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ANALYSIS AND DESIGN OF COMMON EFFLUENT TREATMENT PLANT FOR REUSE

**Dr. Syed Imran Ahmed, Muhammad Ahsan Siddique,
Syeda Fatima Bushra, Ahsan Ali Khan, Sadia Ajmal, Nazeer Malik,
Muhammad Shoaib, Mavra Rizvi**

Presenter:

Ahsan Ali Khan
Under Graduate Student
NED University

Sequence of Presentation

- Introduction
- Research Objective
- Research Scope
- Research Methodology
- Details of Design and Analysis of CETP
- Research Conclusions
- Recommendations

Introduction

- Surface water pollution has enlisted as one of the most serious problems in developing countries. (Suthar et al., 2010)
- Effluents from many industries are discharged into rivers, which cause water pollution. (Qureshi, 2002)
- The Lyari and Malir Rivers, which run through Karachi, Pakistan's largest industrial city, are open drains used to discharge untreated industrial effluents. (Helmer et al., 2011)
- Reusing these effluents can have a significant impact on reducing or completely removing the impact of these effluents from receiving environments. (Toze, 2006).

Introduction

Therefore, there is need of treating industrial effluent before it gets dumped.

To accomplish this study we selected **COMMON EFFLUENT TREATMENT PLANT**

Because

It is difficult for each industrial unit to provide and operate individual wastewater treatment plant because of the scale of operations or lack of space or technical manpower. (Vasudevan et al., 2012)

The Common Effluent Treatment Plants (CETPs) are considered a viable treatment solution for collective treatment of effluents, particularly from small and medium scale industries.

Research Objective & Scope

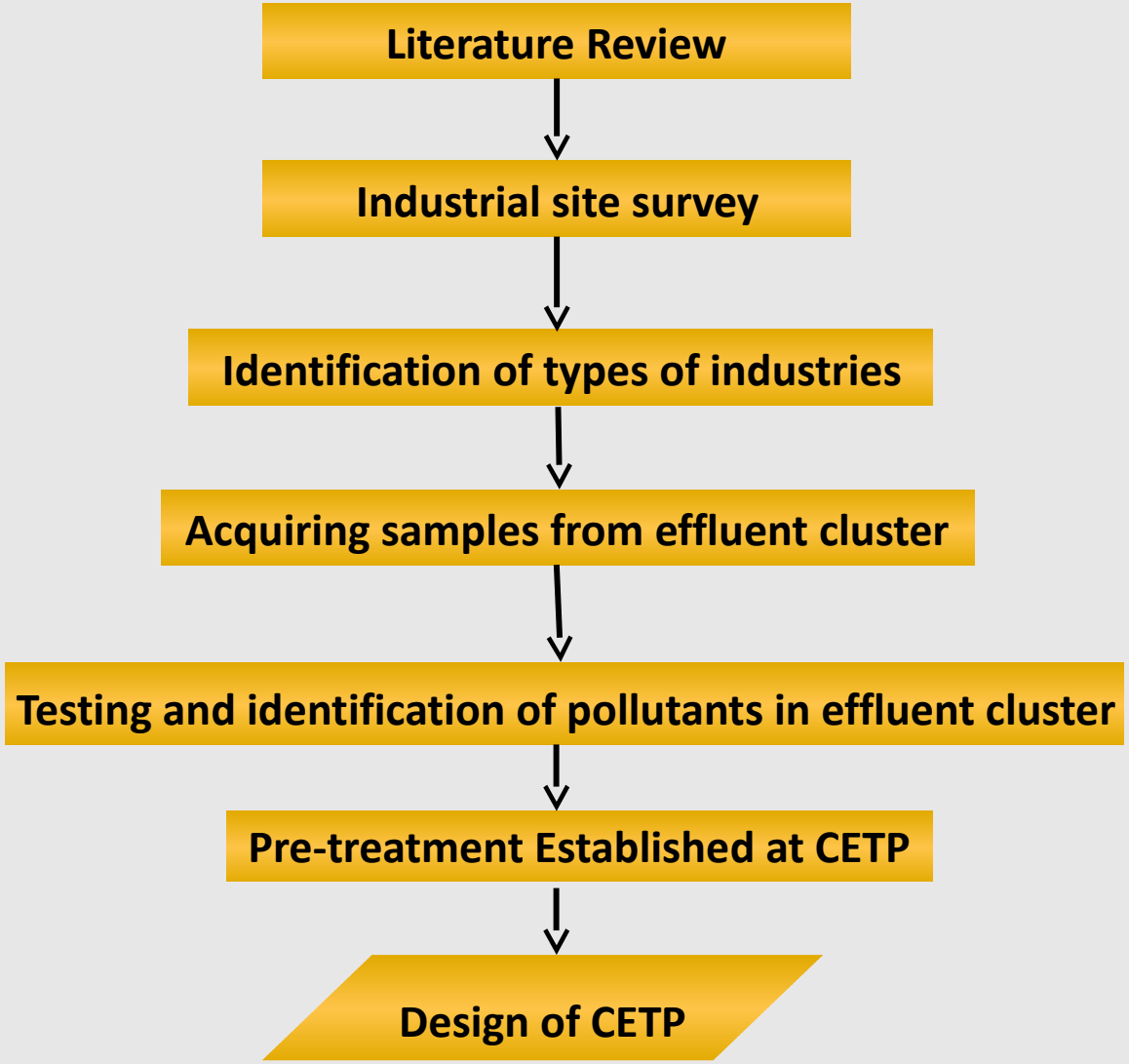
Research Objective

The research objective is to identify economical treatment method, analysis, and design of a common effluent treatment plant (CETP) for the reuse of effluent .

Research Scope

The scope of the research is limited to the treatment of industrial effluent only of industries located at Shershah area.

Research Methodology



Research Methodology

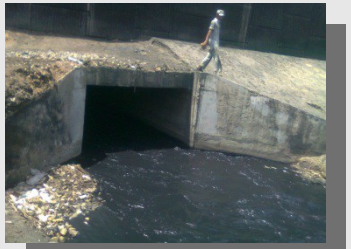
Survey and Identification of industries

Survey of Shershah industrial area was done. The identified industries are enlisted below

Name of industries identified			
1	Textile Industry	7	Flour Mill Industry
2	Dyeing Industry	8	Pharmaceutical Industry
3	Rerolling Industry	9	Beverages Industry
4	Battery Industry	10	Oil/ Fats Industry
5	Paper Industry	11	Plastic Manufacturing Industry
6	Aluminium Factory	12	Cold Storage Industry

Research Methodology

Acquiring samples from effluent cluster



Samples were collected from four outlets where industrial effluent dumped in Lyari river.

Test of Samples

The collected samples were passed through different tests in Pakistan Council of Research in Water Resources (PCRWR) and Pakistan Space and Upper Atmosphere Research Commission (SUPARCO) to find out Concentration of different pollutants

Test Results

Metal Test Results

S. No.	Metals	Unit	Sample	Permissible Limit
1	Lead (Pb)	mg/l	0.078	1.0
2	Mercury (Hg)	mg/l	0	0.01
3	Arsenic (As)	mg/l	ND	0.2
4	Nickel (Ni)	mg/l	0.091	3.0
5	Copper (Cu)	mg/l	0.146	3.0
6	Boron (B)	mg/l	0.226	2.0
7	Zinc (Zn)	mg/l	0.089	15.0
9	Selenium (Se)	mg/l	0.317	0.5

Within Permissible Limit

NEQS National Environmental Quality Standards
WHO World Health Organization

Test Results

Wastewater Parameters Results

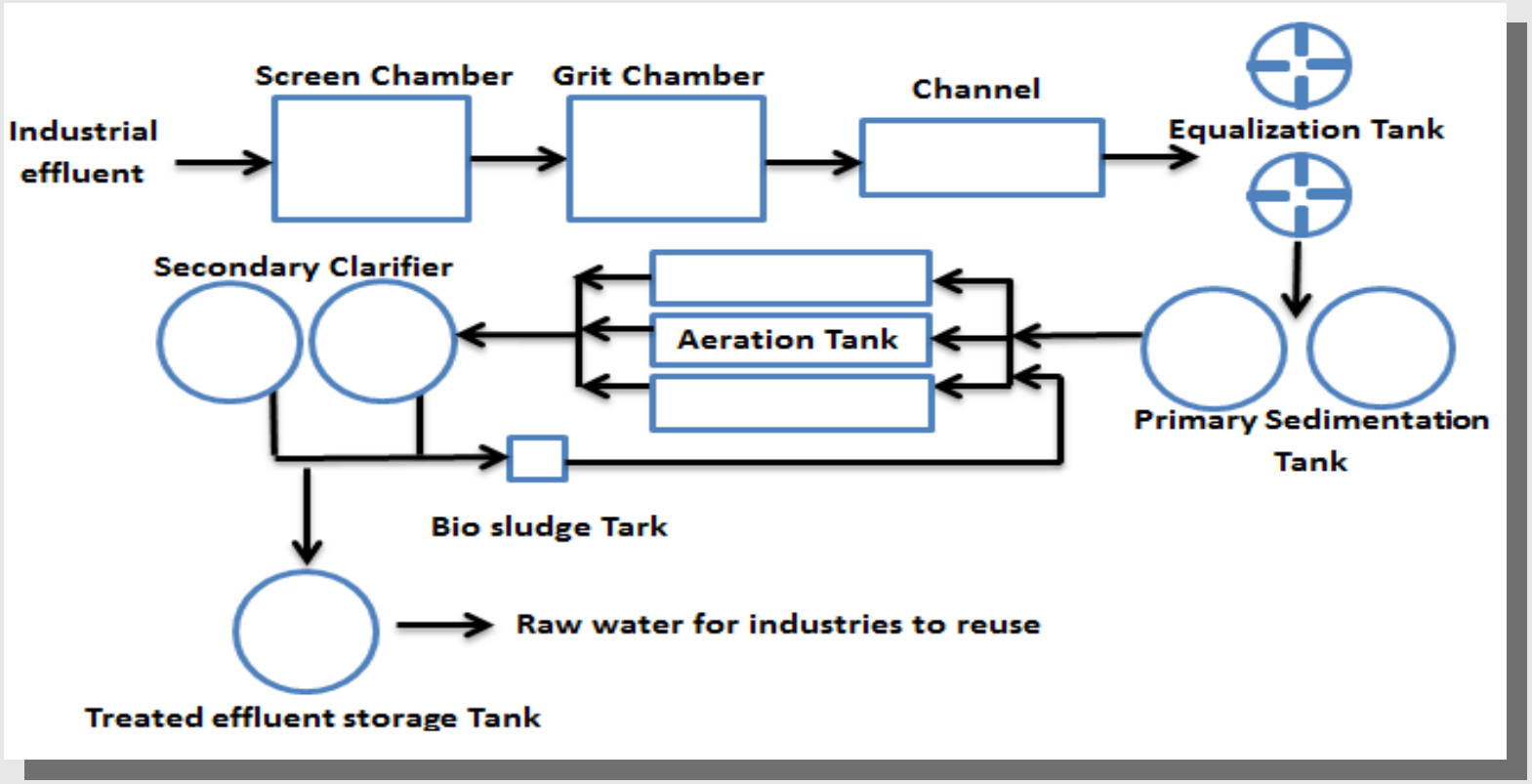
S. No.	Metals	Unit	Sample	Permissible Limit
1	BOD5	mg/l	418	80
2	COD	mg/l	2270	150
3	pH	mg/l	7.35	6-10
4	TSS	mg/l	576	150
5	TDS	mg/l	5158.4	3500
6	DO	mg/l	0.625	0.6-0.8

NOT within Permissible Limit

NEQS National Environmental Quality Standards
WHO World Health Organization

Method for the Treatment

- **The CETP is design for a flow rate of 6 MGD The treatment method of CETP is shown below:**



Technical Details of CETP Units

Units	Size	Design Details	Quantity
Screen Chamber	0.7m x 1.9m x1.5m	Clear spacing between bars=15mm	1
Grit Chamber	19.5m x1.9mx1.25m	Detention time=60 s	1
Channel	25m x2m x1.5m	-	1
Equalization tank	Dia=33m; SWD=4m	HRT=3 hr	2
Sedimentation Tank	Dia=19m; SWD=4m	HRT=2 hr	2
Aeration tank	27m x 27m x 4m	HRT=9 hr	3
Secondary clarifier	Dia=19; SWD=4m	HRT=2 hr	2

Removal of Impurities at each CETP Unit

	BOD	COD	TSS
Inlet	418	2270	576
PST	282.15(32.25%)	1171.8(48.37%)	251.54(56.33%)
AS	80(71.64%)	111.32(90.5%)	109.84(56.33%)
Overall removal	80%	95%	81%

Cost Estimation Of Different CETP Units

Name of Process		Cost in PKR (As of 1st Dec, 2013)	Cost in USD (USD 2013)
Screening and grit removal with bar screen	Capital Cost	50.4 million	4.6 million
	Operation and Maintenance	7.6 million	70.7 thousand
Equalization Tank	Capital Cost	91.8 million	0.85 million
	Operation and Maintenance	54.5 million	0.55 milion
Primary Sedimentation Tank	Capital Cost	105.7 million	0.97 million
	Operation and Maintenance	39.5 million	0.35 million
Activated Sludge	Capital Cost	446.7 million	4.2 million
	Operation and Maintenance	34.7 million	0.33 million
Total cost of the CETP		831.2 million	7.7 million

Research Conclusion

- Industrial effluent can be treated by CETP which include screening, grit removal, equalization tank, primary sedimentation tank, the main activated sludge process.
- The CETP is designed for 6 MGD of wastewater and treat the wastewater up to the permissible limit as set by the NEQS Pakistan.
- This study indicates that the untreated effluent which is directly discharging into the Lyari river has wastewater characteristic values i.e. BOD, COD, TDS, TSS etc. much far beyond the set standards.
- Design CETP can efficiently remove these unwanted parameters and will take it to the limit such as TSS up to 81%, BOD 81% and COD 95% and the pH and DO values are in range.

Research Conclusion

- All heavy metals are within a NEQS limit and they settled down and can remove with sludge during the treatment.
- Karachi Water & Sewerage board and industrial owner can directly get benefited from this research. It will replace the fresh water supply to the industries with the treated water.
- The reduction in fresh water supply to the industries will increase the amount of water supply to society so consequently local people get benefited.

Recommendations

- Proper and timely monitoring of the CETP should be done to get the efficient quality of treated water.
- pH in CETP must be in range of 6 – 9 to save microbes as well of wastage of chemicals, excessive microbes in aeration tank may create nuisance and affect the performance of plant.
- Since design plant follows NEQS, if any industry requires more quality effluent for recycling or reuse purpose, they can further go for tertiary treatment process and treat the wastewater up to their required quality.

Questions/Queries?