

Estimation of Hazardous Phenolic Compounds in Industrial Wastewater

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Abstract:

The purpose of this work was to determine phenolic compounds in industrial waste, from Waluj industrial area, Aurangabad, Maharashtra, India. A phenolic compound which is listed as a priority to environment was investigated by GC-MS (SPE). Phenol recorded 4.70 ppm and made about 35% of compounds, 4.46 ppm for 2,4-dinitrophenol consist 34% of these compounds, 3.17 ppm (24%) for 2-Methylphenol finally, 4-chloro-3-methylphenol recorded 0.97 ppm 7%.

Key words: Hazardous Phenolic Compounds, Industrial Wastewater

Introduction

Phenol can enter to the environment by different resources, may from anthropogenic activity (Mambo *et al.*, 2012). This compounds penetrate in through drainage or industrial sewage to surface water. Many natural processes may formed phenolic compounds from decomposition of organic matter like phenol and p-cresol, chlorinated phenol which comes by synthesis

processes of fungi and plant (Pocurull, *et al.*, 1995). Many phenolic compounds appear in industrial sewage in high concentration. The factories that impregnate wood shows high concentration of phenol value reached upto $9.7 \mu\text{L}$ (Allens and allen,1997). Nitrophenol particularly 4-Nitrophenol presence in the environment from both, natural and anthropogenic activity (Pantaik and Khoury, 2004, Vione *et al.*, 2004). Nitrophenols exist in water concentration that seldom exceeded some μL (Michalowicz and Duda, (2007). 4,6-dinitro-2- methylphenol (DNOC) which used as a compound and precursors in polymers and drug production in polymers and also from degradation of pesticides in environment (FURU TA et al., 2004).methylphenol can found in the surface water from industrial effluent or that water near plants produce coal tar (creosote) (Mcbrain et al.,1996), nitrated form of cresol is used as a compound of herbicide and pesticide properties .it is also used for epoxy ,resin ,days and drug production (RE –POPPI 2005).Environmental Protection Agency (EPA) has set eleven of phenolic compounds as a hazard against the aquatic water the USA specifics a maximum concentration level (MCL) $1 \mu\text{g/L}$ for eleven common phenolic compound are on the U.S. EPA priority pollutants list . The structures of these are shown in figure (1).

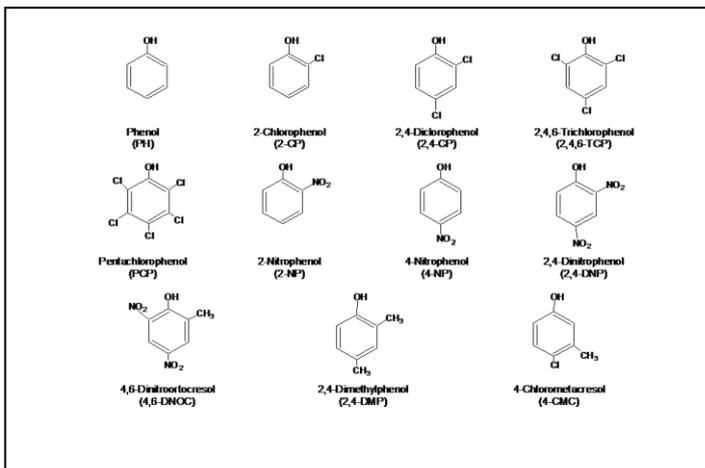


Figure 1. Structures of eleven phenolic compounds considered priority pollutants by US EPA

The present investigation work on the wastewater for industrial sewage to compounds which well known by their toxicity for both aquatic organism and human.

Material and methods

The sample was collected from common effluent treatment plant (CEPT) form Waluj Industrial area Aurangabad city (India), the positioning system (GPS) was used to locate the sample position, the site map distribution is shown in Fig (2)

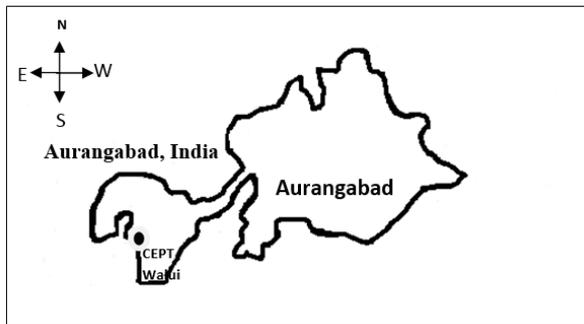


Figure (2) sampling site in Aurangabad city (India)

Collected the sample in glass Sampling which were chemically cleaned before the water sample refrigerated and shipping to the laboratory. Aliquots of the sample (1L) were filtered through a 0.45 μm glass fiber membrane under vacuum and then a surrogate standards (11 phenolic compounds) (EPA)) were added. Phenolic compounds were extracted by solid phase extraction , (SPE) following procedures (Method 528, EPA) .Briefly ,the(SPE)cartridges were first conditional with 3 ml aliquote of methylene chloride followed by 3 ml methanol , and again with 3 ml of 0.05 N hydrochloric acid adjusted the vacuum approximately to flow rate 20 ml \min (50 min for a 1 L sample).the water sample were passed through the cartridges at a flow rate 20 ml \min under vacuum and phenolic compounds eluted with 8 ml of methylene chloride, which would

also be used to rinse the inside of each sample bottle followed by 5 ml methylene chloride rinse of the surface. Residual water was removed by anhydrous (Na_2SO_4) and the volume reduced by evaporation under nitrogen gas to 0.5 ml add the internal standard 11- EPA phenolic compounds.

Results and Discussion

Waluj is an industrial area in Aurangabad city (India), the effluent of the factories send to (CEPT) station to do the compulsory treatment before release these effluent to surface water. The main group of phenolic compounds determined within the effluent was methylphenol particularly 2-Methylphenol (cresol), 4-chloro-2-methylphenol, 2, 4 – Dinitrophenol and phenol also detection in sample. In figure (3) we can see the main concentration of phenol was 4.7 ppm, 2-methylphenol recorded 3.17ppm, 2-chloro-3-metehyphenol was 0.97 ppm, finally 2,4-dinitrophenol 4.46ppm. The other phenolic compounds were no detected as figure (6) which shows the concentration of phenolic compounds.

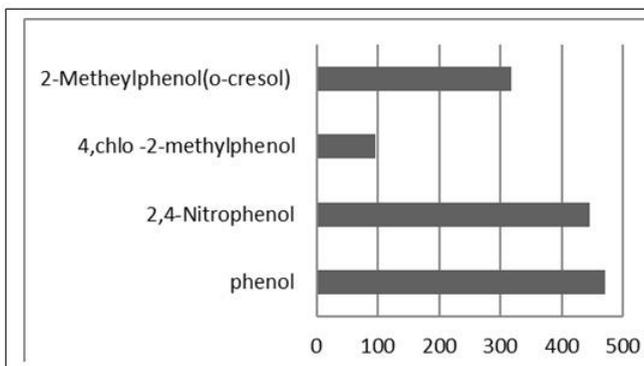


Figure (3) the concentration of phenolic compounds

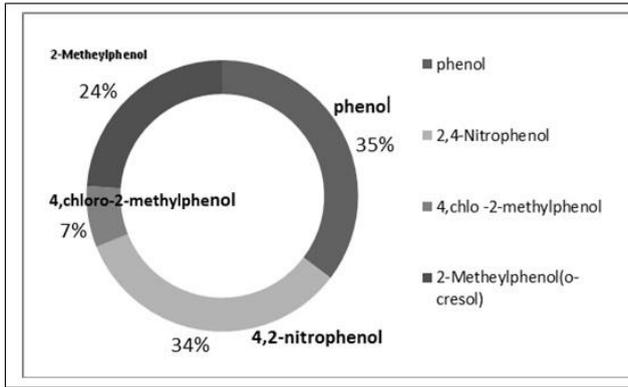


Figure (4) the percent of hazards phenolic compounds from the eleven common phenolic compounds (EPA)

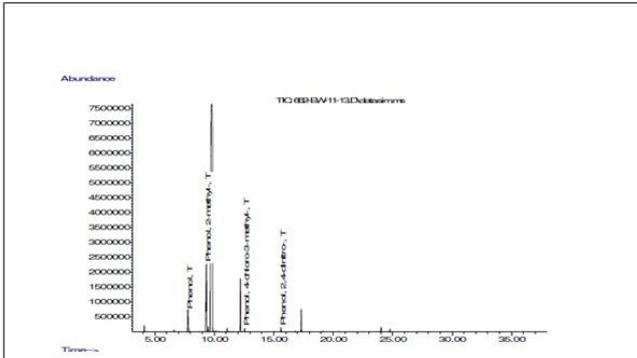


Figure (5) the GC mass chromatograph of the phenolic compounds

Compound	R.T.	QIon	Response	Conc	Units	Dev(M)

Target Compounds						
1) Phenol	7.795	94	8413527	4.70	ppm	#
2) Phenol, 2-chloro-	0.000		0		N.D.	
3) Phenol, 2-methyl-	9.328	108	3991168	3.17	ppm	#
4) Phenol, 2-nitro-	0.000		0		N.D.	
5) Phenol, 3,5-dimethyl-	0.000		0		N.D.	
6) Phenol, 2,4-dichloro-	0.000		0		N.D.	
7) Phenol, 4-chloro-3-met...	12.556	107	522751	0.97	ppm	#
8) Phenol, 2,4,6-trichloro-	0.000		0		N.D.	
9) Phenol, 2,4-dinitro-	15.612	184	296697	4.46	ppm	#
10) Phenol, 4-nitro-	0.000		0		N.D.	
11) Phenol, 2-methyl-3,5-d...	0.000		0		N.D.	
12) Phenol, pentachloro-	0.000		0		N.D.	

(#) = qualifier out of range (m) = manual integration (+) = signals sum						

Figure (6) the R. T. of the phenolic compounds

These phenolic compounds of many chemicals including dyes, plastic, resins and drugs (Bruce, ET AL., 1987) The process of wood pulp chlorination employed during paper production is a very important source of these compounds (including chlorinated) in water (Michalowicz et al., 2008) as shown in figure (4) phenol takes about 35% of the result, 2,4-dinitrophenol consists 34% of these compounds, 24% for 2-Methylphenol finally, 4-chloro-3-methylphenol 7%.

The highest concentration of phenols in industrial sewage may reach to 0.1-10 mg/L, 2,4-dinitrophenol and 2-Methylphenol used in industrial process production drug and in polymers.

Station	Cond. µg/L	pH	COD mg/L	BOD mg/L
CEPT	1.66	4.6	9240	4602

Table: 1 Physicochemical parameters

Nitrated phenols are used in dyes, solvents, plastics and explosive production and formed due to electric, electronic and metallurgical industrial activity (Michalowicz and Duda, 2007).

Conclusion

Waluj is an industrial area in Aurangabad city, different factories located in this area, CEPT is the main station to treat the effluent before discharging to surface water, many phenolic compounds noted such as phenol, 2,4-dinitrophenol, 2-Methylphenol, 4-chloro-3-methylphenol (cresol), which listed with the other phenolic compounds as a hazardous chemical material by (EPA). Environmental Protection Agency. These compounds were so toxic and hazardous to aquatic life and humans.

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