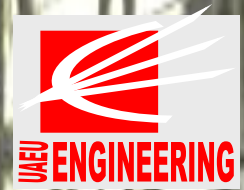




United Arab Emirates University
College of Engineering
Graduation Project (I) Course



Refinery Wastewater Treatment

Student Name:

Shereen Mohammed

Hanan Moh'd

Maryam Ali

Badria Salem

ID

199904094

980922371

200002594

980722581

Examination Committee:

Dr. Fahmi Abu-Rub

Dr. Farid Bin-Yahya

Dr. Nabil Al-Bastaki



Outline

- ✱ Introduction
- ✱ Objectives
 - General Objectives
 - Detailed Objectives
- ✱ Refinery Background
- ✱ Previous Experience
- ✱ Problem Statement
- ✱ Experimental Work
- ✱ Material Balance
- ✱ Introduction to EIA
- ✱ Conclusions & Recommendations



General Objectives

- Designing a plant for wastewater treatment from the refineries.



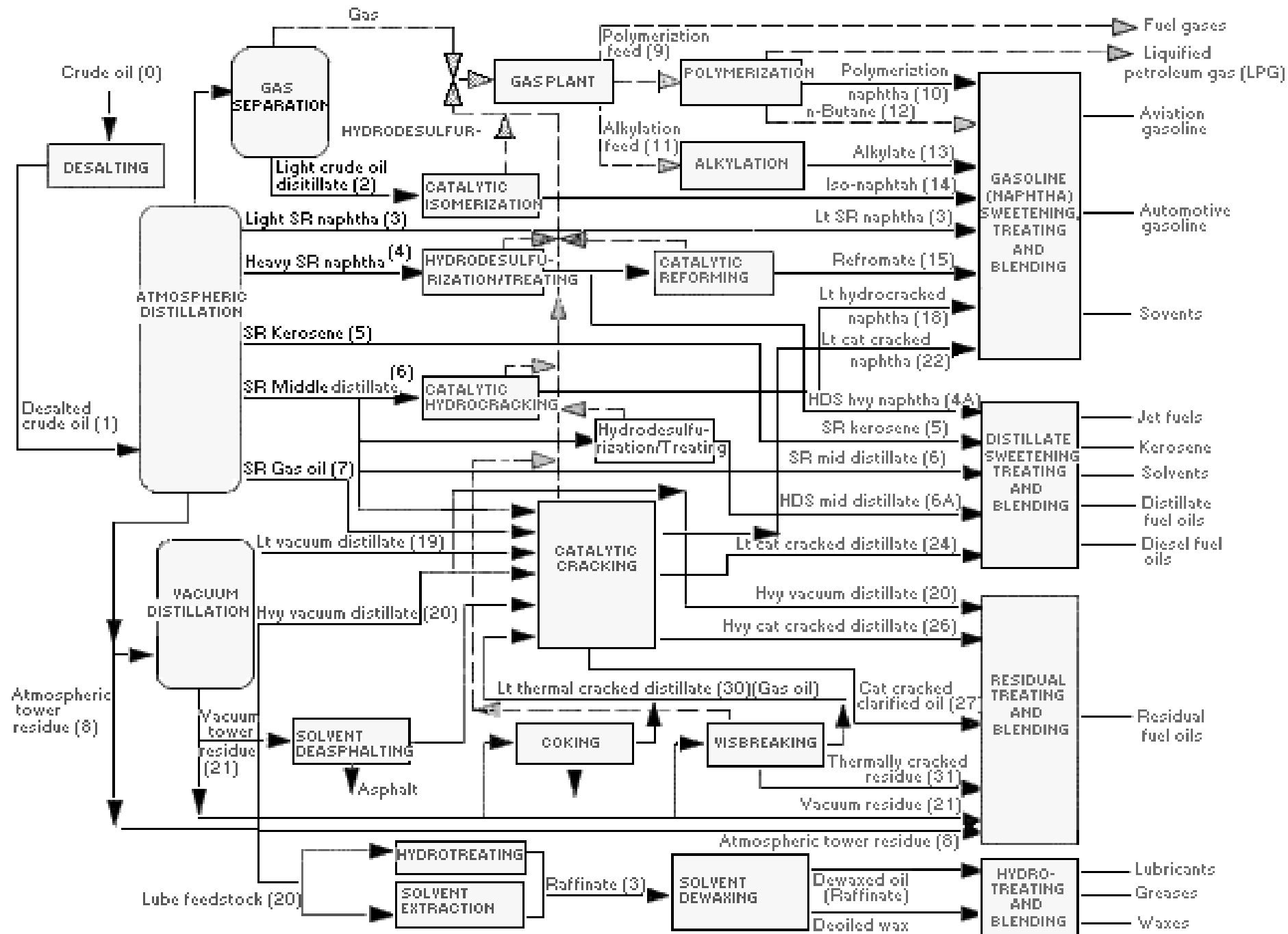
Detailed Objectives

- Literature survey
- Problem statement
- Physical and chemical analysis for wastewater
- Problem formulation
- Options for solution
- Material Balance
- Designing and sizing of the unit operation
- Environmental Impact
- Cost Estimation



Refinery Background

- There are 6 refineries in UAE
- Each refinery produced 100 m³/h
- Units of refinery



Refinery Wastewater Treatment

- Typical sources of wastewater treatment
 - Crude and product storage tank
 - Desalter water
 - Water drains from atmospheric still reflux drum
 - Water from hydraulic decoking of coke drums
 - Condensed steam from coke drum
 - Cooling tower and boiler water blowdown

Traditional Methods for wastewater Treatment

- Conventional Primary Treatment
- Biological Secondary Treatment
- Advanced Primary Treatment
- Chemical Secondary Treatment
- Tertiary or (advanced) wastewater Treatment





Conventional Primary Treatments

- Grit removal
- Primary sedimentation

Grit Chamber

Sedimentation Tank



Biological Secondary Treatment

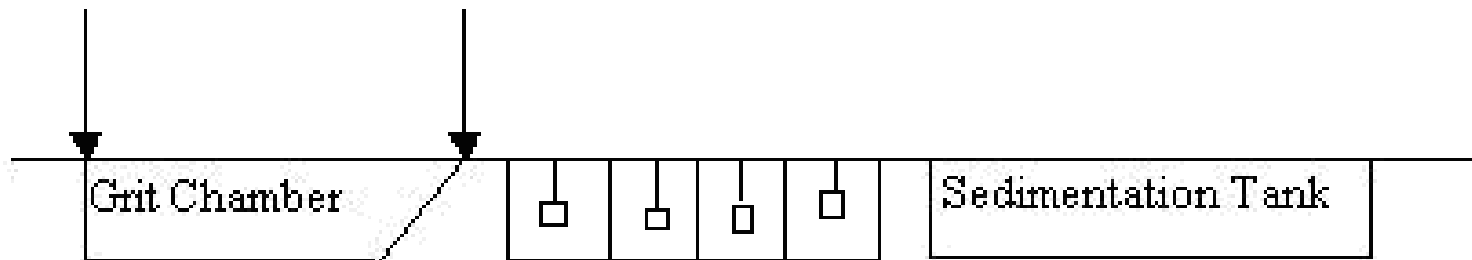
- Primary Conventional method followed by biological treatment

Chemical Secondary Treatment

- Chemical secondary treatment includes pre-treatment, grit removal, flocculation basins, primary

Metal Salts
150 mg/L

Polymer
0.2-0.3 mg/l



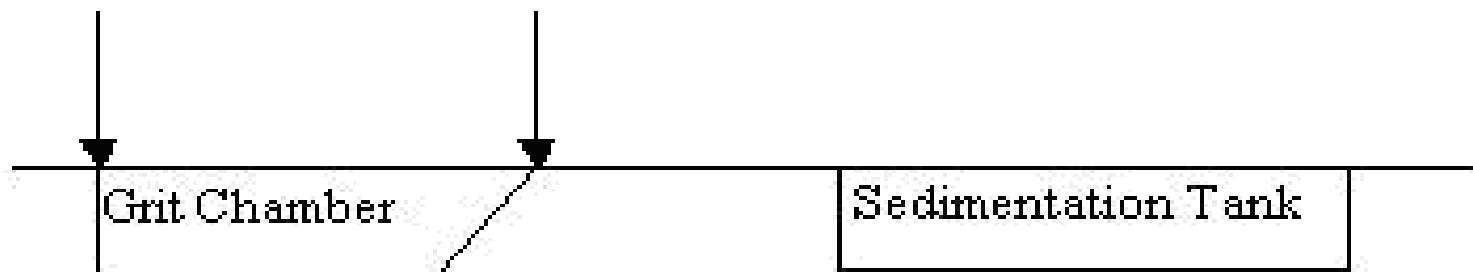
Flocculation Basins
 $t = 30 \text{ min}$

❖ Advanced Primary Treatment

- It is the same as conventional primary treatment with addition of chemicals to enhance coagulation

Metal Salt
20-30 mg/l

Polymer
0.2-0.3 mg/l



Characterization of Refinery Wastewater

- Physical characterization
- Chemical characterization

Physical characterization

- Suspended solids
- Temperature
- Turbidity



Chemical characterization

- Chemical oxygen demand (COD)
- Odors
- Biological oxygen demand (BOD)
- Total Suspended solids
- Nitrogen content (ammonia and organic nitrogen)
- Phenolics
- Phosphorus

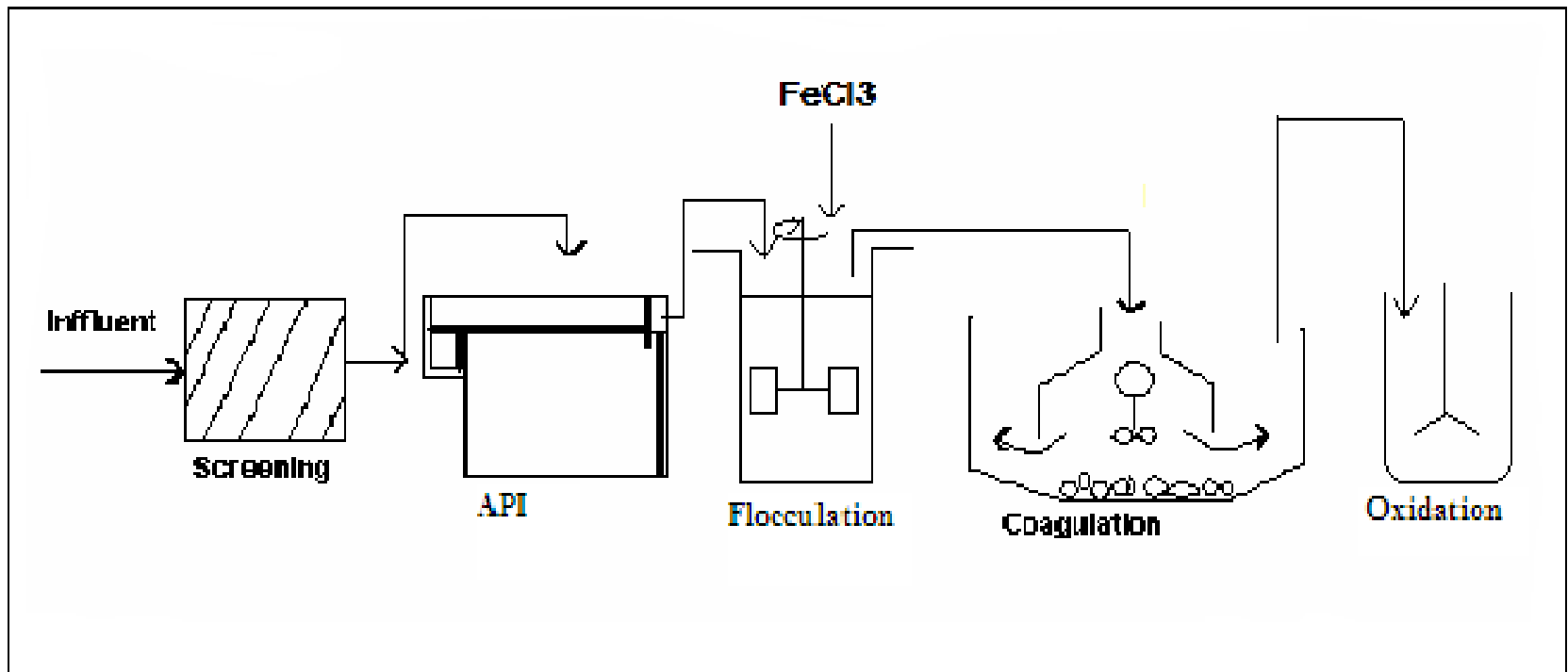
Problem statement

- Problem
- possibilities and limitation
- suggested solution

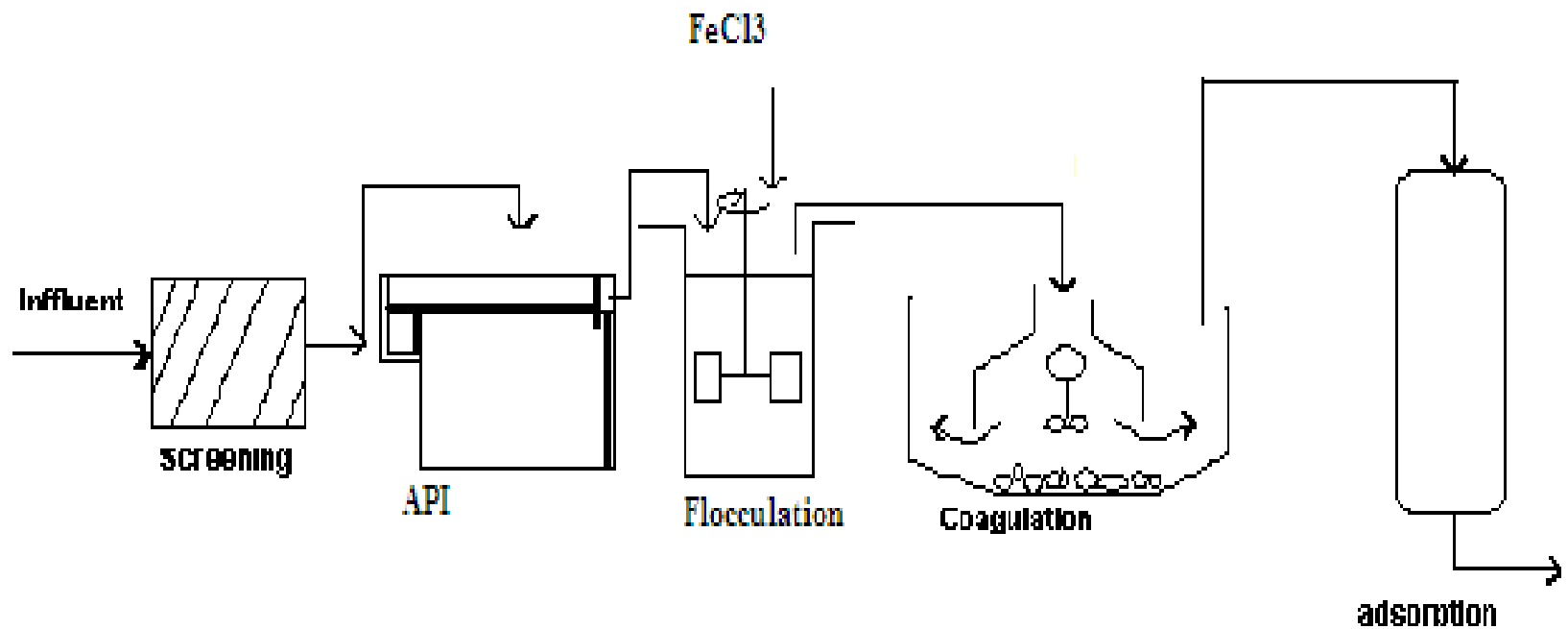
Suggested solution

- **Flocculation and Coagulation followed by oxidation**
- **Flocculation and Coagulation followed by carbon adsorption**
- **Flocculation / Flotation followed by carbon adsorption.**
- **Flocculation / Flotation followed by oxidation**
- **Anaerobic and aerobic treatment**

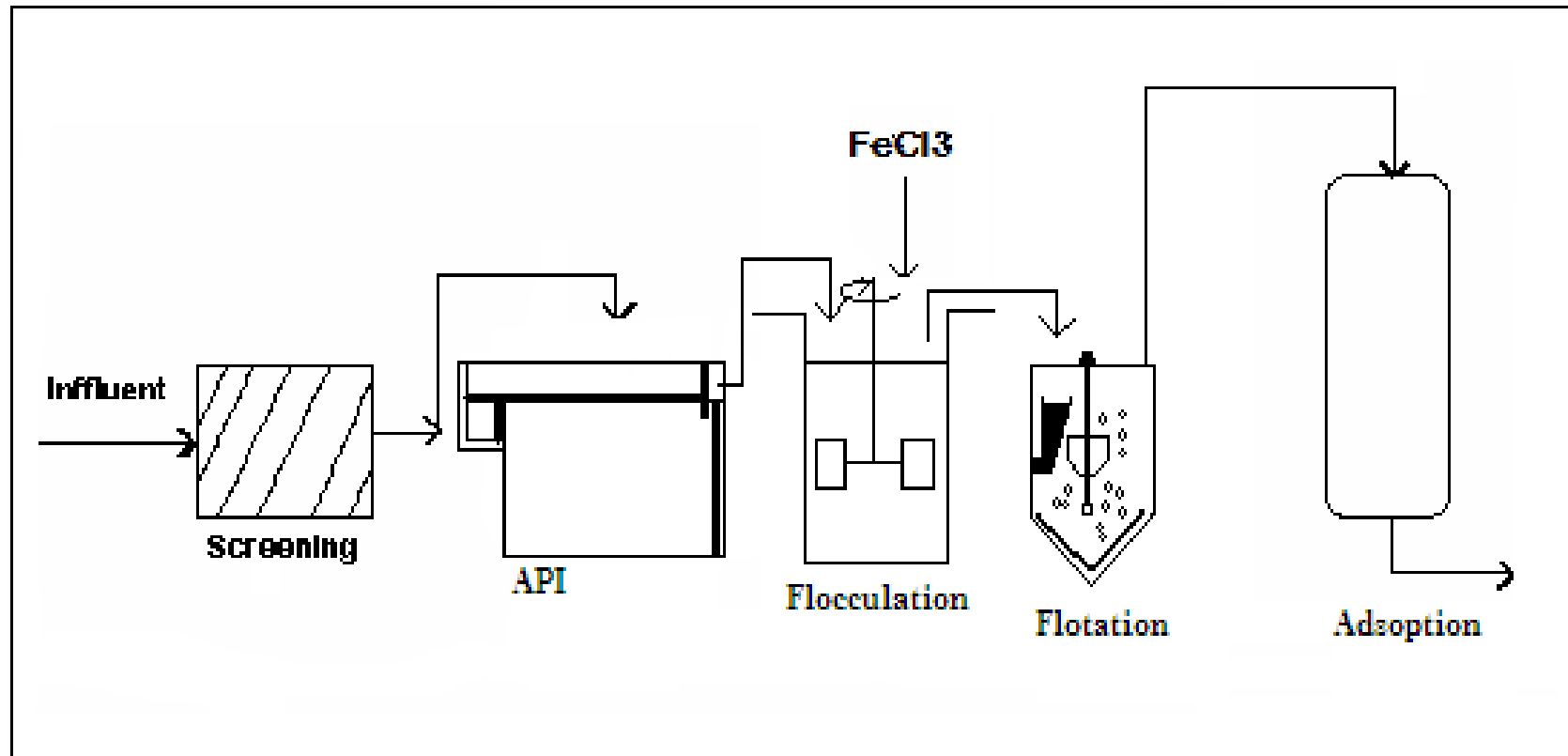
Flocculation and Coagulation followed by oxidation



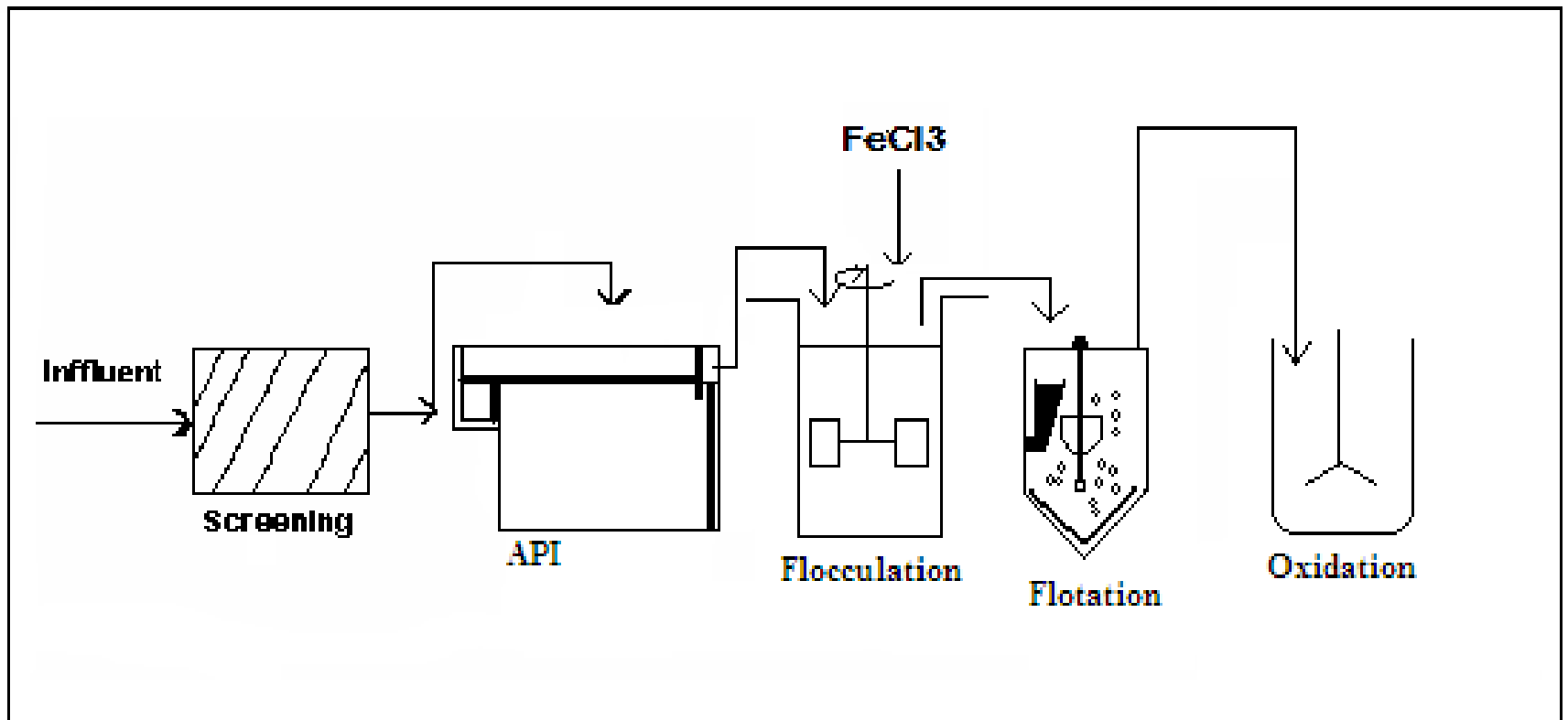
Flocculation and Coagulation followed by carbon adsorption



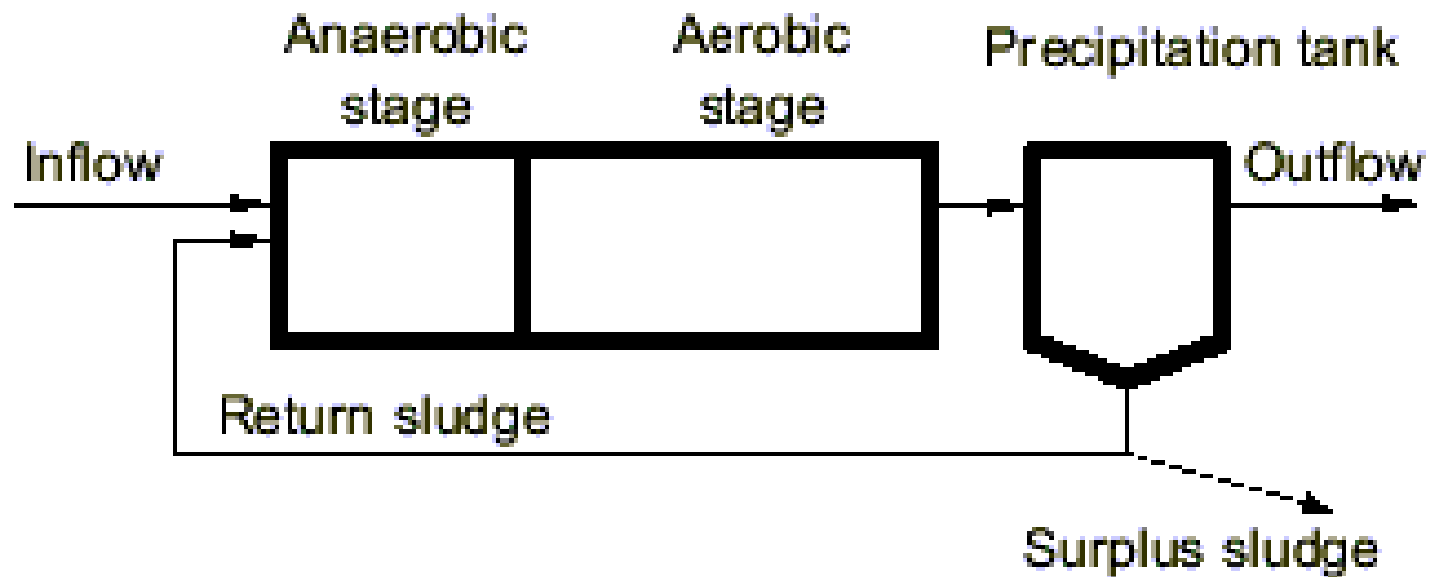
Flocculation / Flotation followed by carbon adsorption



Flocculation / Flotation followed by oxidation



Anaerobic and aerobic treatment



Experimental work

- prepare sample of wastewater.
- Jar test
- Determine TOC

prepare sample of wastewater.

Material	concentration
Zn	50 ppm
phenol	20 ppm
oil	36 gm

Jar test

- Determine the optimum dosage
- Determine the optimum PH

Determine the optimum dosage

Fe Cl ₃ (gm)	Turbidity (NTU)
0	588
5	52
10	29.5
20	12.1
40	17.7
80	16.1

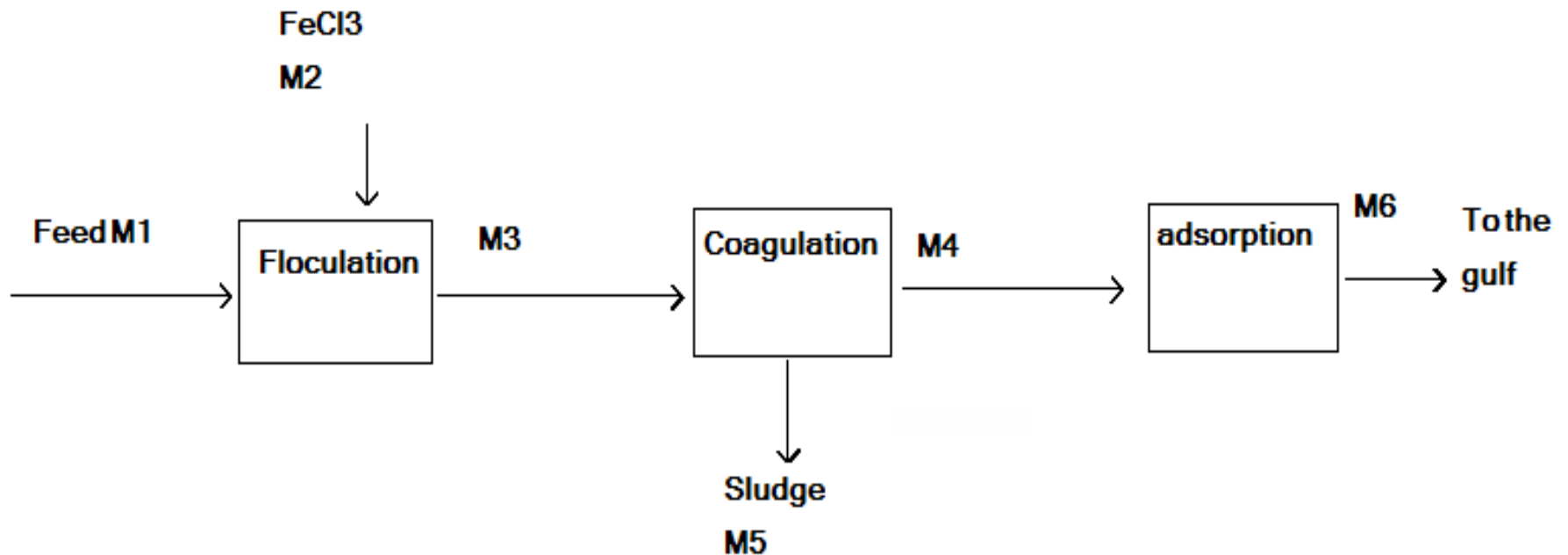
Determine the optimum PH

Turbidity	PH
18.5	4
10.1	5
15.9	6
9.1	7
.2	8
3.9	9

Determine TOC

sample	water only	ppm
1	from the prepared solution 5L without oil	5.828
2	prepared solution (with mud)	19.73
3	by add 20 ml of coagulant +mud+ prepared solution	20.71
4	20 ml of coagulant +mud, prepared solu+3.6 oil	17.96
5	water only	24.92

Material Balance



- Comparison Between The W.W and EIA Regulation

Steams	BOD(ppm)	COD(ppm)	TSS(ppm)	Phenol (ppm)	pH	Zn	Oil
M1	350	800	150	20	6.5-8.5	50	3000
M2	-	-	-	-	-	-	-
M3	350	800	150	20	6.5-8.5	50	3000
M4	150.5	195	30	20	-	50	600
M5	9975	30250	6000	0	-	0	120,000
M6	50	40	50	1	6.-9	2	75
Regulation	50	40	50	1	6.-9	2	75

Environmental impact assessment (EIA)

- ❶ Can be defined as the evaluation of the potential impacts effects of :
 - ✓ suggested projects,
 - ✓ plans
 - ✓ programs
 - ✓ governmental actions that relatives to the physical-chemical and biological components of the total environment.
- ❖ The types of water usually used or produced in refineries is expected to specify the treatment units, which have high removal efficiency

Conclusions & Recommendations

 The main Finding are:

- A comprehensive literature survey was presented.
- Options for the treatment of refinery wastewater have been suggested.
- The optimum pH and dose for coagulation process were found
- Preliminary material balance has been done

 The main recommendations to achieve the design of the plant

- Final selection of the right options using superPro designer4.9 software.
- Experimental work may be conducted to determine the technical feasibility of using flocculation / floatation option
- Sizing and design of the the plant.
- Cost Estimation
- Environmental Impact Assessment.

Thank you for listening
Do You Have Any
Questions?

