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Detection of Organics by FTIR and GC-MS

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CH_2Cl_2 extracted samples of the industrial wastes collected from GIDC Vapi and GIDC Ankaleshwar (Gujarat) were recorded for IR and GC-MS. Several organic compounds have been found including organophosphorus pesticide. These compounds ultimately affect the soil and ground water quality of the area.

Key Words: Organics, FTIR, GC-MS, GIDC Vapi, GIDC Ankaleshwar.

INTRODUCTION

The industrial effluents have a variety of organic compounds[1]. These organic compounds affect the quality of soil and underground water of the area[2]. The organics[3] include the phenols, organic acids, pesticides, dyes, drugs, etc. Numerous studies have been reported[4] for the detection and identification of organics in western countries. In our country, no such type of study was undertaken so far. Therefore, this study was undertaken to detect and identify organic compounds present in industrial waste collected from GIDC Vapi and Ankaleshwar.

EXPERIMENTAL

Industrial effluent samples were collected from the GIDC area Vapi and Ankaleshwar. Organic compounds were extracted from these effluents by using dichloromethane[5]. Extracted organics layer was concentrated in small mass. The extracted mass was recorded for FTIR on Perkin-Elmer make IR instrument and GC-MS was recorded on Hewlett-Packard made GC-MS spectrophotometer at Sophisticated Analytical Instrument Facility (SAIF), IIT, Mumbai.

RESULTS AND DISCUSSION

The characteristic band IR frequencies are given in Table-1 and Figs. 1 and 2. IR bands support the presence of functional groups in the detected organic compounds by GC-MS.

The GC-MS spectra of the CH_2Cl_2 extracted mass are shown in Figs. 3 and 4. Identified organic compounds are listed in Table-2 along with their molecular formula, structural formula and its molecular weight.

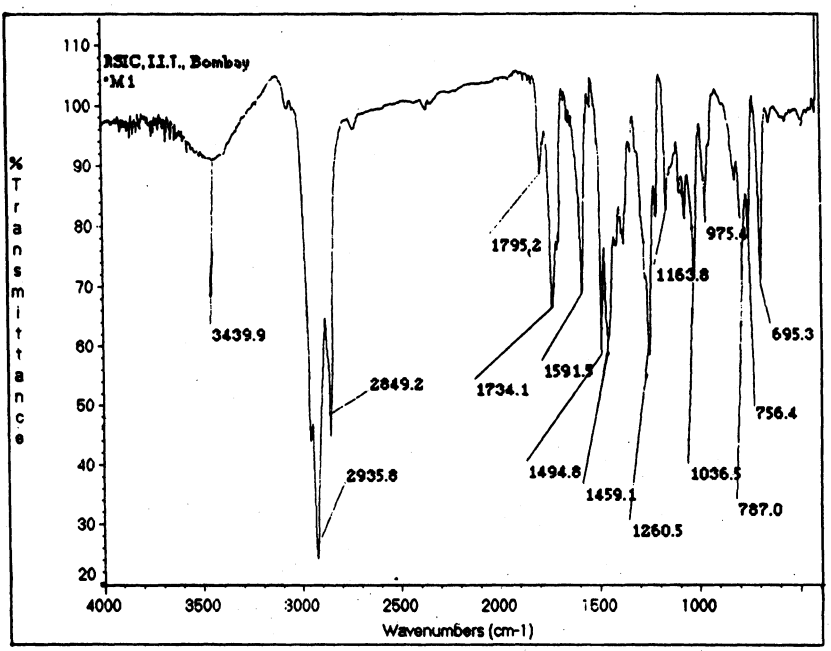


Fig. 1. FTIR Spectrum of Dichloromethane extracted (Sample No. 1)

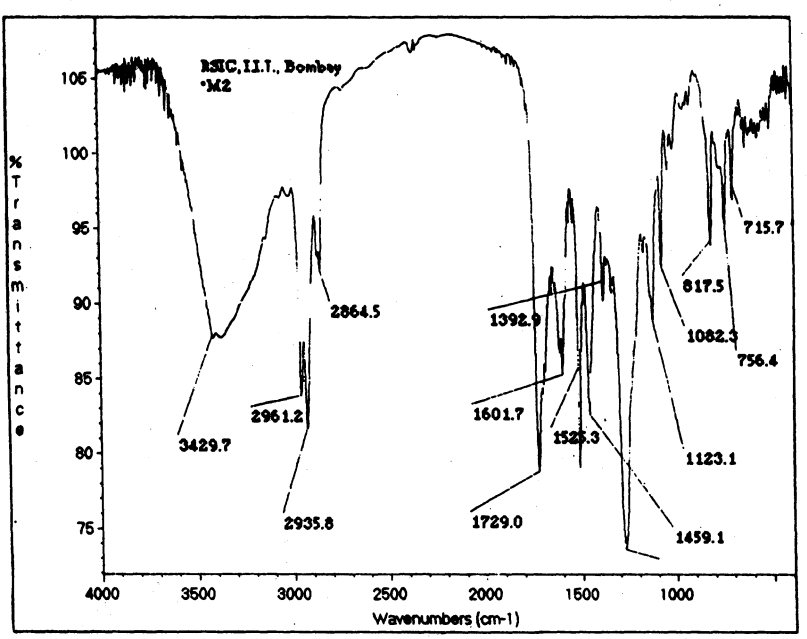


Fig. 2. FTIR Spectrum of Dichloromethane extracted (Sample No. 2)

TABLE -1
THE IR SPECTRUM OF CH_2Cl_2 EXTRACTED MASS

Sample	Wavelength (λ_{max})	Characterisation (Interpretation)
1	3439	N—H (str.)
	1795	C=O (str.)
	1734	Carboxylic acid
	1494	*t*-butyl —C $(CH_3)_3$
	2849	—OH
	1591	C=C (str.)
	756	Ar— (monosubst.)
2	3429	Ar—OH (phenol)
	1729	C=O
	2961	—OH (carboxylic)
	817	Ar—OH (disubstituted)
	1600	C=C (str.)

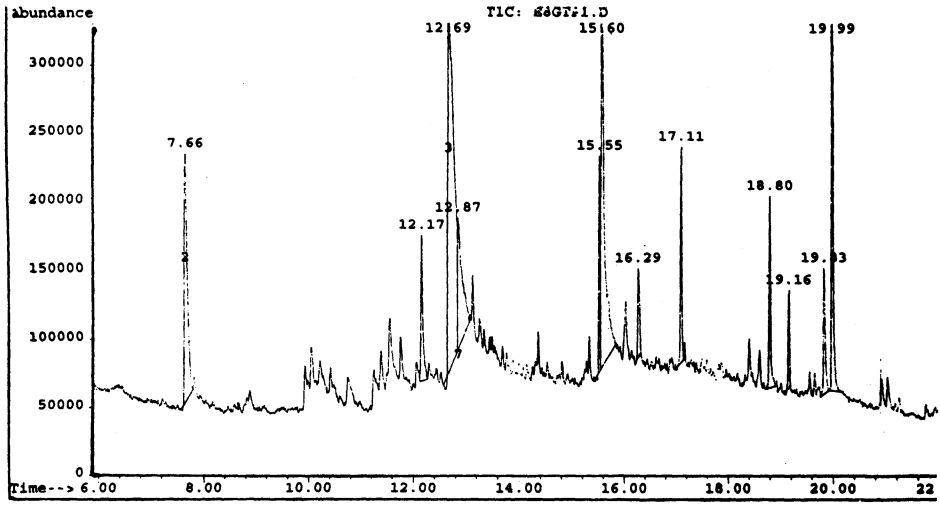


Fig. 3. GC-MS Spectrum of CH_2Cl_2 extracted mass (Sample No. 1)

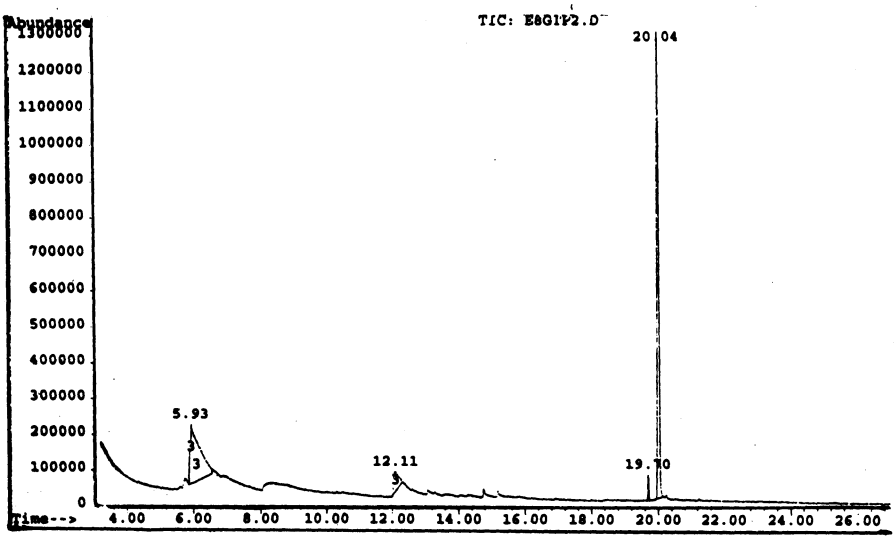
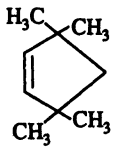
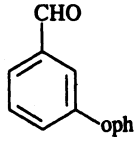
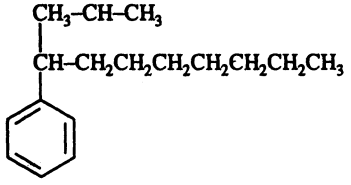
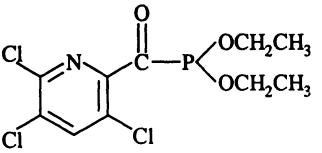
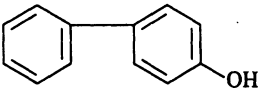
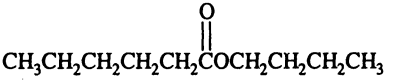
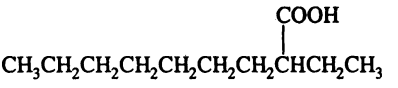
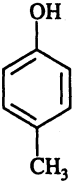
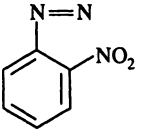
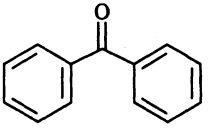
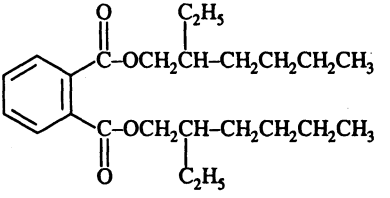
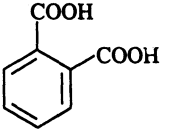


Fig. 4. GC-MS Spectrum of CH_2Cl_2 extracted mass (Sample No. 2)

TABLE-2
ORGANIC COMPOUNDS FOUND IN GC-MS

S. No.	Compound	Structural formula	m.f.	m.w.
1.	3,3,5,5-Tetramethyl cyclopentene		C_9H_{16}	124
2.	3-Phenoxy benzaldelyde		$C_{13}H_{10}O_2$	198
3.	(1-Propylnonyl)-benzene		$C_{18}H_{30}$	246

S. No.	Compound	Structural formula	m.f.	m.w.
4.	Chloropyrifos		$C_{10}H_{11}O_3NCl_3P$	333
5.	*p*-Hydroxy biphenyl		$C_{12}H_{10}O$	170
6.	Butyl hexadecanoate		$C_{10}H_{20}O_2$	172
7.	Octadecanoic acid		$C_{11}H_{22}O_2$	186
8.	4-Methyl phenol		C_7H_8O	108
9.	1-Azido-2-nitro-benzene		$C_6H_4O_2N_3$	150
10.	Benzophenone		$C_{13}H_{10}O$	184
11.	Bis(2-ethyl hexyl) phthalate		$C_{24}H_{38}O_2$	390
12.	1,2-Benzene dicarboxylic acid		$C_8H_6O_4$	166

Chloropyrifos is colourless, crystalline and toxic in nature, used as pesticide. This compound is found to influence the mobility to trace metals in soil[6].

Phenolic compounds, *viz.*, 4-methyl phenol, impart taste and odour to water and are toxic to fish and aquatic life. Benzene compounds including benzophenone, phthalic acid, 3-phenoxy-benzaldehyde, bis-(2-ethylhexyl) phthalate, 1-azido-2-nitrobenzene, (1-propylnonyl) benzene are crystalline compounds. These types of organics are toxic to environment, used as reactants to synthesize many pesticides and pesticide formulations.

Biphenyl compounds are structurally similar to DDT and DDE, and are persistent in the environment because of their chemical stability. Their acute effects are not a serious problem but their chromic effects are so similar to those of DDT and DDE that it is likely that they act synergistically. Chloropyrifos persists in soil for only 60–120 d, being cleaved by hydrolysis into phosphate and trichloropyridin-2-ol.

These organic compounds affect the quality of soil and groundwater of the area. Out of these detected organic compounds some are carcinogenic. Therefore, the industrial wastes should be treated before ponding to open places or river or sea.

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