CVL100:Environmental Science(2-0-0)

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Water Pollution and Treatment

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Treatment schematic (GW→ Potable drinking water)

- Raw Ground water → aeration chamber → Softening unit → Filtration with chlorination →Disinfection → Storage
- See sequence of units used
- Chemical is required to be added
- Water is treated
- Chemical sludge is produced

Units used for (GW→ Potable drinking water

- Aeration chamber (to remove gases; using air)
- Softening unit (to remove cations; using softener and/or cation exchangers)

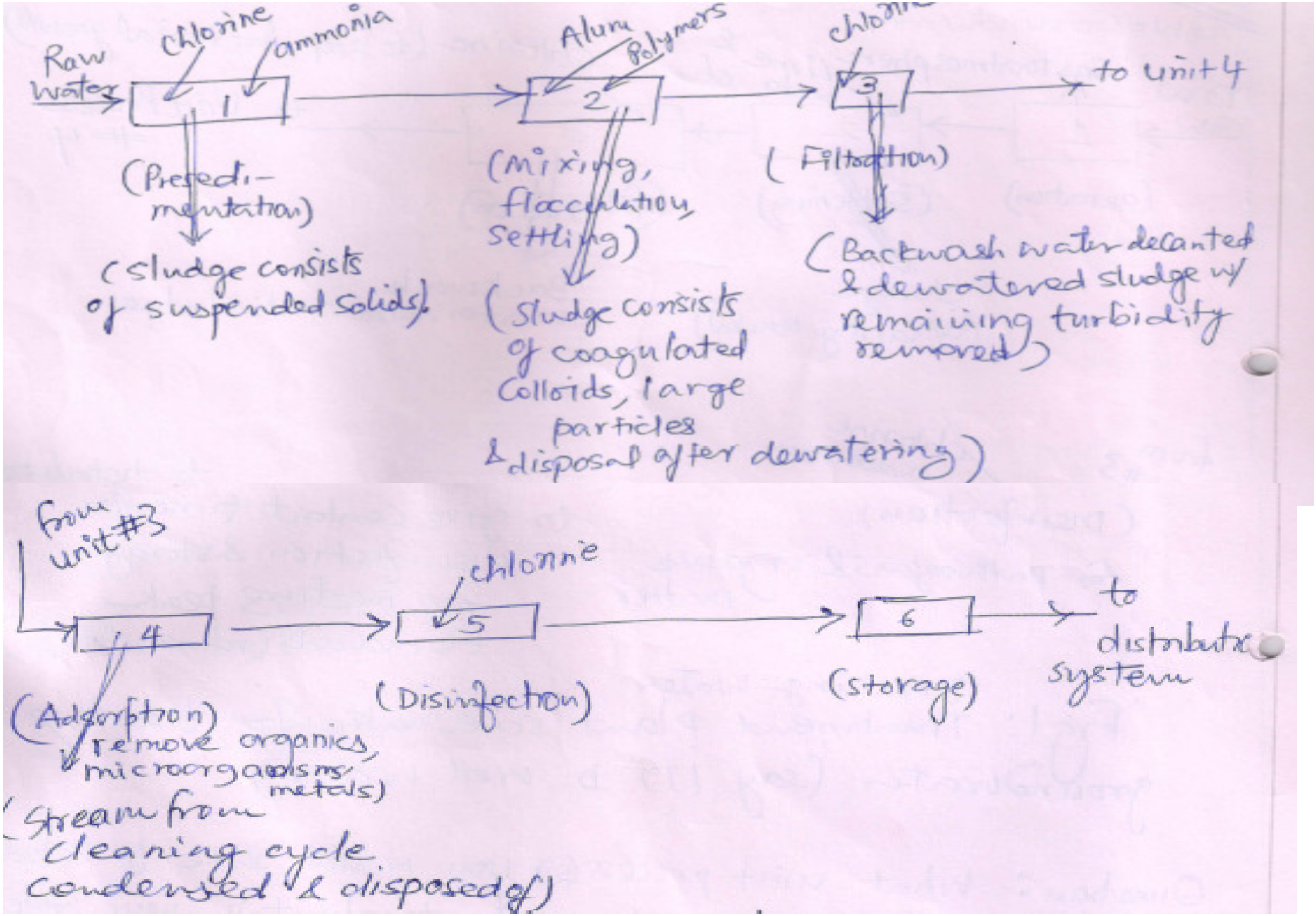
Treatment schematic (GW→ Potable drinking water)

- Filtration with chlorination (to remove solids; to kill microbial growth on filter unit surface)
- Disinfection (to kill microorganisms before water is supplied for public consumption)
- Storage

Exercise 2: Yamuna River Water →produce drinking water

- Think for 5 minutes for two steps.
- Step 1: water quality characteristics determination
- Step 2: selection of units, their order

Exercise 2: Yamuna River Water →Drinking water



Exercise 2: Yamuna River Water →produce drinking water

- Pre-sedimentation → coagulation-flocculation-sedimentation → filtration → adsorption → disinfection→storage/supply
- Soldis removal and ion removal → organic matter removal and ion removal and some pathogen removal→ pathogen removal→ supply
- See the importance of sequence of consitituents removal

- Sludge from steps: Pre-sedimentation, sedimentation, filtration (exhausted media), adsorption (exhausted media)

Indian Standards for Drinking Water

INDIAN STANDARDS FOR DRINKING WATER

PARAMETER	DESIRABLE	REJECTION
Colour (Platinum-cobalt scale)	5	25
Odour	free	free
taste	agreeable	agreeable
Turbidity	1NTU	10NTU
pH	7-8.5	<7&>8.5
Total hardness	200mg/1	600mg/1
Chlorides	200mg/1	1000mg/1
Residual chlorine	0.2mg/1	1.0mg/1
Total dissolved solids	500mg/1	2000mg/1
Sulphates	200mg/1	400mg/1
Nitrates	45mg/1	45mg/1
Alkalinity	200mg/1	600mg/1
Fluorides	1.0mg/1	1.5mg/1
Cyanides	0.05mg/1	0.05mg/1
BOD	Nil	>Nil
Pesticides	Nil	>Nil
Phenolic compounds	0.001mg/1	0.002mg/1
Anionic detergents	0.2mg/1	1.00mg/1
Mineral oil	0.01mg/1	0.03mg/1
As	0.01mg/1	0.05mg/1
Pb	0.05mg/1	0.05mg/1
Cd	0.01mg/1	0.01mg/1
Cr^{+6}	0.05mg/1	0.05mg/1
Hg	0.001mg/1	0.001mg/1
Fe	0.10mg/1	1.00mg/1
Mg	30.0mg/1	150mg/1
Mn	0.05mg/1	0.05mg/1
Cu	0.05mg/1	1.5mg/1
MPN	0/100ml	1/100ml

The concentration of the Pollutants should not exceed the concentrations

Courtesy:
Prof. B.J.Alappat,
IIT Delhi

Example 2

(read the paper from course moodle area)

SEVIER

Science of the Total Environment 329 (2004) 99–113

www.elsevier.com/locate/scitotenv

Persistence of pharmaceutical compounds and other organic wastewater contaminants in a conventional drinking-water-treatment plant

Paul E. Stackelberg[a,*], Edward T. Furlong[b], Michael T. Meyer[c], Steven D. Zaugg[b], Alden K. Henderson[d], Dori B. Reissman[d]

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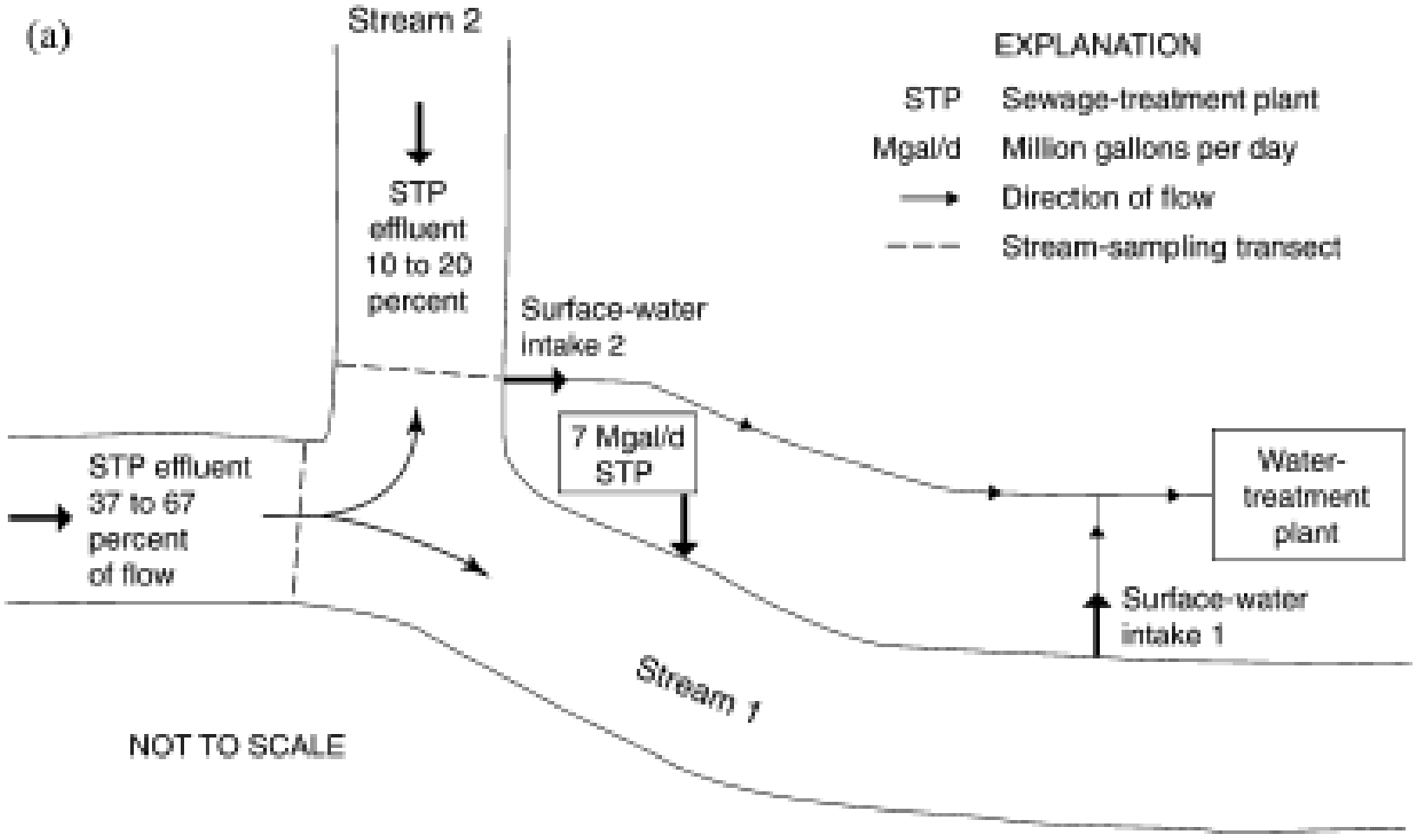
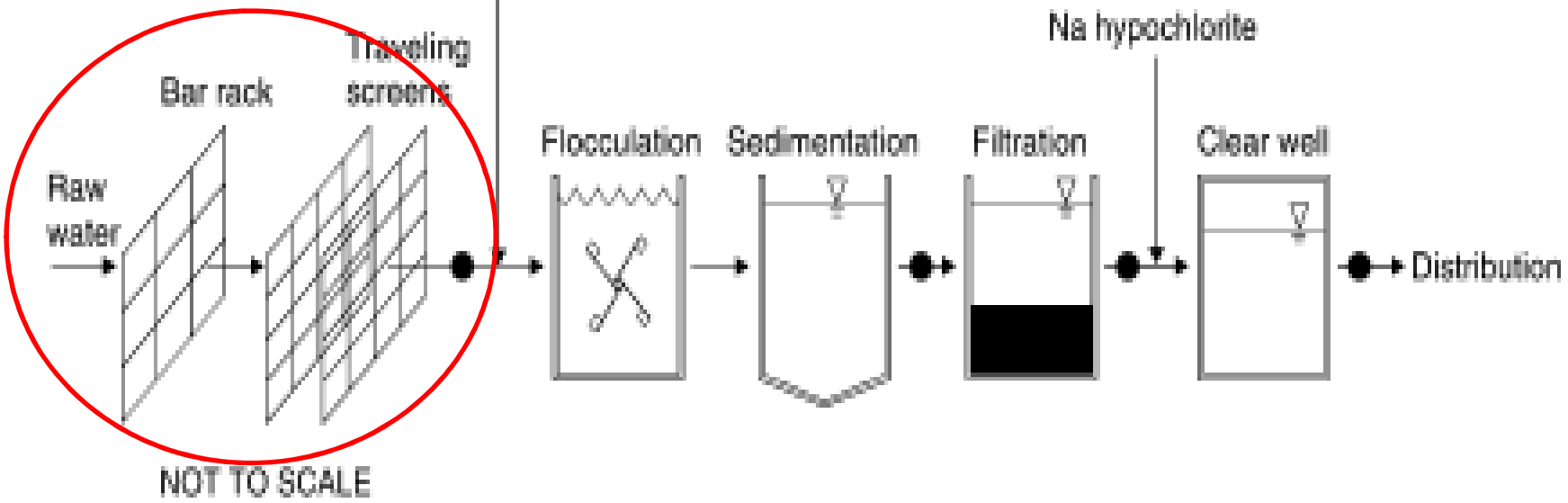
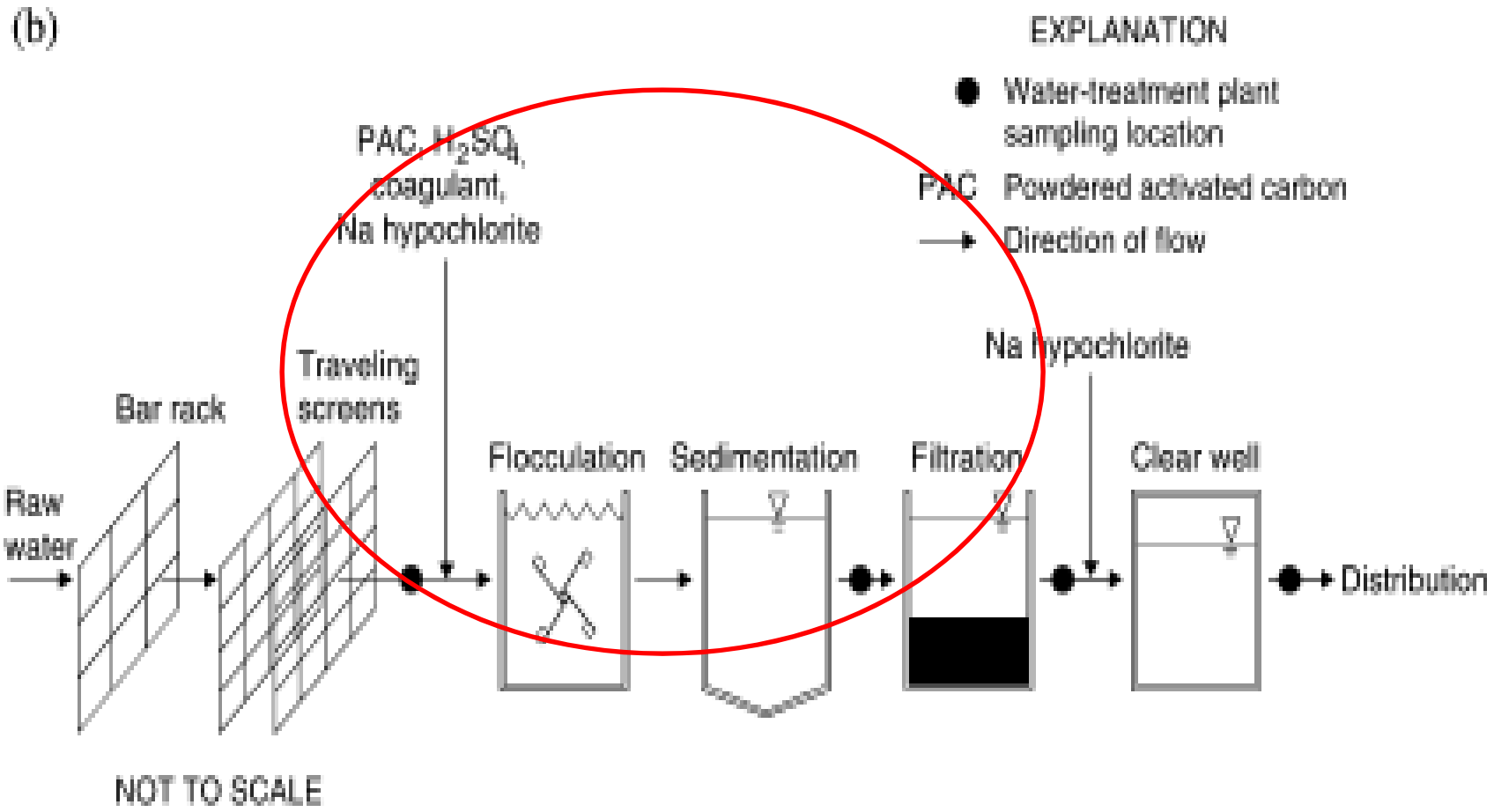

(a)
Stream 2
EXPLANATION
STP Sewage-treatment plant
Mgal/d Million gallons per day
Direction of flow
Stream-sampling transect
STP effluent 10 to 20 percent
Surface-water intake 2
7 Mgal/d STP
STP effluent 37 to 67 percent of flow
Water-treatment plant
Surface-water intake 1
Stream 1
NOT TO SCALE

Stackelberg et al. 2004

To remove large materials and solids

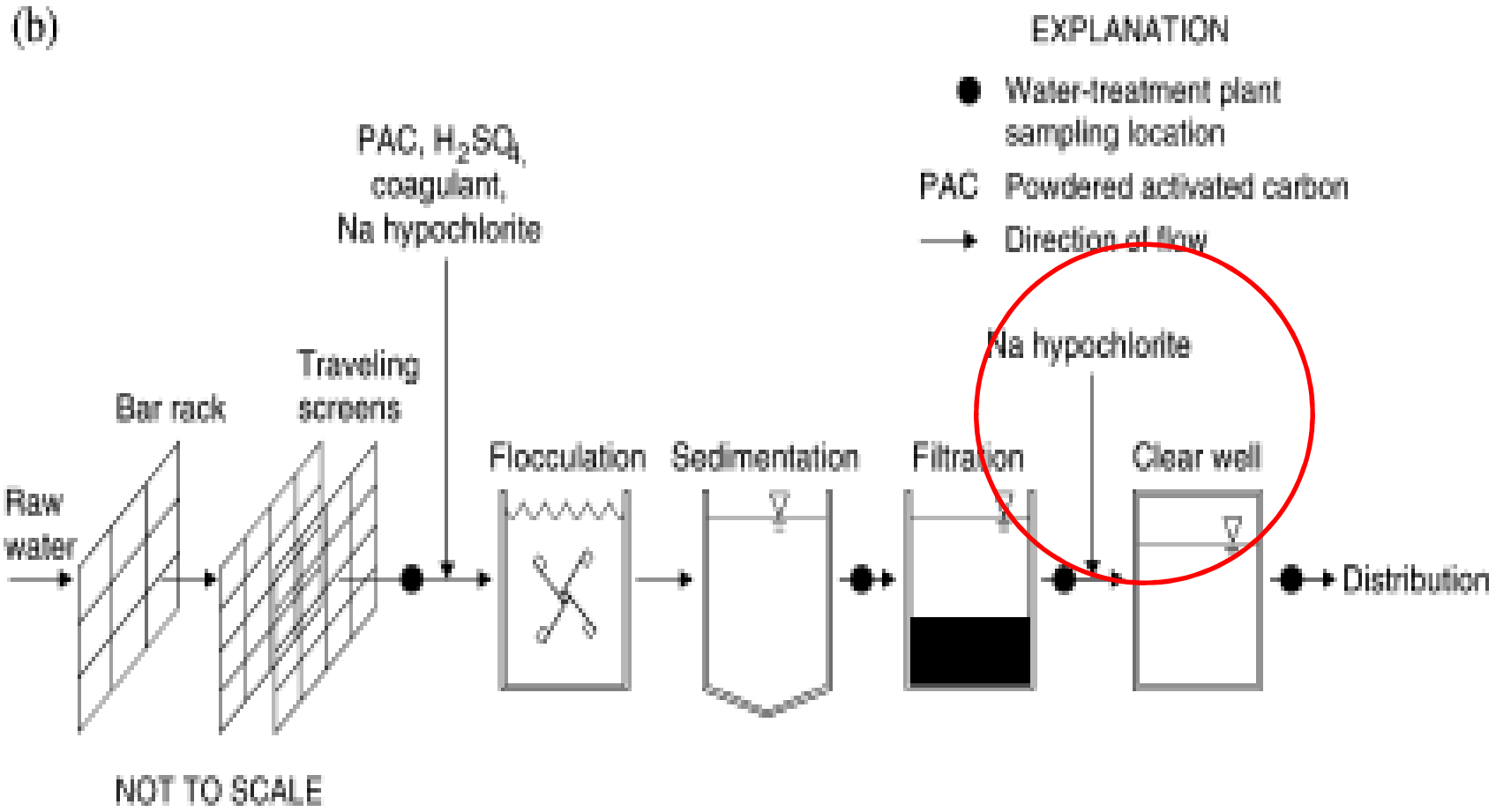


To remove solids; coagulants addition

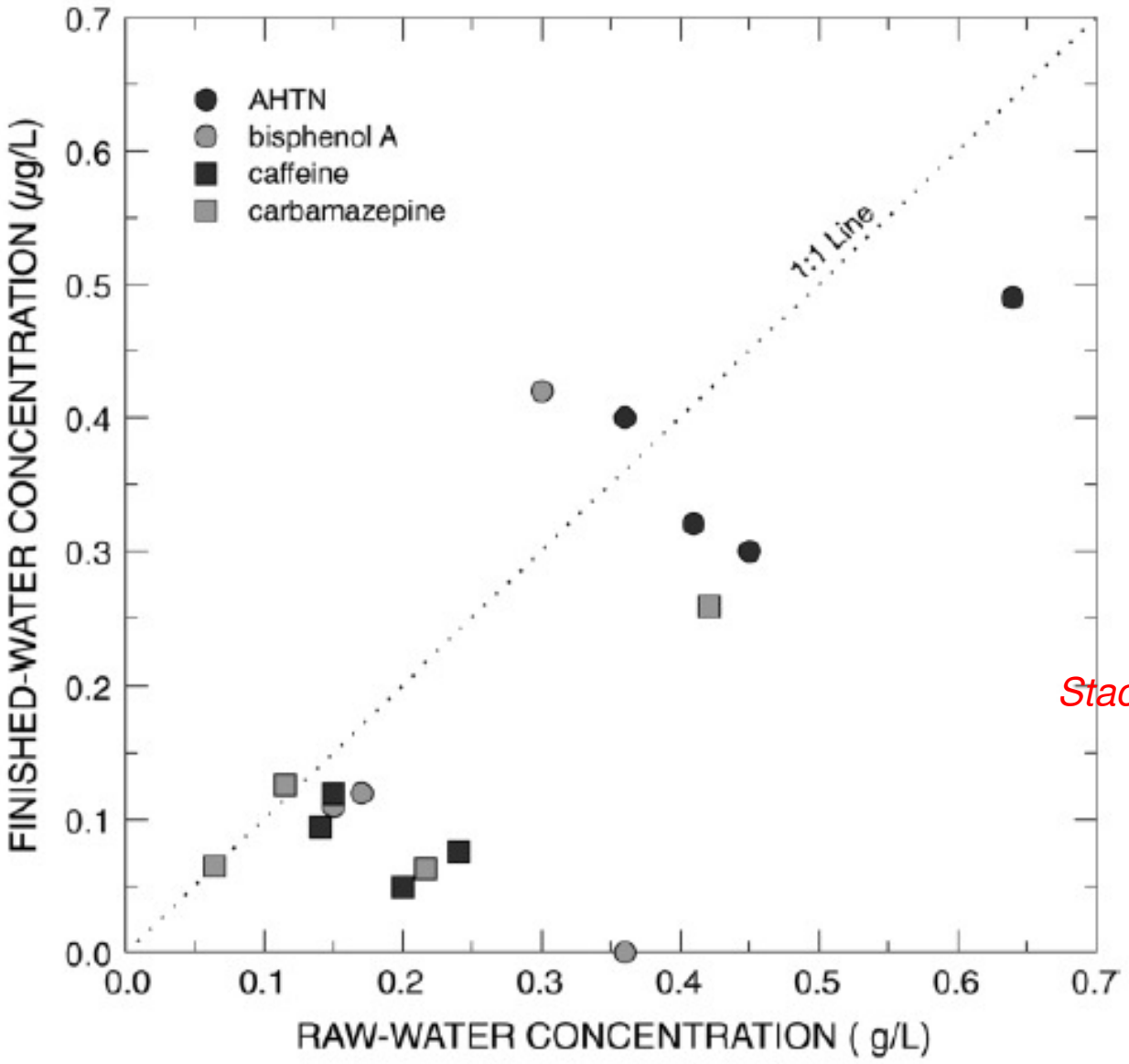


Stackelberg et al. 2004

To remove pathogens; oxidize reduced substances also



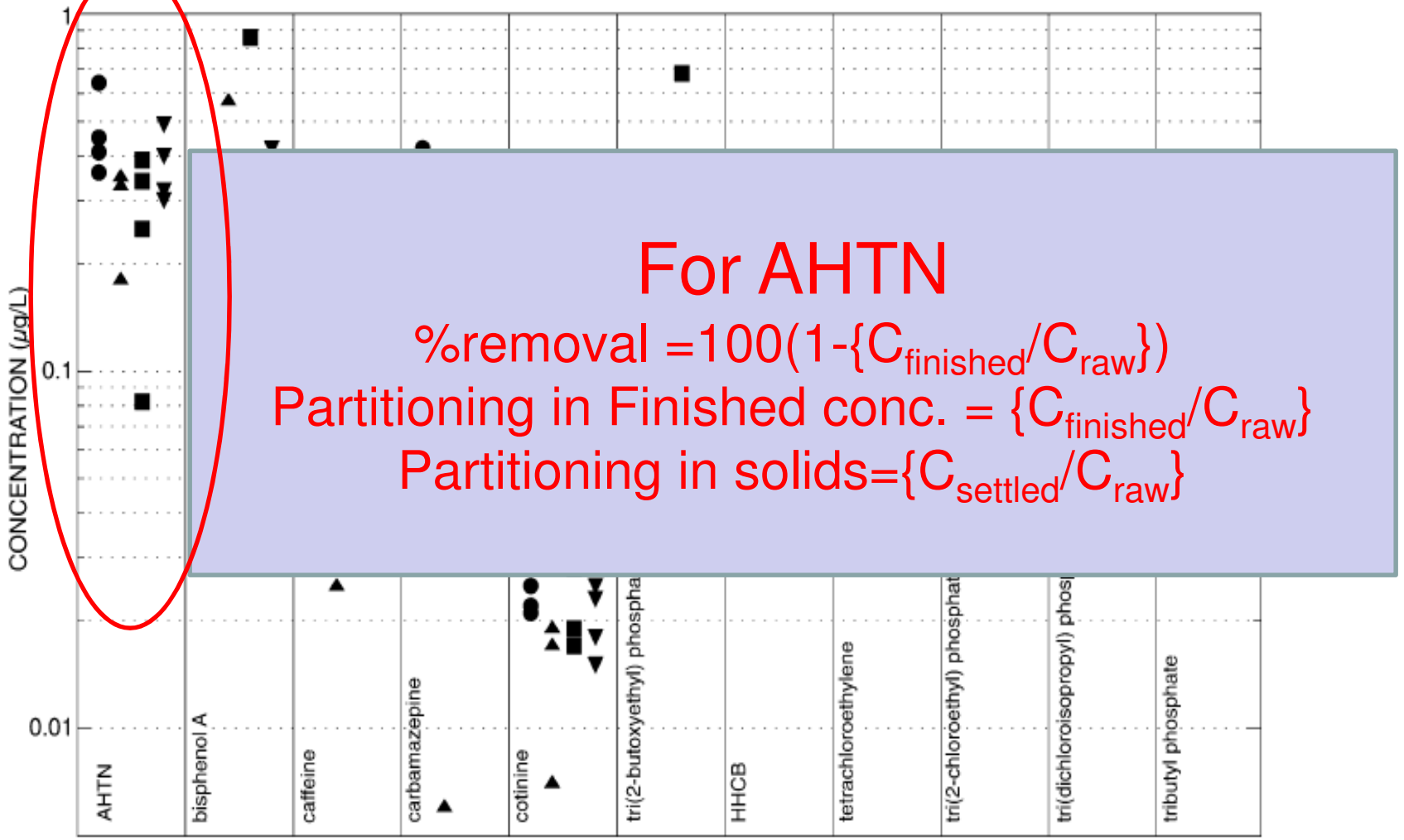
Stackelberg et al. 2004



Stackelberg et al. 2004

Fig. 4. Concentrations of selected compounds in samples of raw and finished water.

Calculate: (a)% removal; (b)partitioning of initial compounds in finished water and in solids



For AHTN

%removal =100(1-{$C_{finished}/C_{raw}$})

Partitioning in Finished conc. = {$C_{finished}/C_{raw}$}

Partitioning in solids={$C_{settled}/C_{raw}$}

Fig. 3. Concentrations of selected compounds in samples of raw (circles), settled (triangles), filtered (squares), and finished (inverted triangles) water.

Exercise 2

Say I am considering volunteering for a one-way trip to Mars *[I can send weekly updates, though!]*, which requires my commitment on optimizing/reducing my daily water consumption. One option is to use treated wastewater for my non-drinking activities. Which two parameters do you suggest me to monitor before I accept the condition and why?

Exercise 3

Suppose IIT Delhi water has suspended solids, organic matter, microorganisms, hardness, and dissolved CO_2, which are problematic constituents. Other dissolved constituents are below problem levels. Draw a schematic diagram of a treatment plant that will render this water potable. Identify each unit and show points of chemical addition with their names.