SIWI WORLD WATER WEEK

الشركة القابضة لمياه الشرب والصرف الصحي

Holding Company for Water and Wastewater

Wastewater Management in Egyptian Textile Industry Sector

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WWW, 27 Aug. - 1 Sept. 2017
Stockholm, Sweden

Presentation Outline

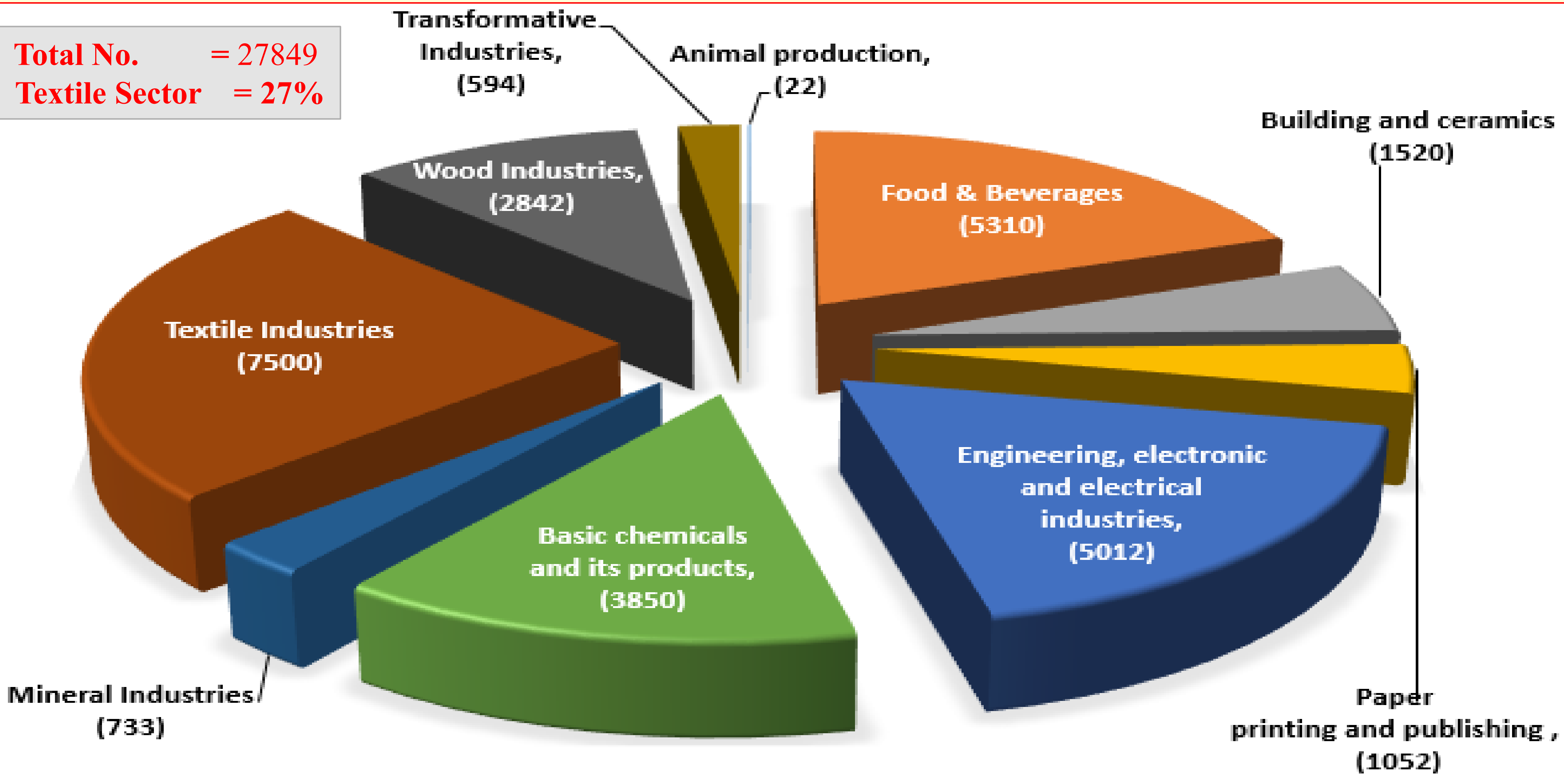
- ***Background***
- ***Origin and Characteristics of Textile Wastes***
- ***Textile Wastewater Management***
- ***Conclusion***

Industrial Sector : Background

- At present, the industrial sector in Egypt is a major contributor to economic growth, employment generation, and export proceeds.
- Accounting for **20 %** of Growth Domestic Product (GDP)
- There are around **28,000** formally registered industrial establishments employing nearly **4** million workers, which represents around **20%** of the labor force.
- In several governorates textile manufacturing is a leading provider of economic sustainability and income (more than 25% of total employment).

Industrial Sectors in Egypt

Total No. = 27849
Textile Sector = 27%



Textile Sector in Egypt: Facts and Figures

- The textile industry is one of the oldest industries in the world which date back to about 5000 yrs. BC (scraps of linen cloth found in Egyptian caves)
- ***7,500*** Companies (public and private sector), ranging from modern and highly automated plants, to small traditional units focusing on hand-made products.
- The textile industry has a major impact on Egypt's economy. It accounts for more than 34% of total export.
- The textile industry is both a major water user and polluter, regarding water discharges, air emissions and waste production.

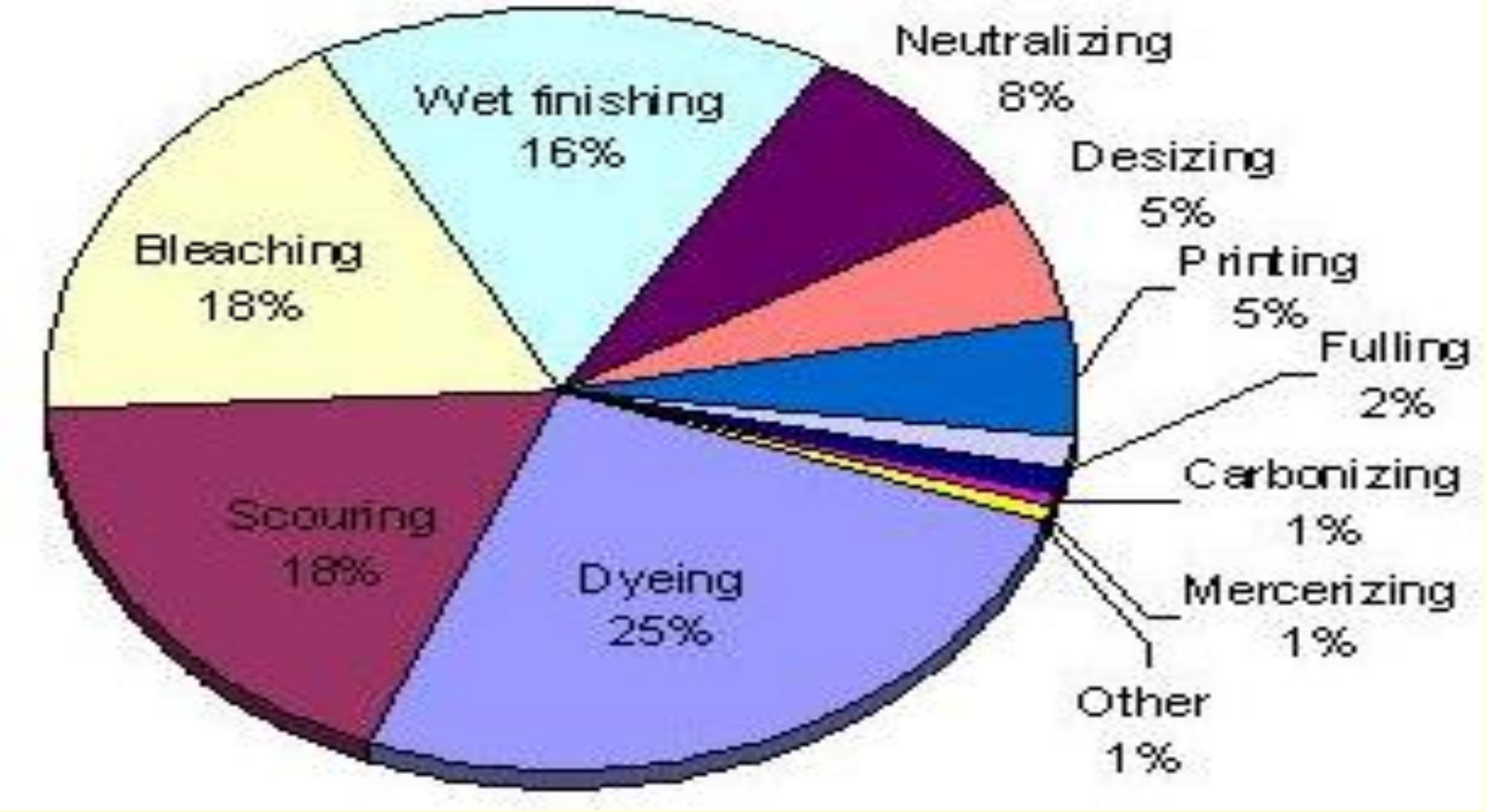
Origin and Characteristics of Textile Wastes: Continue…

Process	Source	Major Constituents	Water Use (L/Kg)	Characteristics	Pollution Impact L	Pollution Impact M	Pollution Impact H
Sizing	Cleaning of: Slasher boxes, rolls, make up vessels	▪ Starch derivatives ▪ Semi-synthetic sizing agents (CMC, CMS) ▪ Synthetic sizing agents (PVAs, polyacrylates) ▪ Additives: -urea, glycerin,-waxes and oils -preserving agents(PCP)	10 - 90	BOD COD Temp.	√	√ √	√ √ √ √
Desizing	Washing of sized fabrics (desizing contributes the largest BOD for all cotton wet processes, c. 45%)	▪ Hydrolysed sizing agents (e.g, starch: high BOD, PVA, CMC; low BOD). ▪ Enzymes or oxidants. ▪ Wetting agents	30 - 110	BOD (34 – 50% of total) COD Temp. (70 – 80 °C)			√ √
Scouring	Washing of cotton waxes and impurities is the second largest BOD contributing (31%)	▪ Saponified waxes, oils, fats. ▪ Surfactants. ▪ Alkalies. ▪ High temperature.	200 - 400	Oily fats. BOD (30% of total) PH (High). Temp.(70 – 80 °C)			√ √ √
Bleaching	Washing after bleaching contributes the lowest BOD in cotton wet processing	▪ Residual bleaching agents. ▪ Stabilisers. ▪ Surfactants, Wetting agents ▪ Mild alkalinity	50 - 150		√	√	√
Mercerisation	Washing effluents	▪ Alkali (NaOH) ▪ Surfactants.Dissolved matter.	-	BOD PH(high)			√ √ √

Origin and Characteristics of Textile Wastes

Process	Source	Major Constituents	Water Use (L/Kg)	Characteristics	Pollution Impact		
					L	M	H
Dyeing	Spent baths. After-washing.	▪ Dyestuff(direct, vat, reactive, sulpher, pigment) ▪ Elctrolytes. ▪ Carriers. ▪ Acids and alkalies ▪ Heavy metals.,Oxidising agents ▪ Reducing agents, Surfactants.	100 - 350	Toxicity. BOD(6% of total) Dissolved solids. PH. Strong colour.			√ √ √ √ √
Printing	Equipment washing and printed fabrics (except emulsion printing)	▪ Dyestuffs. ▪ Alkalies. ▪ Acids. ▪ Reducing agents ▪ Thickeners. ▪ CH2O, Urea, Salts.		Toxicity. COD BOD PH. Dissolved solids Strong colour		√ √	√ √ √ √ √
Finishing	Washing of the finishing bath, rolls, and make-up vessels. After washing.	▪ **Finishing.** ▪ **Acid catalysts.** ▪ **Surfactants.** ▪ **Softeners.** ▪ **Lubricants.** ▪ **Metal salts, Pentachlorophenol (PCP), Anti-mildew.**	10 - 100	Alkalinity. BOD (low) Toxicity.	√ √		 √

Textile Mill Wet Processing (%) in Egypt



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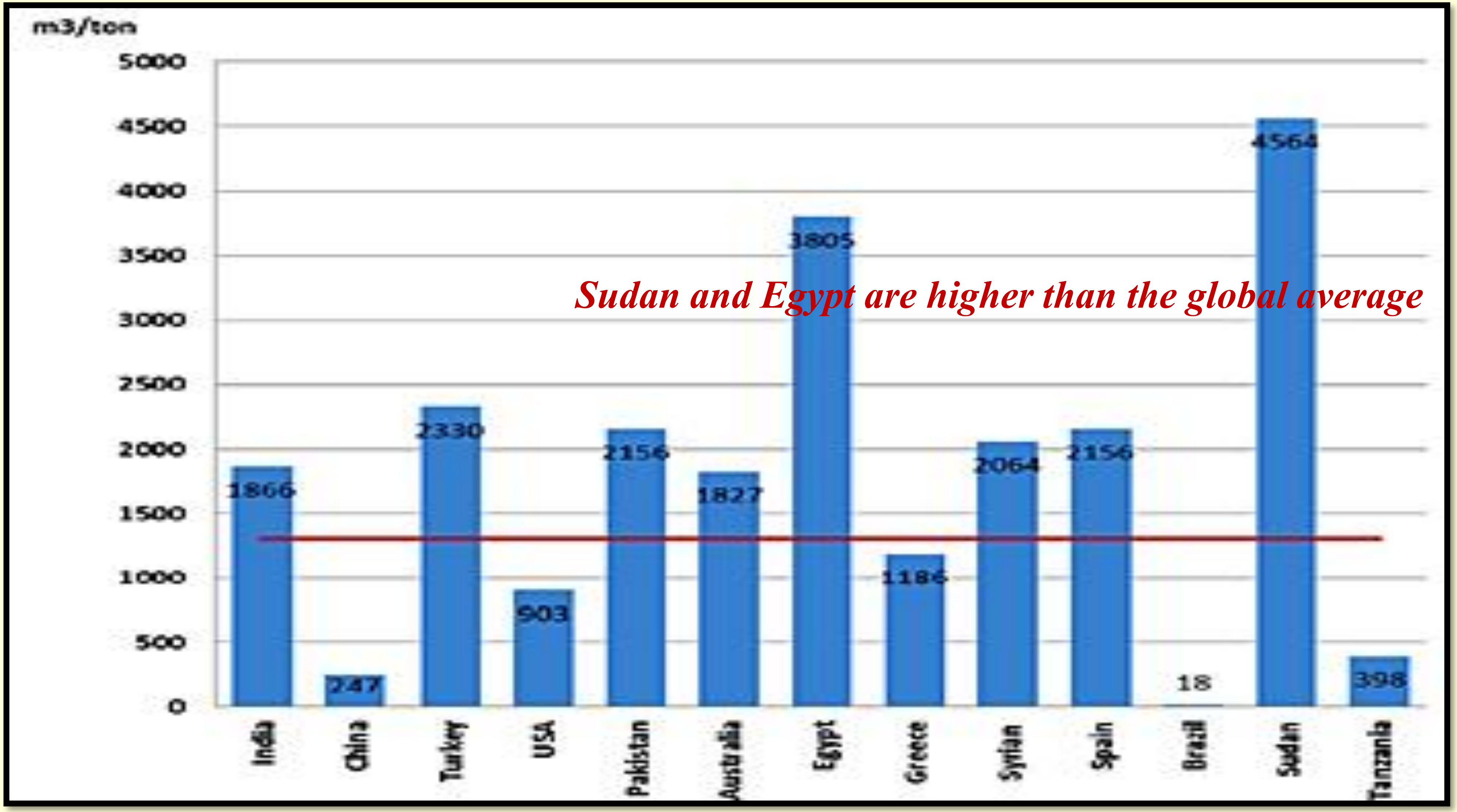
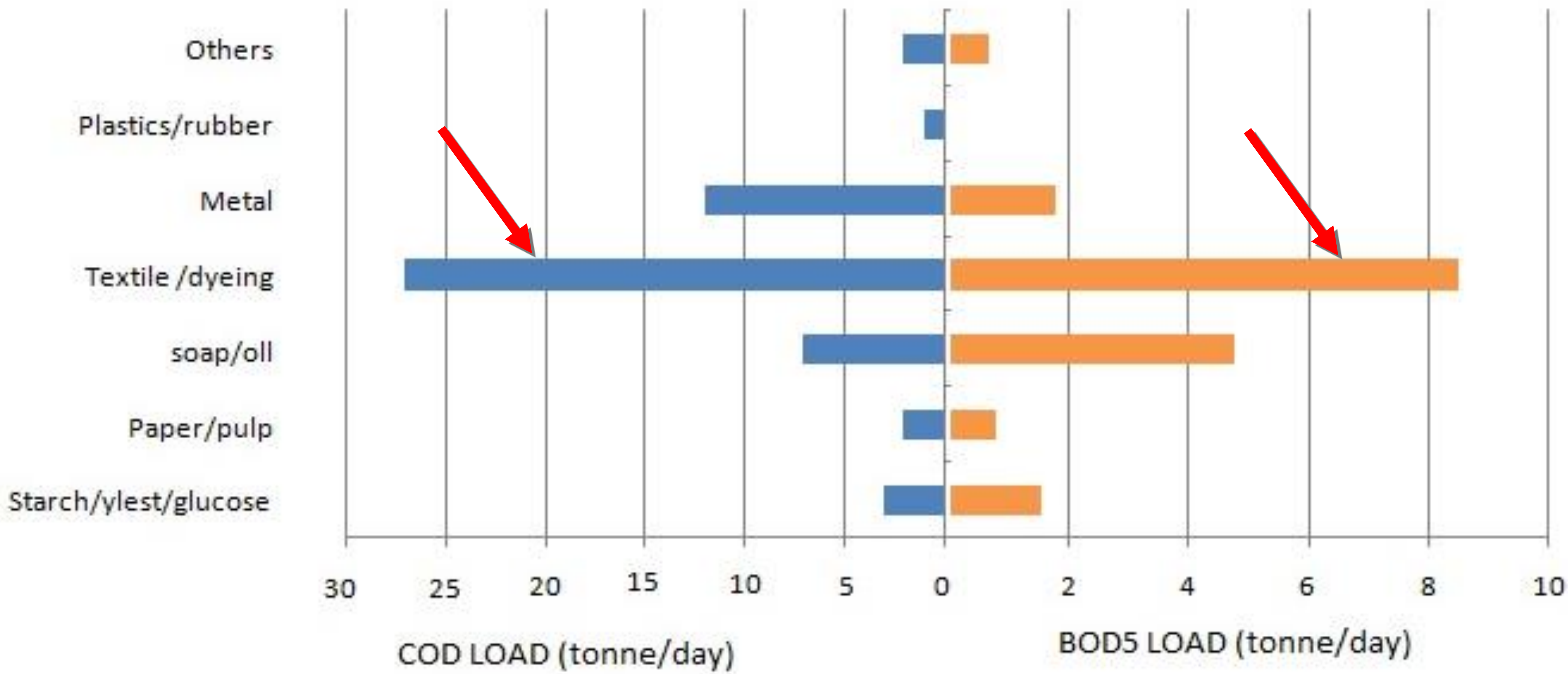
Water footprint in Cotton Production & Processing



Pollution Loads from Different Industrial Sectors In Egypt



Environmental Issues in Textile Wet Processing

- Textile wet processes consume dyes, chemicals, detergents and finishing agents in the conversion of raw materials to finished product.
- Water use ranges from 60 to 400 l/kg of fabric, depending on the type of fabric wet application.
- Generally, textile effluents are highly colored, contain non-biodegradable compounds, and are high in BOD & COD.
- Textile effluents creates operational problems in municipal wastewater treatment plants, which are biological processes.
- The presence of metals and other dye compounds inhibits biological activity and in some cases may cause failure of biological treatment systems.

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Textile Wastewater Management :Options to Control Pollution

I- *Reduction in wastewater volume:*

- **By reducing the number of washings**
- **By recycling of less contaminated water**
- **By good house-keeping to prevent leakages & spillages**

II- *Reduction in concentration of chemicals*:

- **By recovery: caustic soda, size**
- **By reuse of dye bath**
- **By chemicals substitution, e.g.:**

- mineral acid (0.0 BOD) in place of CH3COOH(60% BOD)

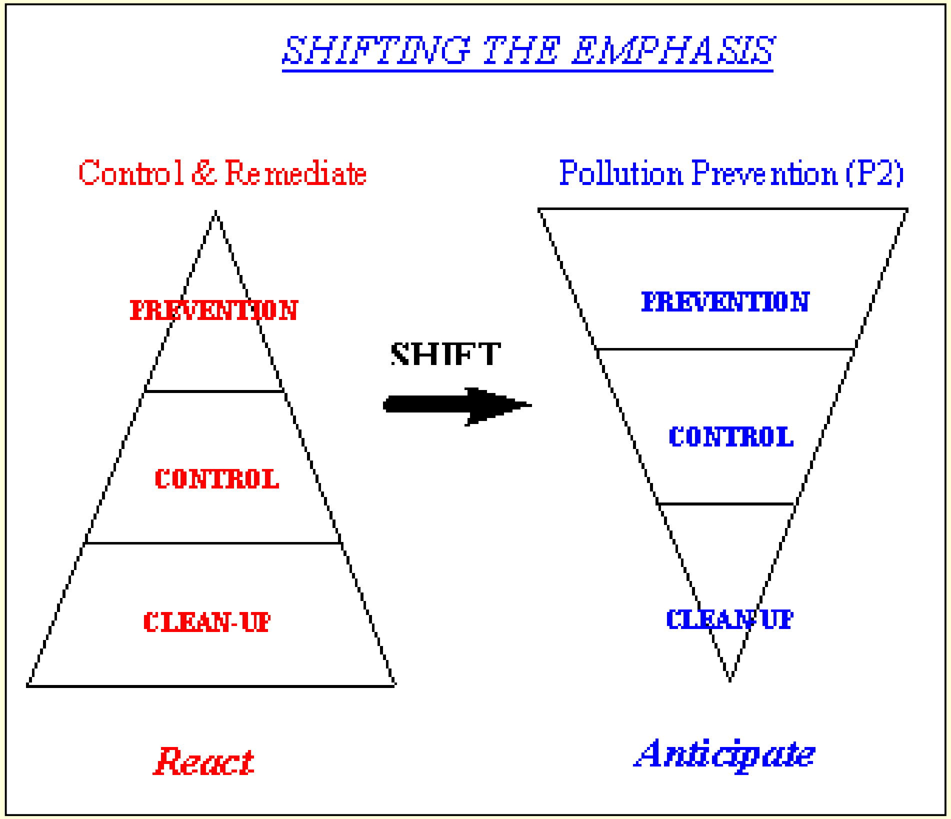
- Synthetic detergent in place of soap,

- H2O2 instead of NaOCL

- Reactive dyes (chemically bonded) instead of direct dyes

***III- By process modification*:**

- **Replacement of kerosene by synthetic thickener**
- **Replacement of Na_2 SO_3 by catalase enzyme**
- **Expanding the use of bi-functional dyestuff**



CP/P2 Scheme Applying: A Case Study, Egypt

Basic Information

- A textile mill that produces 8 ton/day of cotton yarns.
- Processing involves:
  - Winding, pretreatment, dyeing, drying, weaving, shearing, polishing and automatic darning.
  - Yarns are winded to cones, which are either full bleached (10-20% of production) or reactive dyed (90-80% of productions).
- Water consumption is around 1000 m3/d. Pretreatment and dyeing processes are the major sources of wastewater.
- The company is provided with a wastewater treatment unit & the treated effluent is discharged into the sewer system.

CP/P2 Scheme Applying: A Case Study, Egypt (continue..)

1)Replacement of Acetic Acid by Formic Acid

- Formic acid is not only cheaper and stronger, but also of lower BOD and COD as compared to acetic acid.

One kg acetic acid (96%) is equivalent to 1.07 kg COD & 0.64 kg BOD. Corresponding values for formic (80%) acid are 0.21 and 0.096, respectively.

2) Replacement of bi-sulfite treatment step by H2O2-killer enzyme

- A bi-sulfite treatment step is performed after scouring/full bleaching, to protects the brightened fabric from the negative effect of H_2O_2 traces remained after bleaching. This could be substituted by H_2O_2 -killer enzyme

After the substitution of this step, COD value reduced in the final effluent by 37 mg/l , in addition to the reduction in wastewater volume.

CP/P2 Scheme Applying: A Case Study, Egypt (continue..)

3) Replacing Mono-Functional Reactive Byes by Bi-functional Reactive Dyeing

- Under optimum conditions, the amount of mono-functional dye fixed onto the fabric is 60% and the rest (40%) finds its way into the wastewater.
- Bi-functional reactive dyestuffs are characterized by higher fixation ratio (81%) compared to mono-functional dyes.

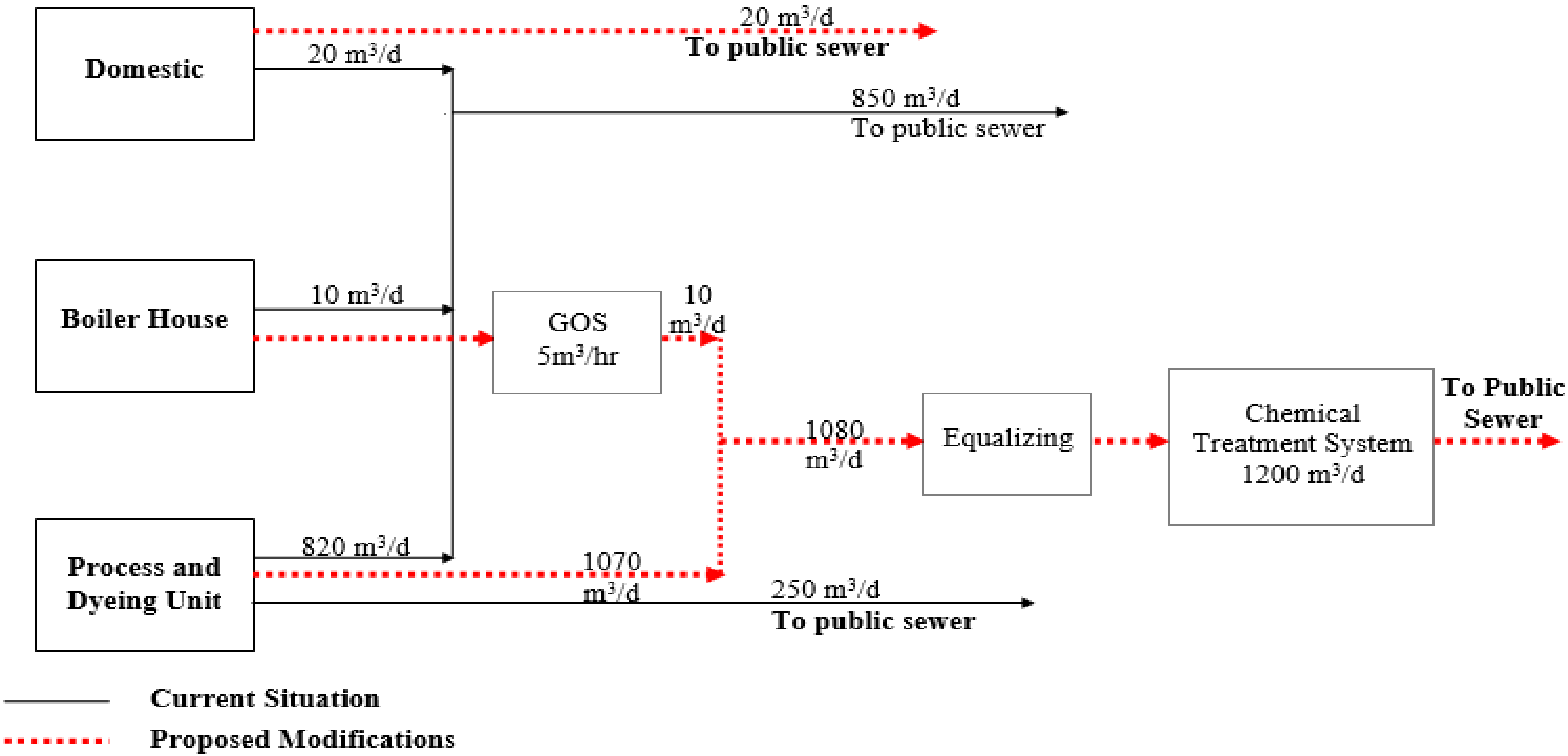
Shifting from mono- to bi-functional reactive dyestuffs is expected to produce a reduction in the COD value of the wastewater by 90 mg/l.

4) Replacing Chemical Scouring by Bio-Scouring

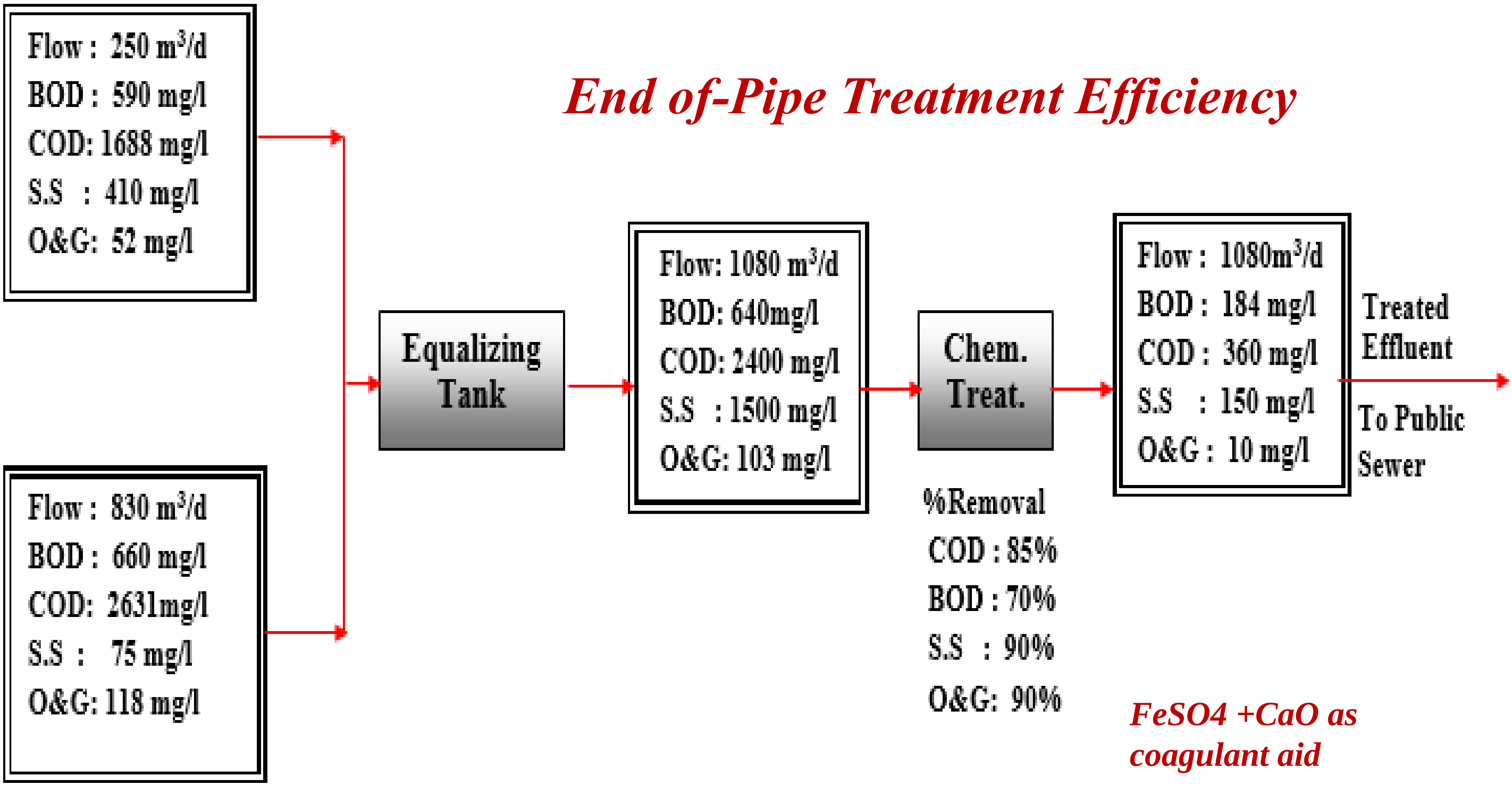
- The process is conducted at the boil using caustic soda. Bio-scouring can be carried out using enzymes at 60ºC for shorter time.

This can result in a reduction in energy consumption, improvement of wastewater quality (reduction in TDS) and shortening of process time by 55 min.

End-of-Pipe Traetment Schemes



End of-Pipe Treatment Efficiency



FeSO4 +CaO as coagulant aid

Conclusions

- The textile industry produce a wide variety of pollutants from all stages in the processing of fibers and fabrics. These include liquid effluent, solid waste, hazardous waste, air emissions and noise pollution.
- The consumption of energy must also be taken into account as the fuel used to provide this energy contributes to the pollution load.
- It is important to investigate all aspects of reducing wastes and emissions from the textile industry, as not only will result in improved environmental performance, but also substantial saving the resources.
- ***An important question to be considered is: whether it is necessary to use any particular material, or indeed whether the product itself is required?***
  - ***An alternative, less toxic substance could be used in the production process,***
  - ***Number of products have already been phased out completely in recent years where their pollution potential is greater than the benefits of their production and alternatives have been found.***

Questions?

Thank You

for Your Attention !

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