ORGANIC MATERIAL DISPOSAL CONCERNS IN E WASTE IN BIHAR

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ABSTRACT:

The awareness towards environment and hygiene is making mankind concerned to look into all kinds of entities encountering in technology development and desire of mankind. Recent upsurge of technology and development in electronic industry has lead to many advancement and ease in lifestyle in automating life but has posed equally challenges for human kind also. The development of EEE products calls for metals and synthetic materials which are often termed as manmade materials. Once the EEE products lose their life and become waste its disposal is turning to be a challenging task these days. The developed nations are pushing their old obsolete materials to underdeveloped and developing countries in name of technology transfer and this product disposal liability ultimately comes to these lesser known technology possessing nations. The crude disposal takes place giving rise to depletion of materials for further production of EEE at one end and worst part of disposal is seen in case of organic / manmade materials which are toxic deadly in nature and cause irreparable damage to environment and living being affected by it. Situation of such disposal in Bihar cities show similar results as can be witnessed in any part of India and sometimes matches to situation of worst affected sites available in world. The study further reveals that the preposition of degradation goes demographic preposition, industrialization extent, non strictness and absence of regulatory & monitoring enforcement mechanisms. Banned substances continued use in product manufacturing must be stopped paving way for use of environment friendly constituents, permitted components and safe technology for safe products. Available options of buy back, extended producers responsibility must be extensively exercised and disposal is done in safe, highly technical manner in controlled, sustained and environment friendly manner.

KEYWORDS: EEE, *Hazardous, e waste, Manmade/Organic, Toxicity, Transmigration, Disposal, EPR.*

1. INTRODUCTION:

Globalization and world conversion to one entity has resulted in rapid technology and product migration giving rise to mammoth growth of industry. Fast growing nature and mans quest for automation and desire to transmigrate economic divide indicates to unique pattern and need for growth of electronic and e suffices services. As a result one can say that most growing, flourishing diversified with most adoptive innovative flair and consumer driven industry is the electronic industry. Pace of growth of this industry equally is responsible for replacement and obsolesce of existing Electric and Electronic Equipments (EEE) products forcing it to become waste and transmigrate to lower economic affordably classes of society[2]. This economic transmigration of products result in collection of EEE in such hands where it gets stuck and often lead to disposable in open and most unskillful and technologically inappropriate dismantling and disposal. The unusable or products which has lost its credential as use and retrieval of materials lead to term waste in general and particularly acquire acronym of electronic waste or e waste. Development of synthetic materials and its extensive use in different industries as raw materials are additionally paving ways for bulk generation of e waste. The synthetic materials are manmade and often consist of deadly toxic and hazardous substances which needs careful specialized disposal in presence of highly expertise environment through experts.

Sector wise development of EEE industry can be listed as

Data processing, Telecom & Entertainment, Medical Instrument industry, Audio Video, Automotive & Automobile, Aerospace & Defense, Home Appliances etc[2].

Percentage wise major shares listing as per available literatures with its visual representations can be shown as in table 1 and figure1[9].

Table 1 showing major stakes of EEE

Area of Use of EEE	Percentage reported in use
Data processing	25
Telecom & Entertainment	21
Industry & Medical	18
Audio & Video	15
Automotive & Automobile	8
Aerospace & Defense	7
Home appliances	6

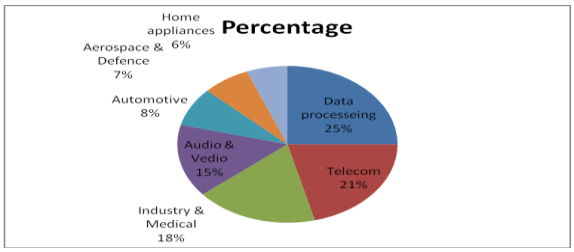

Figure1.Graphical representing of EEE major stakes

Unfortunate, but factually true, developments of electronics have taken place after wars only. The major electronic development world wide can be seen after Ist and IInd world war and even in India after two major wars Electronic industry initiations could be traced. The early two wars and after Indian government initiatives of manufacturing space and defense electronic products the Indian electronics industry initiation could be traced from sixties after independence and development of core sector industrial growth [5]. Development of components and technology followed the growth and development of consumer electronics, mainly through manufacturing of transistor radios, other audio products, B/W TVs, calculators etc. In 80s, manufacture of colour televisions took place followed by computers and telecom products. The growth of EEE can be graphically shown as in figure 2.

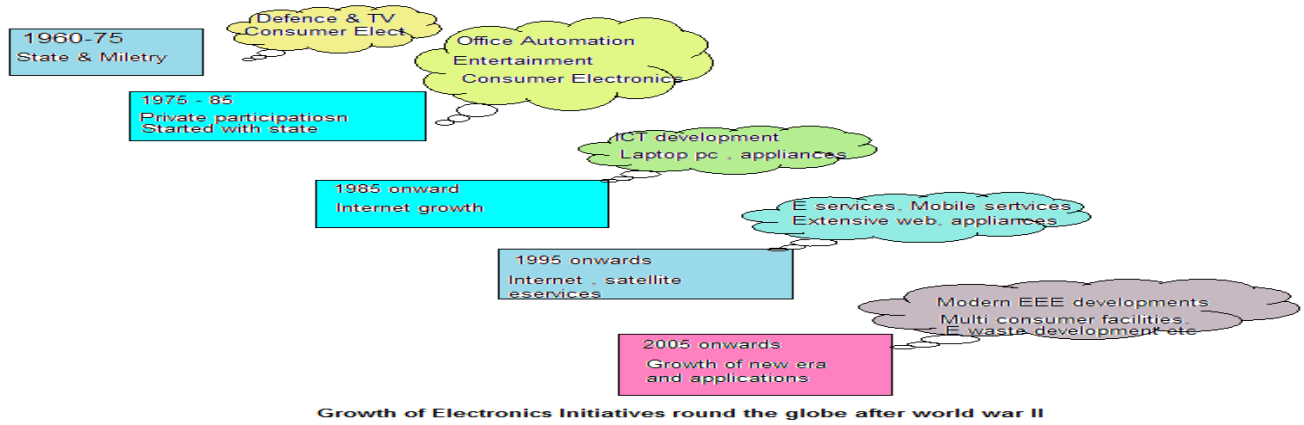

Figure 2. Growth of EEE since 60s

During 2004-05 to 2009-10 EEE hardware (HW) production touched the figure of Rs 109940 registering increase from Rs 50500 crore indicating an increase of annual cumulative growth of 17.3 %. Current economical cumulative growth has come to 13%, this decline is basically due to inflow of finished EEE products from developed nations, illegal migration of EEE products and price reduction in consumer electronic products[3].

Figure 3, 4 shows the graphical details of major EEE producing states stakes as per available literatures.

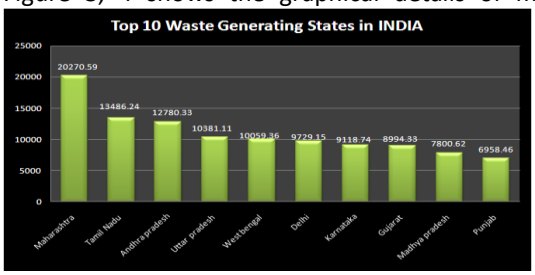

Figure 3

Figure5

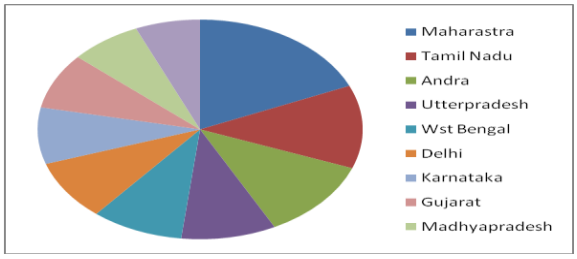

Figure 4.

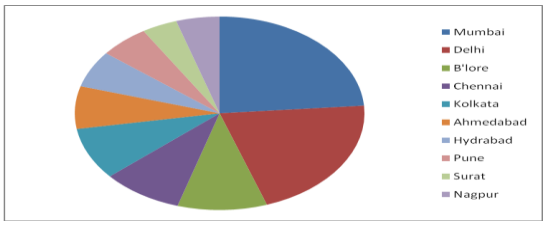

Figure 6

Figure 5 and 6 shows the representation of EEE stakes in the major cities in India where as figure 7 shows a typical growt pattern of Mobile, PC and TV , most responsible consumer items responsible foe e waste generation[9].

Figure 7.

Over all scenario of EEE production as per available literature in India is as represented in table 2[33]

Table 2 Showing Details of State wise E Waste Contribution in India

Sl	States	WEEE in % in India	Sl	States	WEEE in % in India
1	Maharashtra	13.88121	19	Uttarakhand	1.123886
2	Tamil Nadu	9.235316	20	Himachal	1.092317
3	Andhra Pradesh	8.751912	21	Jammu & Kashmir	1.041916
4	Uttar Pradesh	7.108937	22	Goa	0.292682
5	West Bengal	6.888625	23	Tripura	0.259058
6	Delhi	6.662478	24	Chandigarh	0.246321
7	Karnataka	6.244472	25	Pondicherry	0.194619
8	Gujarat	6.159256	26	Meghalaya	0.144903
9	Madhya Pradesh	5.341829	27	Nagaland	0.099364
10	Punjab	4.765149	28	Arunachal Pradesh	0.090188
11	Rajasthan	4.332633	29	Andaman Nicobar	0.063138
12	Kerala	4.226421	30	Mizoram	0.054647
13	Haryana	3.086305	31	Manipur	0.05451
14	Bihar	2.092461	32	Sikkim	0.053483
15	Orissa	2.011792	33	Diu & Daman	0.02794
16	Assam	1.490594	34	Dadar & Nagar Haweli	0.019928
17	Chhattisgarh	1.472242	35	Lakshadweep	0.005067
18	Jharkhand	1.384383			

In case of EEE chain, if we look at the representation from the manufacturing to consumption to waste generation chain and concentrate to outline of contaminants associated with E-waste fluxes from producers to receivers and ultimately to humans, it can be put as in the figure 8.

Figure 8 showing outline of contaminants associated with E-waste fluxes from producers to receivers and ultimately to humans.

2. SITUATION OF E WASTE & CONSTITUENTS:

Till now it is known that e waste are the non usable EEE products and ae in accumulated conditions in the backyard or in the vicinity of population or are in discarded conditions lying at places one has not marked and fixed for. The advancement is a liked parameter for ease and automation but this is emerging as a challenge and has started to grow into serious problems. Constituents which are toxic and hazardous substances make it more serious. In want of employment and livelihood handling of these substances adds to challenges and have serious affects to the persons involved in it in any condition if he is ill prepared technologically. Till date challenge of managing E-waste worldwide is dividing the nations in developed, developing and third world nations with no, little and passing on tendency preparedness ones. India's condition is far more complex and situation can be admitted to be in nascent stage[7].

Various reports including Centre for Environmental Studies indicates to the best option for dealing E-wastes as for reduce the volume of E-waste in multi approach which can include

a) Reuse, replace, reform and remove options through buy back or extended producers responsibility (EPR).
b) Efforts from designers to ensure that the product is built for re-use, repair and/or upgradeability.
c) Manufacturers approach and stress towards use of less toxic, easily recoverable and recyclable materials, which can be taken back for refurbishment, remanufacturing, disassembly and reuse.
d) Recycling and reuse of material seen as next level of potential options for reduction of E-waste.
e) Stress on recovery of metals, plastic, glass and other materials reduce the magnitude of E-waste.
f) Exploration and options for potential to conserve energy, keep environment free of toxic material that would otherwise have been released and minimization of pollution of either nature [21,25].

As constituents Hazardous Metals, Materials & Substances popularly known as organic or manmade materials in E-Wastes can be put as follows

The metals available in the e waste can be classified as hazardous and non hazardous. The hazardous are of main concern for health and other reasons where as the availability and depletion or extinction of metals which are non hazardous can be put in consideration. Metals abundantly found in e waste having harmful effects by any means are as listed herein as

Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	
Cadmium	Chromium	Cobalt	Copper	Gallium	Germanium	
Indium	Lead	Lithium	Mercury	Molybdenum	Nickel	
Selenium	Silver	Sulphur	Tin	Vanadium	Yttrium	Zinc etc.

In case of organic or manmade hazardous materials a variety of such substances can be broadly put in three categories or segments, namely Phthalates, Chlorinated compounds and Flame retardants [9,10.15,25].

Phthalates are commonly known as phthalate dieters. These constitutes non-halogenated chemicals having multiple or numerous applications as plasticizers or softeners in plastics/ PVC in form of insulating covering of wires, cables & other flexible components to basic constituents in adhesives, inks, personal care products, sealants, surface coatings solutions and materials, etc for and in EEE. Phthalates family includes discrete chemicals such as popularly known DEHP (di-ethyl-hexyl phthalate) complex isomers mixtures DINP (di-isononyl phthalate) and similar products. As a waste when these are disposed off, result in large-scale pollution causing indoor and

outdoor losses to environment. Inhalation and contaminations through food causes severe damages. Very often traces can be found in human tissues, blood, as metabolites, in urine etc samples. The phthalate very rapidly get metabolized to their monoester ethyl-hexyl phthalate forms (MEHP) which are more deadly and toxic and have harmful effects.

The DEHP and MEHP are also known as reproductive toxins. These are capable of interfering and causing harmful effects in development of female reproductive system right form tender age itself. The most extensively used popular other Butyl-benzyl phthalate (BBP) and Di-butyl phthalate (DBP) has been reported toxic and equally affecting reproduction systems. Other commonly used phthalate, namely Mono-ethyl phthalate (MEP), mono-n-butyl phthalate (MBP), mono-benzyl phthalate (MBzP), and mono-isobutyl phthalate (MiBP) are phthalates which has been correlated to decreased concentration of AGI. In case of DBP it is reported that it cannot be taken up in food chain by crops as it affects physiology and morphology of crops during growth only. The isomeric forms of phthalates namely DINP and DIDP (di-isodecyl phthalate) have been reported to have severe adverse effects on the liver and kidney with increased intake through foods contamination or inhalation through breath from polluted air.

Inspite of toxicity of phthalates, these continue to leach out of products for their life time as these continue to find use without control on markets round the globe In European Union most of the phthalates have been banned from 1999 itself which can be seen as indicator of disregard to the bans by industries and continuance of the use of banned substances in the consumer products including EEE and disrespecting the e waste menace which is inching every day and threatening the human kind [10-12,28].

Second group among manmade or organic materials are the Chlorinated compounds of which main members are Polychlorinated biphenyls (PCBs) and Chlorinated Benzenes.

PCBs is group of 209 individual organic chemical compounds known as congeners have diversified varying patterns of chlorine substitution which finds wide variety of uses and applications. The applications ranges from use in dielectrics in capacitors, plasticizers to printing inks, transformer oils, hydraulic fluids, tri & tetra chloro-benzenes as solvents, etc. Tendency of accumulation causing harmful effects to environment promulgated its production ban from 1977 but despite of this it is well finding use.[6,9,33]

Till date because of old EEE products still in phase out conditions only till date 1/3 of the banned PCBs have leached into environment and 2/3 are still waiting to penetrate when remaining old EEE will become e waste and allowed to crude disposal mainly through combustion. PCBs when burnt persist in environment as colloidal and become prime source of harm for longer periods. PCBs affect individuals through absorption through skins when one is exposed in environment, dermal exposure, inhalation, and ingestion or reaching inside through foods. Hazardous toxic exposer effects result in , behavioral changes, delayed cognitive development, endocrine systems, liver damage, neuro-toxicity, retarded growth, rise in suppression of immunological system, effects on reproductive system on both male and females, tumor promotion etc has been reported. Worldwide efforts for containing such deadly effects initiatives have been taken notably by BASEL, Stockholm, OSPAR, LRTAP and other conventions[10,12].

Chlorinated Benzenes / chloro-benzenes have chlorine ranging from one to six forming mono, di, tri, tetra, penta or hexa derivatives of benzenes. The mono, di, tri and hexa chlorinated derivatives have numerous applications as solvents and intermediaries in manufacturing of antioxidants, agricultural, dye, pigment, and pharmaceutical products. The hazardous effect have attracted bans on manufacturing of these products but still mono and di-chloro-benzenes continue to be in use and are being manufactured. While disposal of EEE products through combustion thee chlorinated benzenes persist in environment in terrestrial and aquatic forms.

The hazardousness & toxicity increases with chlorination. The effects range from affecting central nervous system, liver infection, thyroid, tumor promoter, regenerative systems, developing fetus etc. The IARC has categorized it as 2B carcinogen[9].

Flame retardants: BFR (Brominated Flame Retardants) is most common flame retardants. These days variety of names has been attributed to BFRs. Most of BFRs are banned due to their highly toxic and hazardous nature causing potential health threats. Polybrominated diphenyl ethers (PBDEs) are available in forms having uses are

PBBs, PCB, Octa BDE, Penta BDE etc. Use and application ranges from use as additives in plastics & foams for flame retardants, plastic casings of electronic equipment, cogners etc. Number of bromine molecules gives them names as di, tri, tetra, tenta, hexa, octa, deca etc. Bio accumulativeness of BDEs decreases with higher orders making lower order ones more environmentally persistent chemicals. Basic reason of toxicity & harardness is lose bonding of these with additives of plastics leading to pronounced/easy presence in environment. This is markedly evident as air dust at workplaces in high concentration. Contaminations of such organic substances can be witnessed in human's blood and milk in areas where these are commercial in use. Engaged manpower in electronic recycling & disposal activities along with residents living nearby areas where such activities take place are at high risk and level of contamination for these toxicity and harardness. Presence of highly toxic environment can lead to long term impacts affecting memory loss, endocrine (hormonal) disruption, estrogen & thyroid hormone systems affects, impairment in immune system, changes in learning & behavior etc. Combustion / burning of plastic containing PBDEs in incinerator or in open may lead to formation of brominated dioxins / furans or bromochlro dixins / furans or both which are more hazardous and toxic than chlorinated dioxins. European Union (EU) framework directives have included penta BDE in the priority hazardous substance list. Octa and penta derivatives are banned substances in EU. Use of deca depravities & all PBDEs is under prohibited list of substances under Restrictions on Hazardous Substances (RoHS) directives for EEE directives.

Triphenyl Phosphate (TPP), age old contact dermatitis substance is other most widely used flame redundant which comes from family members of triary phosphates. Phenolic & Phenyene oxide base resins find extensive use in photographic films as plasticizers and basic constituents of hydraulic fluids & oils. Presence of TPP along with other organo phosphorous in environment due to leaching from polymers has been noticed / reported. TPP to extent of 10% by weight of plastic can be present as material present as outer covers of computer monitors. Disposal of TPP which constitutes most acute hazardous and toxic of the triaryl phosphates by burning in open can cause major degradation / loss / concerns to environment by of contamination. Human blood examination and strong inhibitor of monocyte carboxyl esterase, a key enzyme in human blood cells can be seen in the contaminated areas.[13,14,27]

3. SELECTION OF SAMPLES & SAMPLING, DATA AND ANALYSIS:

Bihar state is one of the oldest states of Indian Republic and has a rich cultural heritage and varied strata of populations which is a good mix of disproportionate economical background. The have ones and have not ones are plenty with almost all types of consumers. The demography is varied and has various industrial scenarios having diverse urban and rural industrialization in clearly marked and known areas. As usual industrial sections are located in and to limited areas having traditional and upcoming products to the limits of the most recent IT sector. The connectivity of state's major urban areas from leading industrial centers is added advantage at one end & disadvantage at other. Cities are well connected to national and international centers of activities. Major traditional cities have inherent large slums areas with good mixed culture having wide known and acknowledged range of economical strata. Diverse use of technology with varied purchasing power can be well understood and seen here. Patna being state political and cultural capital, Muzaffarpur and few more cities claiming to be good cultural centers of state has many economic and industrial development pockets and centers. Technological advancement, inflow of latest gadgets and EEE products, good second grade recycling centers and centers having good repair facilities can be seen. Noticeable strong educational centers and research institutions /facilities are getting stronger in progressing days. In view of potential, growth, diversity and many more factors for the most populous Patna, Muzaffarpur, Samastipur, International border city of Motihari, Cultural city of Dharbhanga, Madhubani and condition of historical city of Gaya needs to be considered for evaluation of impacts of manmade or synthetic e waste disposal generated toxicity which is threatening the inhabitants. EEE use can be seen at peak in the areas identified due to various factors well known and guessed here. EEE inflow can be seen as a result of imports from different cities, transmigration across international borders, developed states and countries besides major leading manufacturers of country together with products of local manufacturers or assemblers.

It is a well known fact that very less organised or formal recycling and disposal centers and facilities are available in nation and Bihar is unfortunate in this area as it lacks such and is still a nightmare in this area. As traditionally in lack of these facilities e-waste have limited destinations better known as slum or waste gatherers / radddiwala, local workshops, bye back options, keeping in house at dumping place or handing over to scrap dealers for further transmigration to nearby metros are available options. Raddiwalas, workshop owners perform recycling & or

disposal activities on local basis causing gross degradation of environment resulting in exposer to locals to contaminations of highly toxic, hazardous and unknown nature. The worst affected area for detailed study by default can be visualized as areas of local repairs, recycling, disposal & burning centers in the vicinity of city located near lonely sites on banks of river / lake side or abandoned area of the selected cities. Here poor, unskilled laborers, poverty driven needy and empty stomach workforce struggling for employment & lively hood.

Once the cities has been located and identified, now identification of locations and diverse strata needs to be identified for proper study and determination of level/ extent of degradation due to these manmade toxic constituents making the environment toxic and polluted i.e. for exploration of extent of contamination by contaminants of surrounding, soils, texture, sediments in order to get most accurate and possibly reliable evaluation of content of contaminations by manmade substances proper collection of samples from most possible identified worst affected areas of region of city in similar quantity from possibly similar conditions from all sampling positions. Site visits of the surroundings were carried out and areas were identified. To best of knowledge and belief on the locals and stake holders of the affected ones and workforce engaged in it samples were obtained which represent maximum contaminations available in surrounding in order to get worst possible affected data is obtained for analysis and consideration. Data on analysis thus available will enable to get true picture of region for proper representation. Contamination, presence of contaminants, visual and analytical analysis and its hazardous effects can ascertain level of toxicity / harardness and affect / impact on human and living beings living in surrounding.

Details of sampling, preposition, details of types and locations have been tabulated in table 3. Standard /authenticated and proper weight & volume analysis was carried out in the adjoining and scientific laboratories available. Outcomes made available have been tabulated, placed along with necessary discussion on possible outcomes subsequent sections.

Table 4. Details of Samples

Sample No	Type	Location
Patna (PAT1)	Recycling/Repairing/Burning / dismantling Place	Slum / scrap dumping / waste treatment and lonely river site
Muzuzaffarpur (MUZ2)	Recycling/Repairing/Burning / dismantling Place	Slum / scrap dumping / waste treatment and lonely river site
Samastipur (SAM3)	Recycling/Repairing/Burning / dismantling Place	Slum / scrap dumping / waste treatment and lonely river site
Motihari (MOT4)	Recycling/Repairing/Burning / dismantling Place	Slum / scrap dumping / waste treatment and lonely river site
Dhrarbanga (DHR5)	Recycling/Repairing/Burning / dismantling Place	Slum / scrap dumping / waste treatment and lonely river site
Madhubani (MAD6)	Recycling/Repairing/Burning / dismantling Place	Slum / scrap dumping / waste treatment and lonely river site
Gaya(GAYA7)	Recycling/Repairing/Burning / dismantling Place	Slum / scrap dumping / waste treatment and lonely river site

By visual inspection most affected areas were identified for study. Samples in equal quantity were obtained from all seven places. Pre cleaned and rinsed with proper chemicals bottles were used for collection of samples to avoid further contamination. These carefully collected samples were sent to technical laboratories for evaluation and examination different types of organic constituents present in the samples. Results thus obtained have been tabulated in the tables listed below. Careful observation and obtained results of critical examination revealed that contamination is present in almost all samples but varies in nature from place to place. The concentration arrives from level of traces to alarming level in toxicity and harardness point of view. Some of deadly constituents are of such level that they pose threat to health, hygiene to individual beings and are reasonably responsible for degradation to environment and cause pollution of all levels. Toxicity level, degradation, and hazardous contents warrants emergent need to develop appropriate technology capable of reducing use of deadly materials and paves ways for use of environment friendly materials for maintaining environment within safe levels for living beings.

Producers / Manufacturers & Promoters, Agencies regulating safety measures and agencies responsible for safeguarding human and living beings should aim and look at it.

Details of observations obtained from the samples collected from the various spots and positions have been produced below. Here it is important to note that the numbers represent number of compounds identified in the e-waste samples from the locations / samples. These include the level of traces even case of obtained in samples.

Table 5. Details of constituents obtained.

ORGANIC COMPOUNDS	PAT1	MUZ2	SAM3	MOT4	DHR5	MAD6	GAYA7
NO. OF ORGANIC COMPOUNDS ISOLATED	163	142	131	132	79	93	121
NO. RELIABLY IDENTIFIED	87	54	69	48	26	36	59

Table 6. Constituents of Chlorinated & Brominated substances

CHLORINATED AND BROMINATED SUBSTANCES	PAT1	MUZ2	SAM3	MOT4	DHR5	MAD6	GAYA7
CHLORINATED BENZENES:							
DI-PENTA CHLORINATED	2	6	2	8		4	8
HEXA CHLORINATED	1	1	1	1	1	1	1
POLYCHLORINATED BIPHENYLS (PCBS)				7			7
CHLORINATED ALKYL BENZENES	2			2	2		2
CHLORINATED ALKANES			1	1			2

Table 7. Constituents of PBDEs.

POLYBROMINATED-DIPHENYL ETHERS PBDE	PAT1	MUZ2	SAM3	MOT4	DHR5	MAD6	GAYA7
TRI-HEPTA BROMINATED	7	6	9		3	9	7
OCTA BROMINATED	1			1		1	

Table 8. Constituents of Triphenyl Phosphate (TPP) & Phthalate Esters

TRIPHENYL PHOSPHATE (TPP) & PHTHALATE ESTERS	PAT1	MUZ2	SAM3	MOT4	DHR5	MAD 6	GAYA7
TRIPHENYL PHOSPHATE (TPP)	1			1			1
DEHP	1		1		1	1	1
DBP, DIBP, DINP	3						

Table 9. Constituents of Hydrocarbons & others.

HYDROCARBONS & OTHERS	PAT1	MUZ2	SAM3	MOT4	DHR5	MAD6	GAYA7
PAHS AND DERIVATES	5	3	9	2	4	6	4
BIPHENYL AND DERIVATIVES	2	3	7	1	1	4	1
ALKYL BENZENES	3	11	14	6	3	6	9
ALKANES AND ALKENES	15	12	18	10	5	11	12
STEROIDS & HOPANOIDS	2	3	2	4	1	7	1

Table 10. Constituents of Nitrogen compounds.

NITROGEN COMPOUNDS:	PAT1	MUZ2	SAM3	MOT4	DHR5	MAD6	GAYA7
ALKYL & ALKYL BENZENE NITRILES	1	1	3		2		1
NITRO DERIVATIVES	3			3		3	

Table 11. Constituents of Oygenated benzene derivatives

OYGENATED BENZENE DERIVATIVES	PAT1	MUZ2	SAM3	MOT4	DHR5	MAD6	GAYA7
PHENYL KETONES	1	2	1	4	1	2	1
PHENOL & DERIVATIVES	1	1	1			4	1
BENZOIC ACID ESTER				1	1	1	

Almost all samples collected reflects presence of multiple synthetic/ organic substances which have been listed in above tables listed against different heading wise tables for segments/ classes of constituents for ease of discussion. Table 5 shows the presence of no of organic compounds isolated and no of reliably identified ones among all the samples. Chlorinated benzenes presence was noticeable in all the samples in some form or the other. In case of PCBs it is present in samples 1, 3, 5 and 6. Case of PBDEs can be identified in samples of in all the samples in some form or other, even in form of traces only. The presence of TPP in sample 1, 4 & 7 : DBP, DiBP and DNP in sample 1 , while DEHP presence was evident in all except sample 2. Presence of hydrocarbons family which includes PAHs with derivatives derivates, biphenyl with its derivatives derivatives, alkyl benzenes, alkenes and alkenes and steroids & hopanoids is evident in all the samples collected i.e. obtained and tested. In case of nitrogen compounds constituents alkyl & alkyl benzene nitrides are available in all samples except sample 6 leaving nitro derivatives presence in 1,4 and 6 samples.4 only. Phenyl ketones were present in all samples compared to benzoic acid ester presence in samples 4, 5 &6 and phenol & derivatives availablility1, 3, 6 and 7 samples only.

Polychlorinated dibenzo-p-dioxins and furans (PCDD/Fs 2,3,7,8 substituted congeners) examination for sample 1 and 5 was particularly taken as these cities have age old traditions and civilization for quantitative analysis to estimate range of PCDD/Fs toxicity in terms of toxicity equivalents (TEQs). The TEQs gives concentration equivalents for toxic congener 2,3,7,8- tetrachlorodibenzo-p-dioxin popularly known as TCDD. Mass equivalents as per known conventions are obtained to get account of toxicity & harardness of individual congeners. Total TEQs for mentioned two samples obtained can be tabulated as hereunder:

Analytical results of quantification of 2,3,7,8-substituted PCDD/Fs available in samples PAT1 and DHR5

Table 12. Analytical results of samples 1 and 5

Congener	conc pg/g_s1	TEQ pg/g_s1	Log TEQ_s1	conc pg/g_s5	TEQ pg/g_s5	Log TEQ_s5
2378-TCDF	15.4	1.5	0.1760913	221	22.1	1.3443923
12378-PCDF	113.9	5.67	0.7535831	226.6	11.3	1.0530784
23478-PCDF	21.4	10.5	1.0211893	771.5	385.7	2.5862496
123478-HxCDF	49.9	5	0.69897	673.9	67.4	1.8286599
123678-HxCDF	27.4	2.7	0.4313638	443	44.3	1.6464037
234678-HxCDF	63.34	6.3	0.7993405	563.8	56.4	1.7512791
123789-HxCDF	18.6	1.9	0.2787536	185.8	18.6	1.2695129
1234678-HpCDF	296.1	2.9	0.462398	794.9	7.9	0.8976271
1234689-HpCDF	112.1	1.1	0.0413927	114	1.1	0.0413927
OCDF	971	1	0	1695.7	10.7	1.0293838
2378-TCDD	3.15	3	0.4771213	34.8	34.8	1.5415792
12378-PCDD	3.44	1.7	0.2304489	172.2	86.1	1.9350032
123478-HxCDD	16.6	1.6	0.20412	164.6	16.5	1.2174839
123678-HxCDD	24.4	2.5	0.39794	376.1	37.6	1.5751878
123789-HxCDD	15.9	1.6	0.20412	174.2	17.4	1.2405492
1234678-HpCDD	167.5	1.7	0.2304489	2524.1	25.2	1.4014005
OCDD	2461.7	2.5	0.39794	5968.3	6	0.7781513
		53.17			849.1	

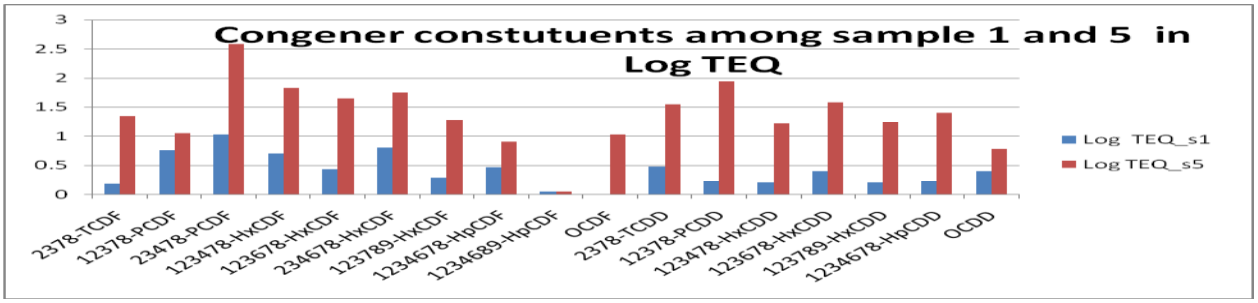

Figure 9. Showing the details of different quantitatively obtained constituents in log scale for sample 1 and 5

It can be concluded that level of PCDD/Fs in sample 1 was 53.17 pg/g TEQ which is lower than reported from sites in China and Africa but adheres in range of what is available in other areas of India. In India normal range of combustion residues for e waste combustion regions range between 80 to 180 pg/g TEQ and can go upto 675 pg/g in selective cases. The PCDD/Fs level of sample 1 site is of moderate in nature perhaps for the reason that these gets transported to other locations as per connectivity to metros. The normal ranges obtained / reported are below 1 pg/g TEQ and rarely above 10 pg/g TEQ.[11]

Sample from site 5 is however indicator of very high level of contamination particularly at order of 849.1 pg/g TEQ. The total count is somewhat below 1000 pg/g TEQ which is seen to be threshold level for serious contamination[11]. The individual PCDD/Fs compounds profiles are almost similar in two samples. The similarities can be indicator of similarities of volumes and prepositions left after open burning of e-wastes from primary sources. Figure 9 shows the graphical representation of data obtained among the comparative representation of samples collected from 1 and 5 sample/sites.

4 CONCLUSION :

The Electronic industry which has registered rapid industrialization growth particularly after second world war has given reasons to cheer but at same time has put lines on our foreheads also. The unprecedented growth has lead to many metals and manmade substances inclusion in manufacturing of EEE products. Since all equipments or services have a life span and after that they lose their credential and turn to waste which in this case is termed a E waste has many manmade and depleted virgin materials capable of reuse and some which cannot be further used. The usable ones needs technology for reuse but the non usable materials also need technology for proper disposal as they when left uncared to the unskilled persons for disposal are left in open air or burnt in air leading to multiple stages of environmental degradation. The manmade organic materials have long lasting effects and are becoming prime concern. A national survey is need of hour to ascertain toxic and hazardous degradation evaluation. In this step a survey of leading cities of Bihar was done. The situation is n more different from remaining cities in India and in particular cases it can be seen that for degradation we even match to the world worst affected areas also.

Addressing these need multiple efforts rising from careful designing of product , use of proper collection mechanism , development of proper disposal system, segregation of useful materials to reduce e waste volumes and stopping illegal trans migration of e goods for having an accountable inventory for addressing these. Global enactment to address these and in state regulating mechanism development and stringent enforcement and implementation mechanism can address to some extent. Educating masses through curricula can be an effective means to teach citizens about the harmful effects for proper situation handling also.

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