

A short account on petrochemical industry effluent treatment

Abstract

This article briefs the issues related to the wastewaters released by petrochemical industry, the current methods used for treating the petrochemical industrial effluents and new innovative methodologies proposed for the petrochemical industrial effluents.

Keywords: petrochemical industry, wastewater, technology, innovative methodology

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Introduction

Petrochemical plants are in the business of developing substances such as hydrogen, carbon monoxide, synthesis gases, chemicals such as ethylene and its derivatives, benzene and toluene to name a few. Aromatic hydroxy compounds present in petro chemical industry effluent can be toxic when present in elevated levels and are known to be carcinogens.¹ Thus, the removal of such chemicals from industrial effluents is of great importance. Wastewater treatment in petroleum refineries is a complex process, with demanding environmental management challenges. Petrochemical wastewater often requires a combination of treatment methods to remove oil and other contaminants before discharge in order to comply with environmental regulations.²

Current wastewater treatment process - petrochemical industry

The current wastewater treatment methods³ include allowing different streams to be collected separately, routing, and treatment. Dependent on the concentration and source of contamination, the degree of the (required) treatment steps such as primary, secondary and tertiary (Table 1) are utilised.

Table 1 Three different steps in petrochemical wastewater treatment

Treatment	Methods opted
Primary treatment	API/CPI/PPI separator, sour water strippers, buffer tanks
Secondary treatment	coagulation flocculation-flotation, biological treatment
Tertiary treatment	sand-filtration, membrane-filtration, chemical oxidation

A typical petrochemical wastewater treatment plant (Figure 1) contains an influent stream that receives feed into the system.⁴ After the solids are removed by a mechanical separation, the next few stages, comprising automatic and flotation oil sucking processes, remove the oil to an oil storage tank. Water, from which oil has been removed,

flows into an anaerobic system where it is treated by microorganisms in the absence of air. The treated water enters the aerobic treatment stage, where the contents are aerated by the bubbling of air. The flocs that created are collected in sedimentation tanks, generally referred to as Secondary Sedimentation Tanks. The flocs are large enough to settle to the bottom of coagulation tanks as sludge. The sludge removed by the scroll is dewatered and compacted. The dewatered sludge can either be dumped, dried or incinerated. The high quality permeate stream is finally discharged for reuse.

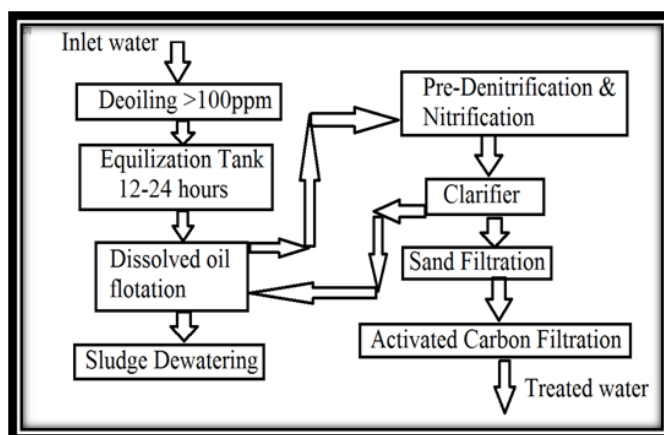


Figure 1 Typical petrochemical wastewater treatment plant.

New technologies in the petrochemical industry waste water treatment

It is of utmost importance to dispose off the residues present in the petrochemical industry effluents in a proper manner as well as to keep the concentration of chemicals in the effluent stream to a minimum level to comply with the environmental laws. Thus, research into new or more efficient waste water treatment technologies so as to degrade the complex refractory molecules into simpler molecules is vital to combat the deteriorating water quality. The petrochemical industry has made great strides in improving its wastewater treatment through technology which are presented in Table 2.

Table 2 New petrochemical wastewater treatment technologies

S. No	Methodology	Explanation
1	Clean electrochemical technologies ⁵	The removal of chemical oxygen demand (COD), turbidity, phenol, hydrocarbon and grease from petrochemical wastewater (PCWW) was experimentally done by using electro flotation (EF) and electro coagulation (EC).
2	Enhanced biodegradation using ozonation and BAC advanced treatment system ⁶	The characteristics of degradation/conversion of bio-refractory and the growth of a bio film are investigated in laboratory-scale pre-ozonation and lifted moving-bed biological activated carbon (BAC) advanced treatment processes.
3	Sulfide removal by autotrophic denitrification ⁷	This alternative new treatment scheme completely removes H ₂ S by the combination of the proposed biological method and the existing stripping with CO ₂ .
4	Anaerobic treatment ⁸	anaerobic digestion has been the solution to treatment problems for which aerobic systems were inefficient.
5	Observer-based time-optimal control of an aerobic SBR ⁹	The control strategy regulates the feed rate to maintain a constant optimal substrate concentration in the reactor, which in turn minimizes the reaction time. Since this control requires on-line knowledge of unmeasurable variables, an Extended Kalman Filter is used as a nonlinear observer.
6	Rhodococcus rubber sand modelling the processes using the modified gompertz model ¹⁰	Phthalate ester isomers, including dimethyl phthalate (DMP), dimethyl isophthalate (DMI) and dimethyl terephthalate (DMT), were found to be transformed by Rhodococcus rubber isolated from a mangrove sediment using DMT as a carbon source.
7	Treatment using wetlands ¹¹	Several large-scale wetland projects currently exist at oil refineries, and numerous pilot studies of constructed treatment wetlands have been conducted at terminals, gas and oil extraction and pumping stations, and refineries.

Conclusion

There are many health hazards raised by the effluents released by the petrochemical industries. Though conventional methods are used for current scenario, they have certain short comes. Therefore many new technologies were identified, formulated and reported. Further researches required to identify removing petrochemicals from their effluents completely.

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Conflict of interest

The author declares no conflict of interest.

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