERTIARY
ZERO DISCHARGE
DOE/BSR/DETOX Target
Compliance Values To
Environment
STWI Achiever Status
Conservation & Sustainability
SALT
RECOVERY
Not Economical

Parameter	Specifications	ECR & ZD Output Parameters in **GREEN**
Inland Discharge Standards (BD DOE)		
Chemical Oxygen Demand COD	200 mg/l	**120 mg/l**
Biological Oxygen Demand BOD	50 mg/l	**30mg/l**
Total Suspended Solids (TSS)	150 mg/l	**30 mg/l**
pH	6-9	
Dissolved Oxygen	4.5	

INTEGRETY
OF ETP Output
Becomes Input Values
For Ultra Filtration

SECONDARY TREATMMENT using Ultra filtration

BOD post UF	**0.02 Micro Meters**	18 mg/L	**11 mg/l**	65% Removal
COD post UF		70 mg/L	**42 mg/l**	65% Removal
TSS post UF		7.5 mg/L	**1.5 mg/l**	95% Removal

TERTIARY TREATMMENT using Reverse Osmosis

BOD Post RO	**0.001 Micro Meters**	1.0 mg/L	**.55 mg/l**	95% Removal
COD Post RO		3.5 mg/L	**2.1 mg/l**	95% Removal
TDS Post RO		< 150 mg/L		See Membrane specs
TSS Post RO		0.38 mg/L	**.1 mg/l**	95% Removal
HARDNESS		0.0 mg/L		10 - 50 Points

UF GUARANTEES RO PERFORMANCE

TECHNICAL & ECONOMIC Sustainability
TDS before RO
2,700 mg/L

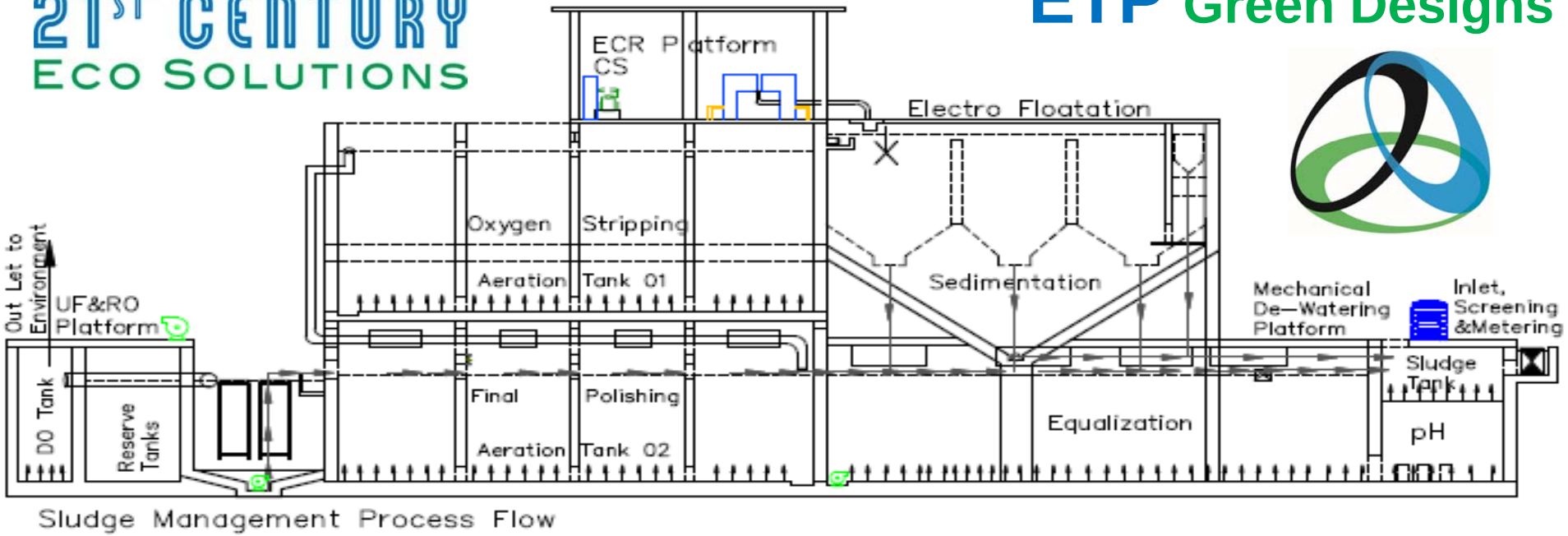
Guaranteed 70-80% WATER Recovery

NEW ETP's

STWI "ACHIEVER" Status

21ST CENTURY
ECO SOLUTIONS

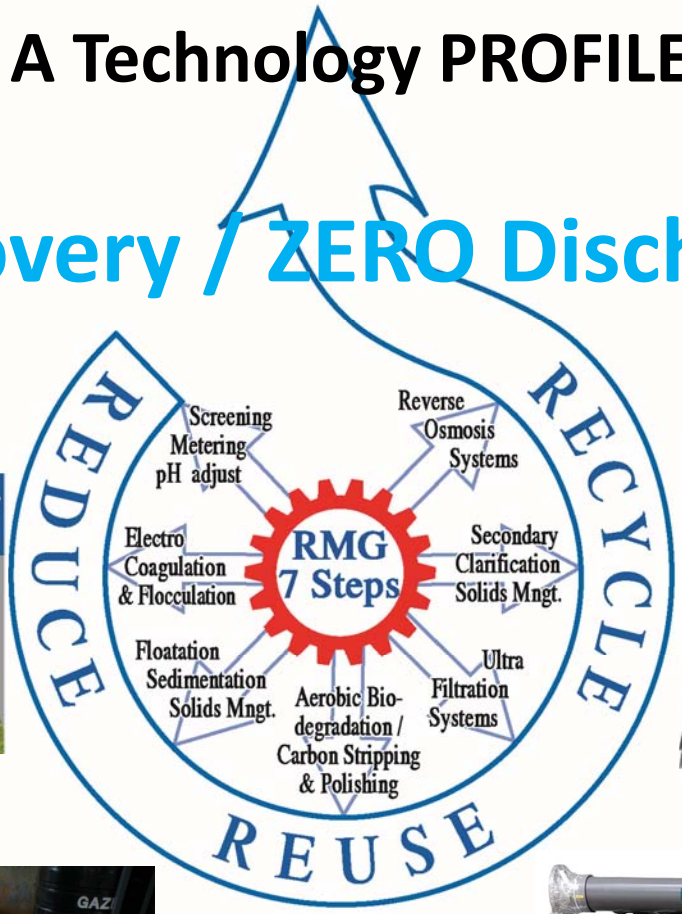
ETP Green Designs



Sludge Management Process Flow

A Technology PROFILE

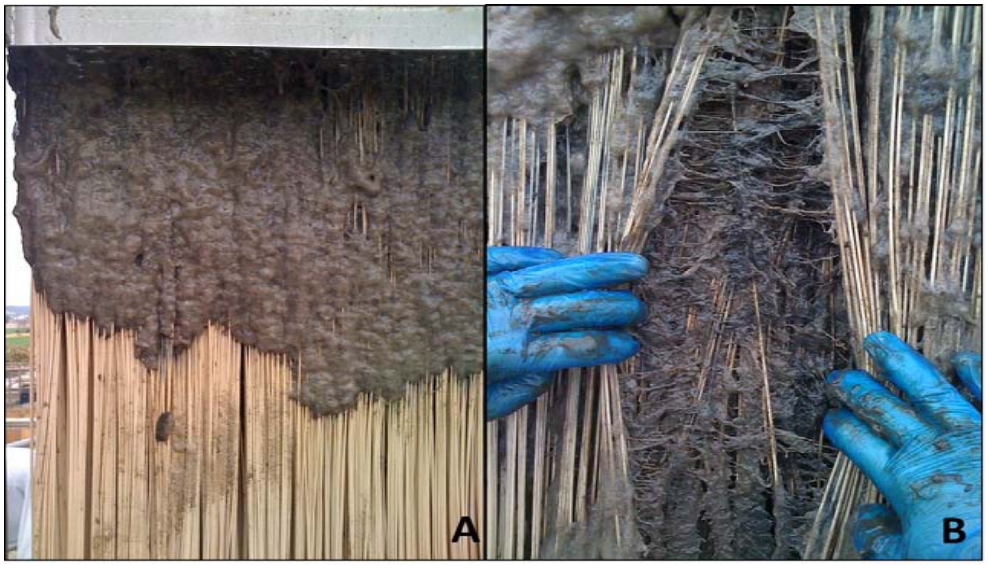
Recovery / ZERO Discharge



ETP PRECAUTION and CARE
RMG TEXTILE Effluents HIGH in Lint & Fibre

Clogging

Sludging



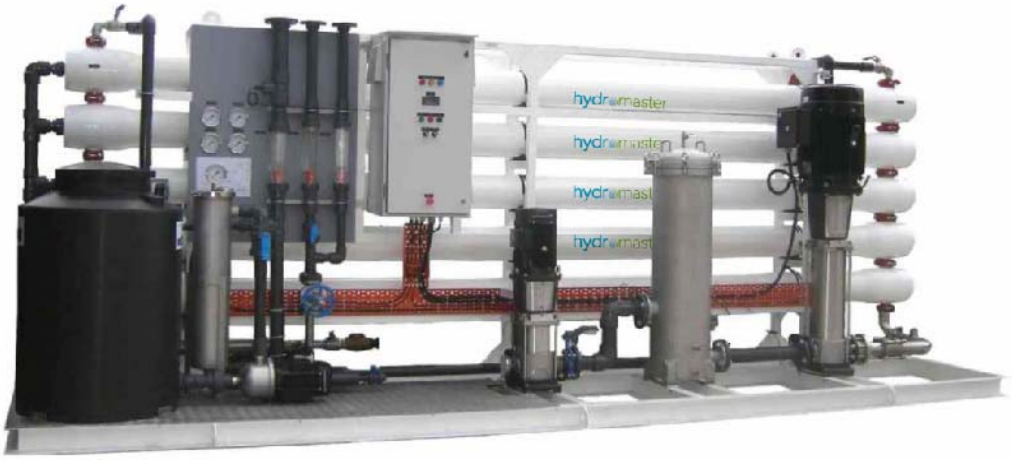
Ragged membranes. A, Top of the cassette. B, inside the cassette. (UF or MBR)

hydromaster

Membrane Bio Reactor

Ultra Filtration

Low Pressure Reverse Osmosis



UF guarantees TARGET VALUES & Protection of RO System

ULTRA FILTRATION

- Does not change the chemistry of water.

Same water quality with coagulation / flocculaltion

→ Removes turbidity

- UF removes larger organics, colloids, bacteria while allowing most ions and small organics to permeate the porous structure.
- Larger pore size → Requires much lower differential operating pressure.

UF Is simply required to remove above to protect RO

Low Pressure Reverse Osmosis

Direct Feed from UF to RO System available

WHY THE ETP OUTPUT INTEGRITY So IMPORTANT

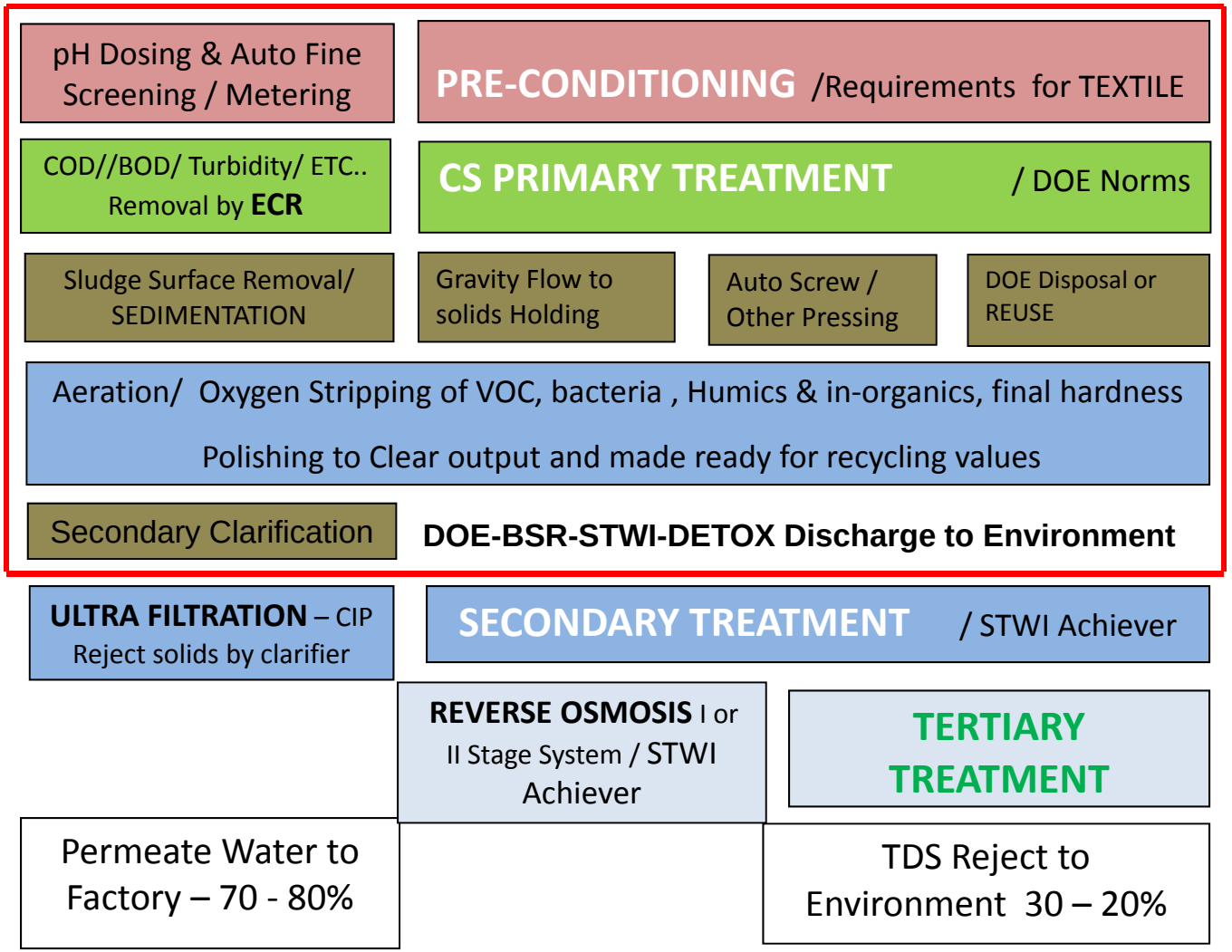
- Flux decline (or membrane compaction) is an intrinsic membrane property
  - solely a function of pressure + temperature

- Fouling is the buildup of material on the membrane surface (or interaction of components of the feed stream with the membrane) causing additional increase in feed pressure to maintain permeate flow
  - Designer selects an appropriate fouling allowance
  - Fouling is not covered by the membrane manufacturer's warranty

- There is a membrane system to treat most any water problem.

- RO systems should be used to remove only **dissolved** solids - they need VERY clear feed water.

ECR O_2 ETP output for RECOVERY OBJECTIVES



The Integrity Of ETP Outlet

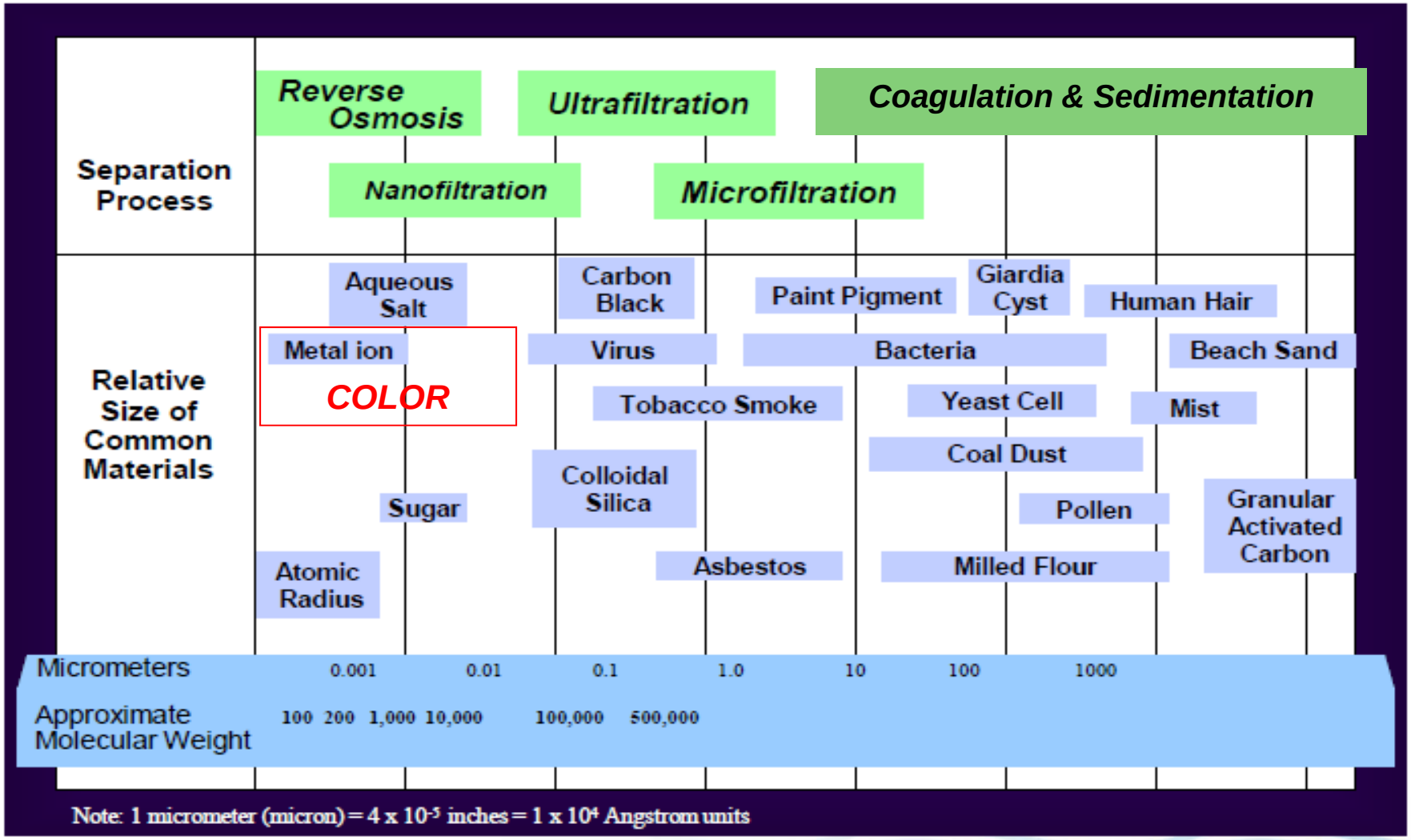
- Insures -

Minimized Costs Associated With

SECONDARY & TERTIARY

Filtration Systems

TECHNOLOGY based SEPERATION PROCESS



Sustainable Water Group

BSR

Water Quality Guidelines

Revised June 2010

CHEMICAL CONSTITUENTS

Parameter	Lower Limit
Antimony	≤ 0.50 ppm
Arsenic	≤ 0.01 ppm
Cadmium	≤ 0.01 ppm
Chromium	≤ 0.10 ppm
Cobalt	≤ 0.02 ppm
Copper	≤ 0.25 ppm
Cyanide	≤ 0.20 ppm
Lead	≤ 0.10 ppm
Mercury	≤ 0.01 ppm
Nickel	≤ 0.20 ppm
Zinc	≤ 1.00 ppm
Color	≤150 ADMI

Heavy Metals	ECR Average % Removed	Other Contaminants	ECR Average % Removed
Aluminum	99.0	Aldrin	98.0
Arsenic	**96.0**	Chloreiviphos	99.0
Barium	98.0	Cypermethrin	94.0
Calcium	98.0	DDT	99.0
Cadmium	**98.0**	Diazinon	99.0
Chromium	**99.0**	Lindane	99.0
Cobalt	**62.0**	Proptamphos	99.0
Copper	**99.0**	Boron	70.0
Iron	99.0	Cyanide	99.0
Lead	97.0	E. Benzene	99.0
Magnesium	98.0	MP-Zylene	98.0
Manganese	83.0	O-Zylene	98.0
Mercury	**66.0**	Toluene	99.0
Molybdenum	80.0	Fluoride	60.0
Nickel	**99.0**	Nitrate	40.0
Vanadium	95.0	Nitrogen TKN	93.0
Zinc	**99.0**	PCB-Arochlor	82.0
Platinum	83.0	Hydrocarbons	98.0
Selenium	42.0	Phosphate	98.0
Silver	91.0	Potasium	45.0
Tin	89.0	Silicon	99.0
COLOR	**90%**	**VOC/POP's**	**N/D**

Coliform	400 bacteria per 100ML

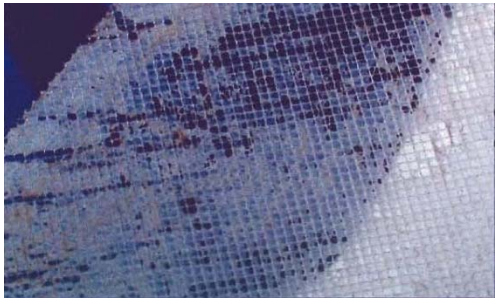
Foam: No visible discharge of floating solids or persistent foam.

Domestic Sewage: Sewage must not be discharged directly into open bodies of water. If there is no public treatment facility available, a treatment system should be installed.

OUTPUT Insures Long Lasting & Economical **ZERO DISCHARGE**

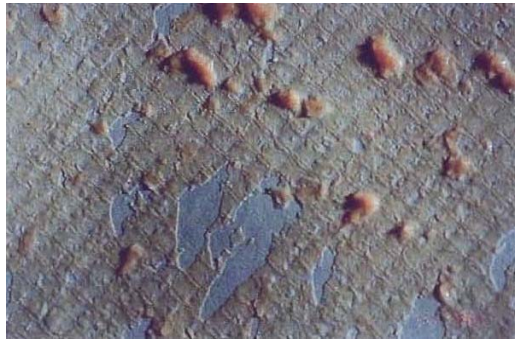
OPERATIONS & COST

Heavy Metal Fouling in lead (1st) element



Bio fouled feed spacer

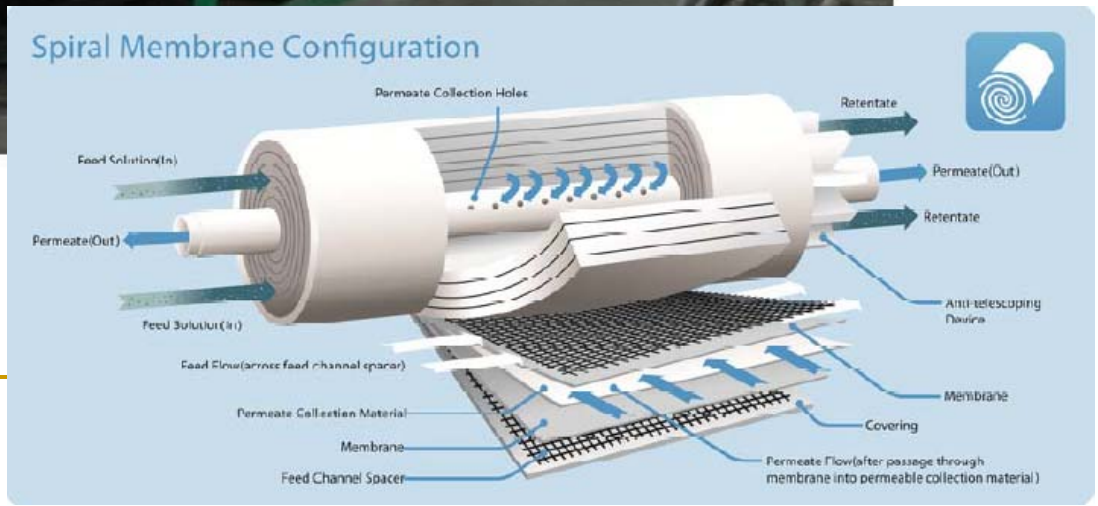
Calcium Sulphate scaling last stage element



Bio fouled membrane

scaled membrane Surface With Imprints from the feed spacer

UNIVERSAL RULE for RO particle size to be LESS than <.001 Micrometer



Fully Automated
Self Cleaning

EMPIRICAL **(Scientific)** and **(Factory)** PROVEN ECR **APPLICATION and AFFECTIVENESS**

International Journal of Environment and Bioenergy, 2013, 6(2): 96-116

Modern Scientific Press

International Journal of Environment and Bioenergy ISSN: 2165-8951

Journal homepage: www.ModernScientificPress.com/Journals/IJEE.aspx *Florida, USA*

Article

Removal of Reactive Dyes from Textile Wastewater by Electrocoagulation Process: An Effective and Clean Approach

SHAHJALAL University of Science and Technology

Dept. of Chemical Engineering and Polymer Science

"As a reference, the cell **(ASP MLSS – BIO CELLS)** uptake was shown to be inversely proportional to the number of sulfonate groups of 18 azo dyes studied, *and found that*

- *11 passed practically unchanged* through the activated sludge system,
- *4 were absorbed by the activated sludge* (WAS) and
- *3 were biodegraded "*

INTECH Europe publishes "Organic Pollutants – Environmental and Analytical Update" 2014

" **Separation/ Elimination Procedures – A Critical Overview"**

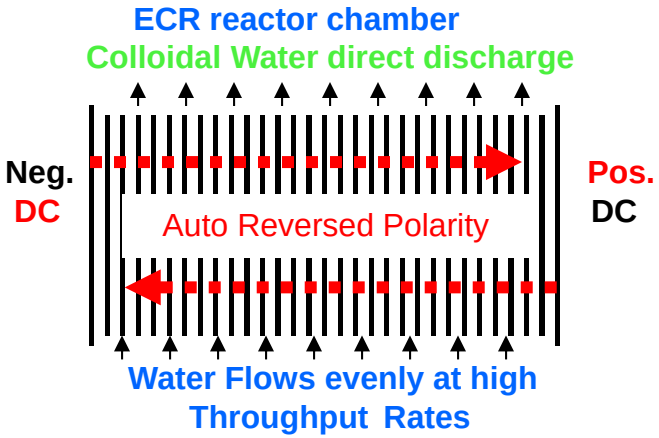
WHY COAGUALTION / SEDIMENTATION IS PREFERED

PRODUCTS used in TEXTILE Industry	**POLLUTION** Reduction Characteristics
"Colorants & optic whitening agents, fibres & impurities of polymeric nature, synthetic polymeric resins, silicones"	**"Difficult** to be biodegraded with moderate – high BOD5"
"Polyvinyl alcohols, mineral oils, tensides resistant to biodegradation, anionic or non-ionic emollients"	**"Difficult** to be biodegraded, moderate BOD5"
"Formaldehyde or N-methylolic reagents, coloured compounds or accelerators, retarders & cationic emollients, complexants, salts of **heavy metals"**	**"Can not** be removed by conventional biological treatment, low BOD5**"**

ECR Science & TREATMENT

"The *Electro Contaminant Removal process* is based on **valid scientific principles** involving responses of water contaminants to strong electric fields and electrically induced oxidation and reduction reactions"

Instant Flocculation



Atmospheric pressure chamber

Units sized from 15 to 180 M^3/Hr.

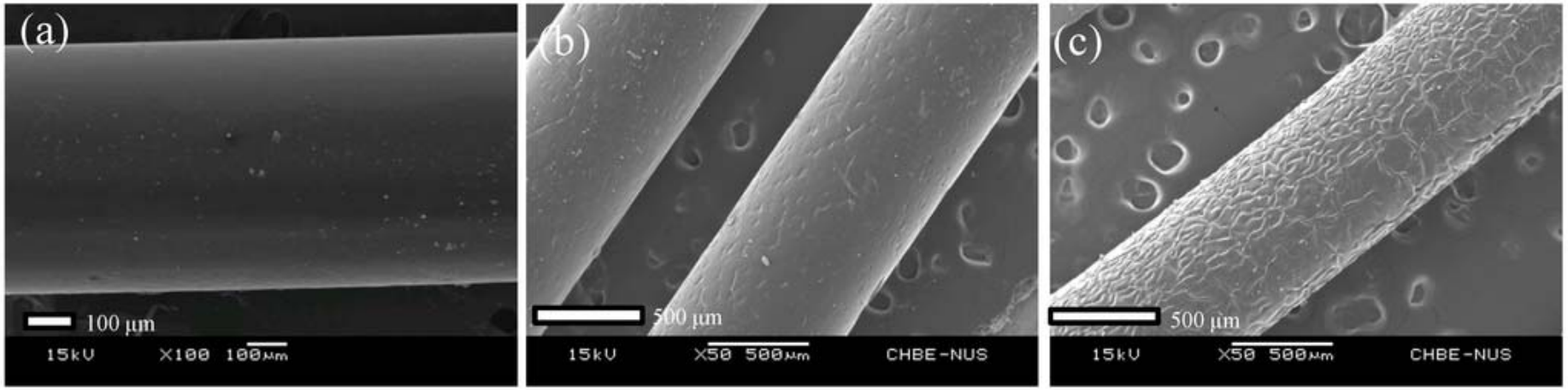
Greater surface reaction area

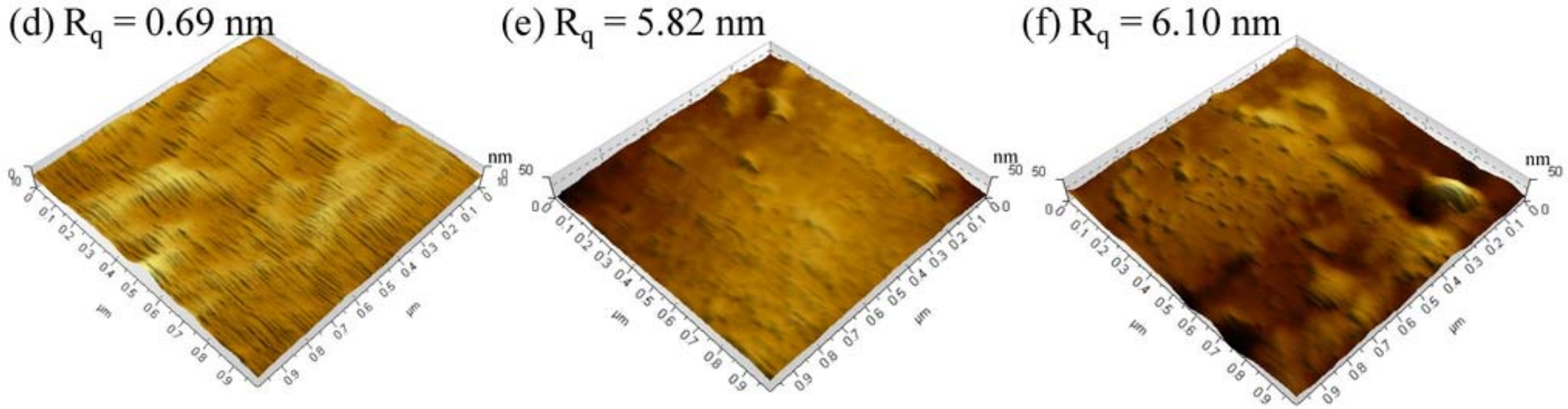
Easy blade replacement & CIP cleaning

Journal of Hazardous Materials *Gebze Institute. Turkey* ***March 2003***

"Treatment of **TEXTILE** Wastewaters by **ECR using Iron** & Aluminum electrodes". The process has been found to be **very efficient in COD removal and de-coloration with low-energy consumption".**

UNDERSTANDING Incorrect ETP Treatment – AFFECTS
RMG produces SYNTHETIC – inorganic – Effluent(s)

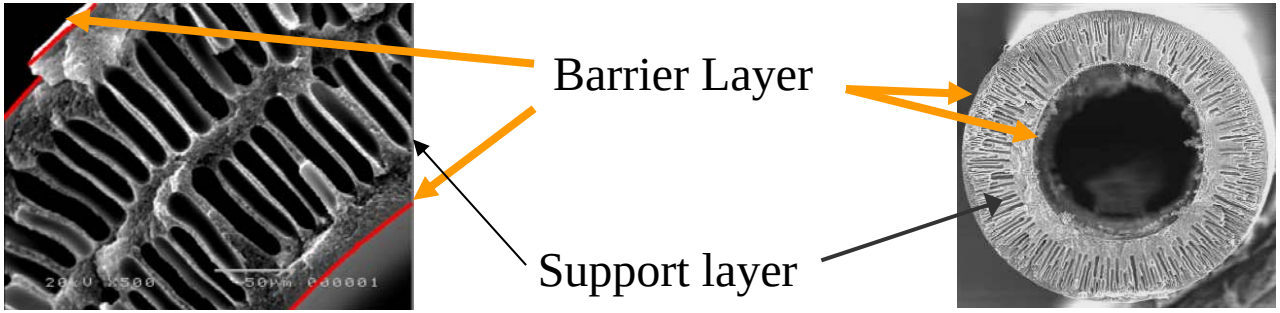




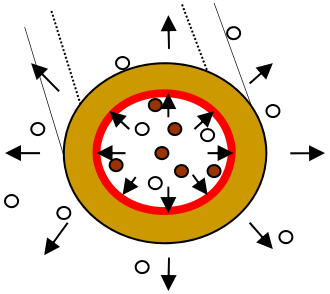
UF Hollow Fiber Membrane BIO FOULING

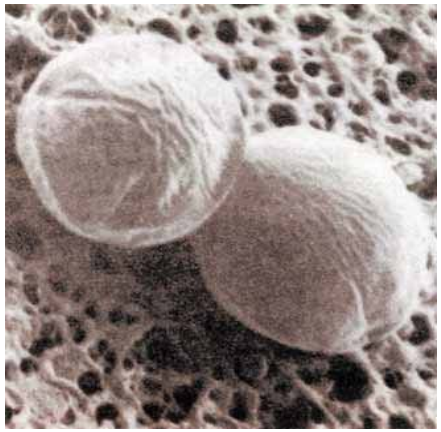
Membrane Operations / FOULING

ECR Inherently destroys bacterial reproduction mechanism

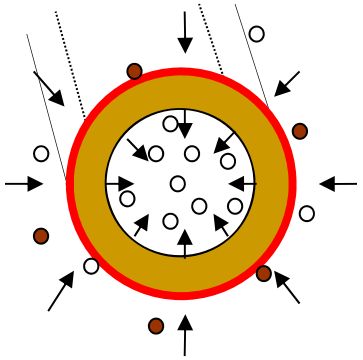


INSIDE-OUT





OUTSIDE-IN



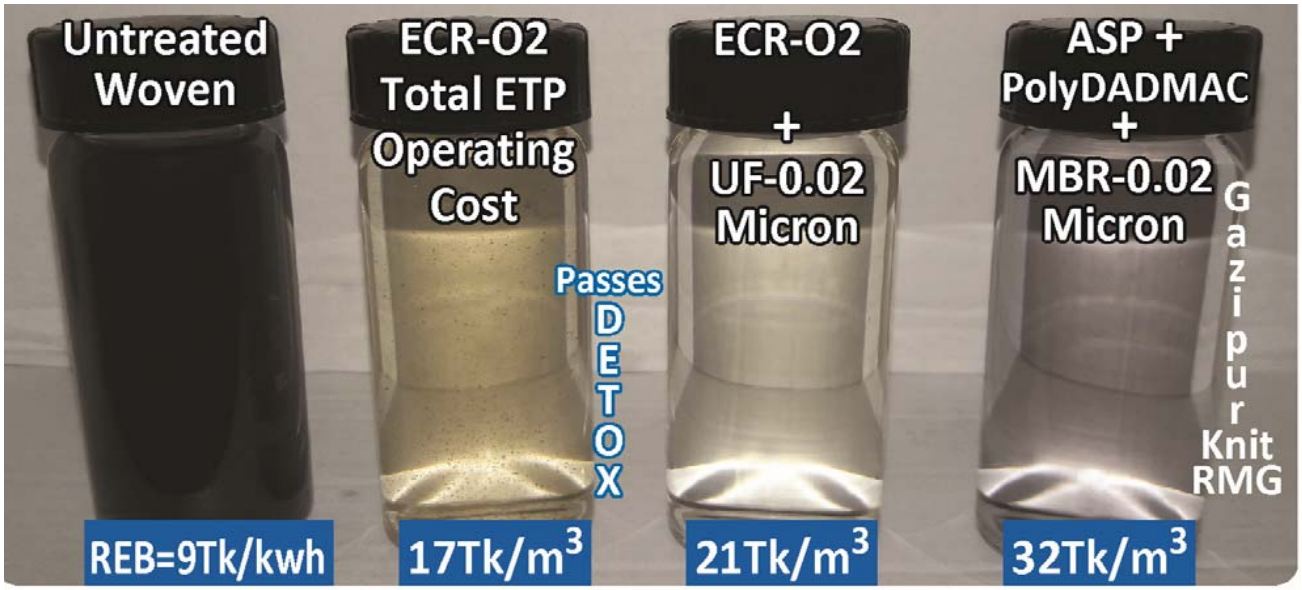
Giardia Spores Trapped on Membrane Surface

Journal of Hazardous Materials 3 August 2005, Pgs. 3098-3108 Volume 39 issue 13

electrocoagulation (EC) "Finally, EC pretreatment significantly outperformed chemical coagulation pretreatment for virus removal."

ECR-O2 is coagulation followed by Sedimentation (CS)

electro chemically oxidized to biodegradable compounds before Aerobic methods .



Using ASP

+ De-colorant

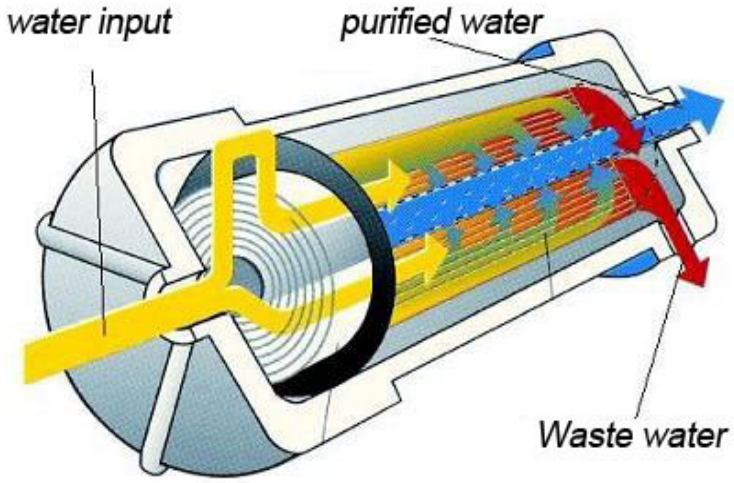
+ MBR does NOT

achieve great

success

or good

Recovery economics.

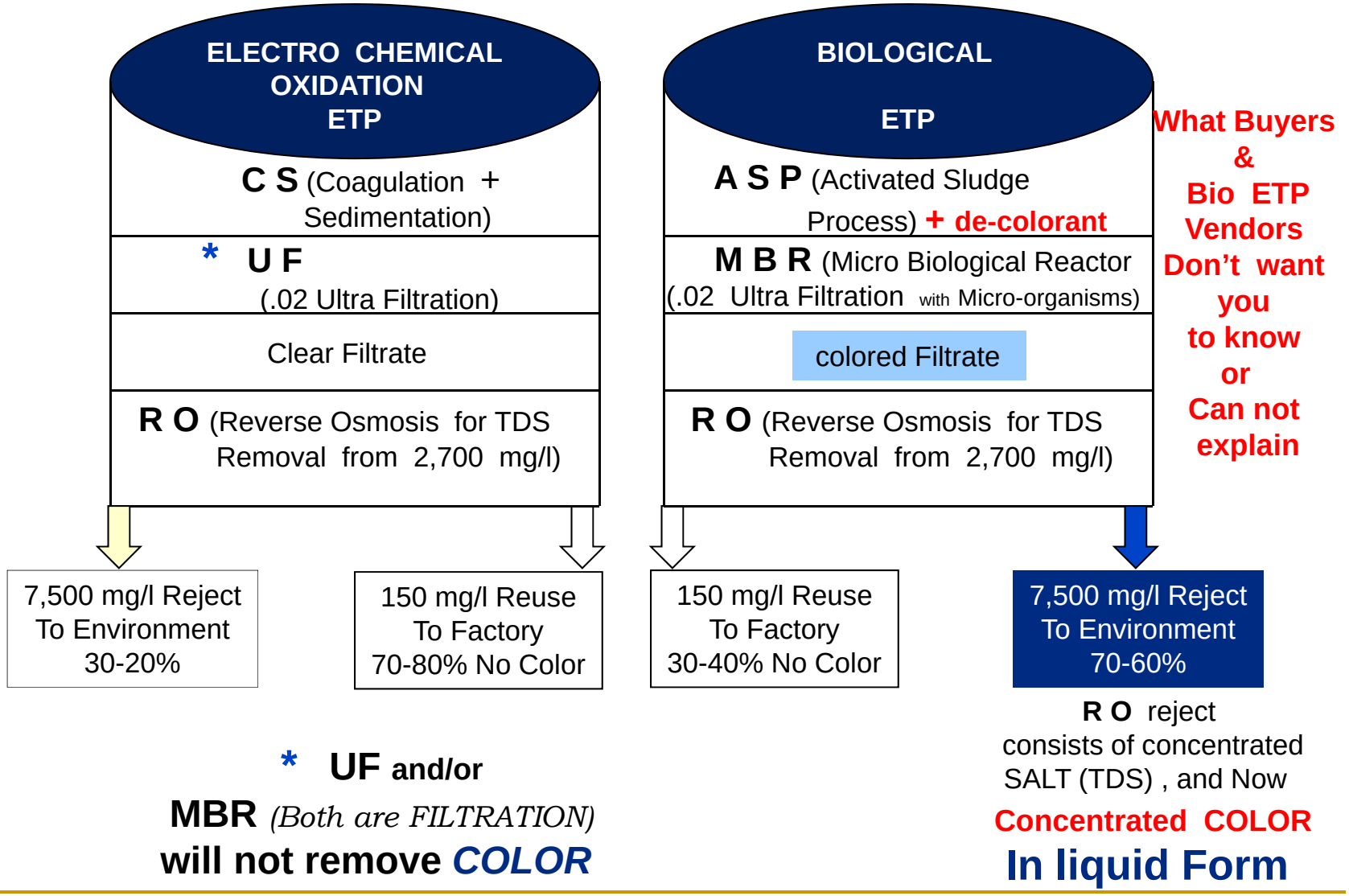


The more Color, bacteria & Contaminants through UF and into RO Elements – Will result in:

- **greater cleaning chemicals and cleaning frequency**
- **more Power due to increased pressure**
- **shorter Life Span of elements**

REALITY of R O Permeate & R O Reject

Color & Metals can only be removed by CS ETP or by RO membranes



What Buyers & Bio ETP Vendors Don't want you to know or Can not explain

* **UF and/or MBR** *(Both are FILTRATION)* **will not remove *COLOR***

R O reject consists of concentrated SALT (TDS) , and Now **Concentrated COLOR In liquid Form**

PRETREATMENT CAPABILITIES AND BENEFITS OF ELECTROCOAGULATION

Prepared for
Office of Naval Research
Under contract No. N00014-04-C-0027

"Second, the results do clearly indicate the most beneficial application of **EC** is in terms of providing **Pretreatment to membrane systems.**

The use of **EC in front of** a multi-membrane system of **UF/RO** or MF/RO **will improve performance of membrane system** and to broaden its application to include feedwater having high suspended solids levels."

Asian Journal on Energy and Environment
ISSN 1513-4121
Available online at www.asian-energy-journal.info

Reuse of dye wastewater through colour removal with electrocoagulation process

Khanittha Charoenlarp* and Wichan Choyphan

Rajamangala University of Technology Krungthep, Nang Linchee Road, Bangkok 10120 Thailand.

A Technology PROFILE for RMG / Apparels REDUCE – REUSE – RECYLE

ZERO Discharge

FLAGSHIP

SCIENCE & ECONOMICS

DRIVES ETP and WATER Recovery Programs

KNOWLEDGE Based EXPERIENCE

PRACTICAL Technology APPLICATION

ECR O2 ETP Operating Plants / ACTUAL COSTS Today - 2017

JOYDEBPUR,GAZIPUR DHAKA.

PLANT CAPACITY ---- 120M3/hr*24hr*30days =86400M3/Month.

1. Electricity cost (Blower+Pump)=40kw/hr*24hr*30days*4.00TK/kw		=115200 TK/Month.
2. Electricity cost (E.C.R. M/C) =120kw/hr*24hr*30days*4.00	TK/kw	=345600 TK/Month.
3. M.S Plate cost =744 pc*500TK/pc		=37200 0TK/Month.
4. Hcl Acid cost = 10000kg*8.00TK/kg		= 80000TK /Month.
5. Polyelectrolyte cos t =20 Kg*250TK/Kg		= 50 00TK/Month.
Total		= 917800TK /Month.

Note: Electricity calculates by **gas generator rate**.

Treatment cost =10.62TK/M3.

ASULIA, SAVER DHAKA.

PLANT CAPACITY ---- 120M3/hr*24hr*30days =86400M3/Month.

1. Electricity cost (Blower+Pump)=35kw/hr*24hr*30days*7.50TK/kw	=189000TK/Month.
2. Electricity cost (E.C.R. M/C) =35kw/hr*24hr*30days*7.50TK/kw	=189000TK/Month.
3. M.S Plate cost =248pc*500TK/pc	=124000TK/Month.
4. Polyelectrolyte cost =30Kg*250TK/Kg	= 7500TK/Month.
Total	=509500TK/Month.

Note : Electricity calculate s **REB rate**.

Treatment cost = 9.20TK/M3.

RUPGANG, NARAYNGONG DHAKA.

PLANT CAPACITY ---- 120M3/hr*24hr*30days =86400M3/Month.

1. Electricity cost (Blower+Pump)=75 kw /hr*24hr*30days*7.50TK/kw	=405000 TK/Month.
2. Electricity cost (E.C.R. M/C) =110 kw/ hr*24hr*30days*7.50TK/kw	=594000 TK/Month.
3. M.S Plate cost =744 pc*500TK/pc	=372000 TK/Month.
4. Polyelectrolyte cost =60 Kg*250TK/Kg	= 15000 TK/Month.
Total	=1386000 TK/Month.

Note: Electricity calculate by **REB rate**

Treatment cost =16.04TK/ M3.

ECR O2 ETP and ZERO DISCHARGE ACTUAL COSTS Today

Operating Cost in Tk/M³ (Total Water Costs less WTP) (9 **Tk/Kw**) (Total Water Cost to be offset by RO return to WTP – 70-80%)						**TOTAL ZD Op. Cost**
Costing by Hydromaster Singapore UF & RO systems	**ETP Total Cost/M³**	**De-Colorant** Cost/M³	**Ultra Filtration** Chemical / Power	**MBR Filtration** Chemical / Power	**Reverse Osmosis** Chemical / Power	**TK per M³**
ECR O2 **Small Area** **NO Color** **NO Metals**	**< 18.00**		**2.5** Chemicals **.80** 0.1kwh/m3 **0.02 Micron**		**2.0** Chemical **9.0** 1 kwh/m3	**32.30**
ASP Bio **Large Area** **COLOR With Metals**	**12.00**	**10.00 +**		**4.0** * Chemicals **4.0** 0.5kwh/m³ **0.02 Micron**	**3.5** ** Chemicals **9.0** *** 1 kwh/m3	**42.50**

* **MBR uses more energy and re-circulates contaminants back into ASP**

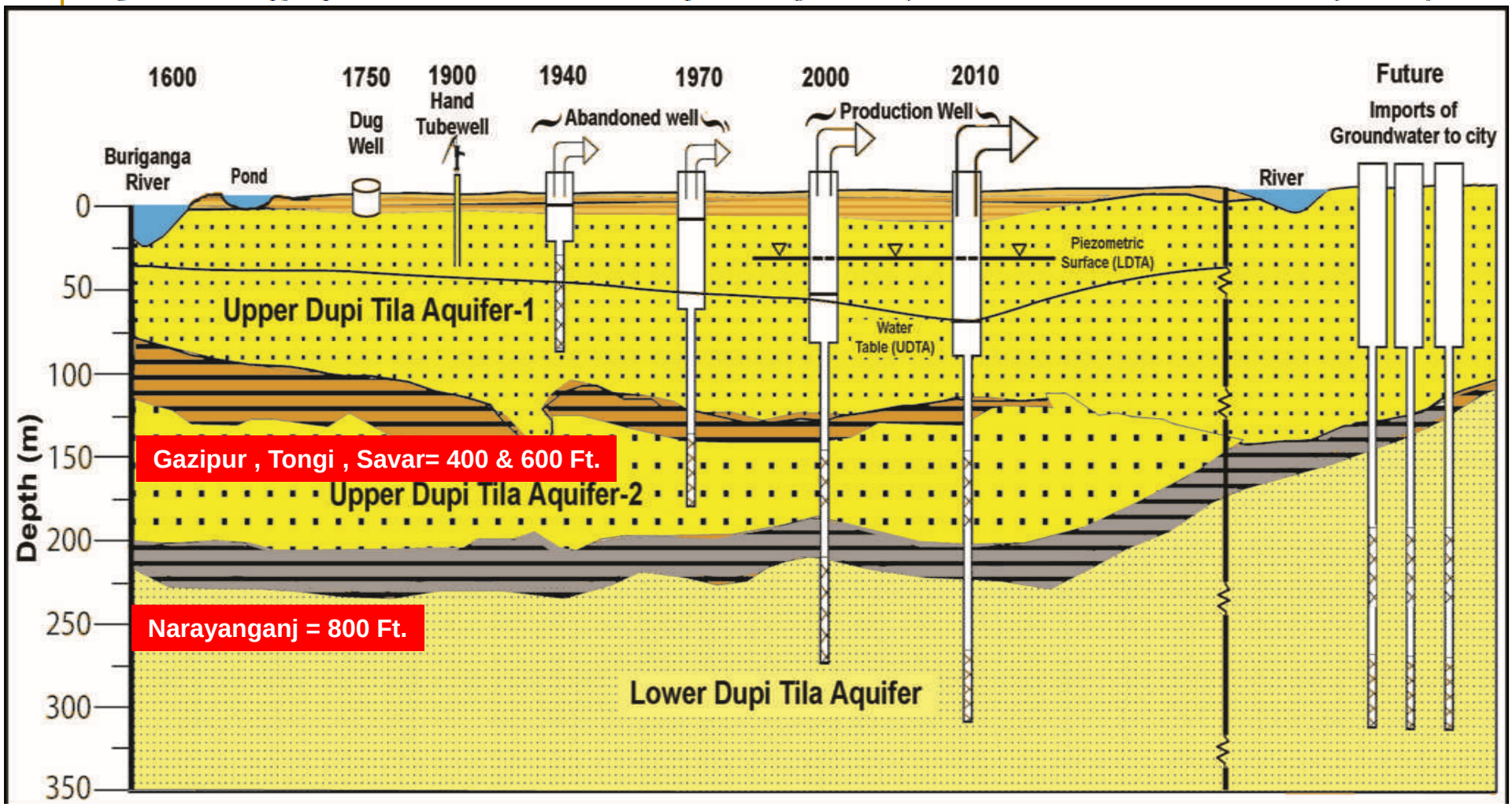
* * **RO alone must remove Color, hardness, Chlorine, & Heavy Metals.**

Colored water & contaminants will raise cost of RO cleaning chemicals by consumption & frequency.

*** **Operating power will increase due to higher Operating Pressures.**

NOTE: **Membrane Replacements not formulated.**

Hydrostratigraphic units of Dhaka Aquifer System (Source: DWASA and IWM, 2008).



40% GAP in

water supply

by 2030

2030 Water Resource Group

IFC & World Bank **Annual Report – 2014**

Expressed again at Sustainable Apparel Forum - 2017

RMG Effluent TREATMENT is simple science
REMOVING SOLIDS & Contaminants from Water
At ETP before entering ZERO DISCHARGE Systems

SLUDGE Note: ***Heavy metals processed with sufficient activation energy precipitate into acid resistant oxide sludge that pass the Toxicity Characteristic Leaching Procedure (TCLP) which allows the sludge to be reclassified as non hazardous*** ***(Renk, 1989; Franco, 1974; Watanabe and Nojiri, 1975; Duffey, 1983).***

DOE 2016 Sludge Management - Standards and Guidelines

Salt Evaporation Plants

are required for ZERO LIQUID DISCHARGE

large foot prints, Big energy

Operating TDS range of Evaporation Plants

Total Dissolved Salts

> = 30,000 Mg/L

Recovered salt remains contaminated with Hardness and Other impurities

EVAPORATION = BDT100 - 150 Tk / M3

FUEL SOURCES in BANGLADESH - REALITY

Crude OIL , Natural GAS , COAL , TREES/ Wood

Water WILL NOT be available when and where it is needed - and the Water Resource WILL NOT catch up or wait for the Economy of the RMG Industry to be correct.

PRESERVE বাংলাদেশ PROTECT
Industry Resources

A BUYER & SUPPLIER RESPONSIBILITY

a DOMINOE affect