ISSN No. : 0972-1266

ENVIS Newsletter

Vol. 17 | No. 3 | August 2010

Industrial Waste

Indian Institute of Toxicology Research

August 2010 Vol. 17, No. 3

IN THIS ISSUE

EDITORIAL

Central Pollution Control Board (CPCB) in one of its report in 2009 mentioned that every year, some 36,165 industries generate 62,32,507 metric tonnes of hazardous waste (HW) in the country, out of which recyclable portion of hazardous waste is in the range of 49.5%, while land disposable portion and incinerable portion stand at 43.7% and 6.6%, respectively. Though the industries generate 4,15,794 MTA of incinerable waste annually, we have the capacity to manage just 3,27,705 MTA. Industrial solid wastes generated by the thermal power plants producing coal ash; the integrated Iron and steel mills producing blast furnace slag and steel melting slag; non-ferrous industries like aluminum, zinc and copper producing red mud and tailings; sugar industries generating press mud; pulp and paper industries producing lime and fertilizer and allied industries producing gypsum create environmental problems with high risk to exposed population. If not managed properly, this industrial hazardous waste can pollute groundwater, streams, lakes and rivers as well as cause damage to wildlife and vegetation.The EPA has five general criteria for something to be considered hazardous toxic waste. It must be a solid and have one of the following characteristics: ignitability, corrosivity, reactivity, or toxicity. In most instances, cultural uses of the term toxic waste are applied to waste materials that pose health or environmental risks. There are considerable health risks from most types of toxic waste. A number of factors magnify this risk many fold. In some cases, simple ignorance of the toxic effect of a given waste material leads to improper disposal as non-toxic waste. In othes, malicious toxic waste dumping has occurred over the years in an attempt to evade expensive waste management procedures. Small and medium sized enterprises (SMEs), however, are the major hazardous waste generators. Nearly fifty percent of the total industrial output in India is contributed by the SMEs. They also account for 60 to 65 percent of the total industrial pollution. Most of these industries generate hazardous wastes, which find their way into the environment in uncontrolled manner. The problems relating to disposal of industrial solid waste are associated with lack of infrastructural facilities and negligence of industries to take proper safeguards. The large and medium industries located in identified (conforming) industrial areas still have some arrangements to dispose solid waste. However, the problem persists with small scale industries. In some cities, industrial, residential and commercial areas are mixed and thus all waste generated through different activities gets intermingled. Therefore, it becomes necessary that the local bodies along with State Pollution Control Board (SPCB) work out requisite strategy for organising proper collection and disposal of industrial solid waste.

Editors :
Dr Poonam Kakkar
Dr Anvita Shaw

Published by :
Distributed Information Centre on Toxic Chemicals
Environmental Information System (ENVIS)
at IITR, Lucknow

ODDS AND ENDS

Health risk assessment of heavy metals via dietary intake of foodstuffs from the wastewater irrigated site of a dry tropical area of India.

The present study was conducted to assess the risk to human health by heavy metals (Cd, Cu, Pb, Zn, Ni and Cr) through the intake of locally grown vegetables, cereal crops and milk from wastewater irrigated site. Milk is not directly contaminated due to wastewater irrigation, but is an important route of food chain transfer of heavy metals from grass to animals. Heavy metal concentrations were several fold higher in all the collected samples from wastewater irrigated site compared to clean water irrigated ones. Cd, Pb and Ni concentrations were above the 'safe' limits of Indian and WHO/FAO standards in all the vegetables and cereals, but within the permissible limits in milk samples. The higher values of metal pollution index and health risk index indicated heavy metal contamination in the wastewater irrigated site that presented a significant threat of negative impact on human health. Rice and wheat grains contained less heavy metals as compared to the vegetables, but health risk was greater due to higher contribution of cereals in the diet. The study suggests that wastewater irrigation led to accumulation of heavy metals in food stuff causing potential health risks to consumers.

Food Chem Toxicol. 2010 Feb; 48(2):611-9.

Adverse reproductive and child health outcomes among people living near highly toxic waste water drains in Punjab, India.

Environmental influence plays a major role in determining health status of individuals. Punjab has been reported as having a high degree of water pollution due to heavy metals from untreated industrial effluent discharge and high pesticide consumption in agriculture. The present study ascertained the association of heavy metal and pesticide exposure on reproductive and child health outcomes in Punjab, India. A cross-sectional community-based survey was conducted in which 1904 women in reproductive age group and 1762 children below 12 years of age from 35 villages in three districts of Punjab were interviewed on a semistructured schedule for systemic and general health morbidities. Medical doctors conducted a clinical examination and review of records where relevant. Out of 35 study villages, 25 served as target (exposed) and 10 as non-target (less exposed or reference). Effluent,

Toxic Waste Water

ground and surface water, fodder, vegetables and milk (bovine and human) samples were tested for chemical composition, heavy metals and pesticides. Spontaneous abortion (20.6 per 1000 live births) and premature births (6.7 per 1000 live births) were significantly higher in area affected by heavy metal and pesticide pollution ($p<0.05$). Stillbirths were about five times higher as compared with a meta-analysis for South Asian countries. A larger proportion of children in target area were reported to have delayed milestones, language delay, blue line in the gums, mottling of teeth and gastrointestinal morbidities ($p<0.05$). Mercury was found in more than permissible limits (MPL) in 84.4% samples from the target area. Heptachlor, chlorpyriphos, beta-endosulfan, dimethoate and aldrin were found to be more than MPL in 23.9%, 21.7%, 19.6%, 6.5% and 6.5% ground water samples respectively. Although no direct association could be established in this study, heavy metal and pesticide exposure may be potential risk factors for adverse reproductive and child health outcomes.

J Epidemiol Community Health. 2010 Feb;64(2):148-54.

The Health Risk assessment of Pb and Cr leached from fly ash monolith landfill.

As of 2004, nearly two hundred thousand tons of fly ash monoliths are created each year in Taiwan to confine heavy metals for reducing the leaching quantity by precipitation. However, due to abnormal monolith fracture, poorly liner quality or exceeding usage over designed landfill capacity, serious groundwater pollution of the landfills has been reported. This research focuses on Pb and Cr leaching from monolithic landfill to assess the risk of groundwater pollution in the vicinity. The methodology combines water budget simulations using HELP model with fate and risk simulations using MMSOILS model for 5 kinds of landfill structures and 2 types of leaching models, and calculates the risk distribution over 400 grids in the down gradient direction of ground-water. The results demon-strated that the worst liner quality will cause the largest risk and the most significant exposure pathway is groundwater intake, which accounted for 98% of the total risk. Comparing Pb and Cr concentrations in the groundwater with the drinking water standards, only 14.25% of the total grids are found to be under 0.05 mg/L of Pb, and over 96.5% of the total grids are in the safety range of Cr. It indicates that Pb leaching from fly ash monolithic landfills may cause serious health risks. Without consideration of the parameters uncertainty, the cancer and noncancer risk of Pb with the sanitary landfill method was 4.23E-07 and 0.63, respectively, both under acceptable levels. However, by considering the parameters uncertainty, the non-carcinogenic risk of Pb became 1.43, exceeding the acceptable level. Only under the sealed landfill method was the hazard quotient below 1. It is important to use at least the sealed landfill for fly ash monoliths containing lead to effectively reduce health risks.

J Hazard Mater. 2009 Dec 15;172(1):316-23.

Distribution and health risk assessment of organochlorine pesticides (OCPs) in industrial site soils: a case study of urban renewal in Beijing, China.

A field survey was conducted in a contaminated industrial site of southern Beijing, China to investigate the contents and distribution of the organochlorine pesticides (alpha-, beta-, gamma-, delta-HCH, p,p'-DDT, p,p'-DDE, p,p'-DDD and o,p'-DDT) in the profiles of soil, and a health risk assessment was carried out with CalTOX multimedia exposure model. Results showed that mean concentrations of total hexachlorocyclohexane isomers- (HCHs) and total dichlorodiphenyltrichloroethane isomers (DDXs) in soils were in the range of 13.20-148.71 mg/kg, and 3.02-67.43 mg/kg, respectively. Organochlorine pesticides (OCPs) content peaked in the surface and declined in soil profile with depth. The amounts of HCHs in three profiles of soil were larger than DDXs. Composition analysis indicated that there was a trend of degradation of OCPs in the site, but the mean of HCHs and DDXs concentration were over the state warning standard limit (HCHs, 0.50 mg/kg; DDXs, 0.50 mg/kg). According to current land use development, health risk assessment with CalTOX and Monte Carlo analysis showed that health risks mainly came from two exposure pathways: dermal uptake and inhalation, and the total risk values all exceeded the general acceptable health risk value (10-6). The sensitivity analysis indicated that five parameters significantly contributed to total risk.

J Environ Sci (China). 2009;21(3) : 366 -72.

Cancer incidence in the wastewater treatment plant of a large chemical company.

To evaluate cancer incidence among employees assigned to BASF's wastewater treatment plant a retrospective cohort study including 477 male employees who had ever worked in the facility for at least 1 year since the start of operations in 1974 was conducted. Cancers were identified by review of occupational medical records and a standardized questionnaire completed by the participants or their next of kin. Confirmation through hospital records was sought for all reported cases after obtaining informed consent. Standardized incidence ratios (SIR) and 95% confidence intervals (CI) were computed using comparison data provided by the Saarland Cancer Registry. Further comparisons were made between three different subgroups of employees, working in maintenance, wastewater processing, and sewage sludge treatment. A total of 50 cancers were observed (SIR 1.14, CI 0.85-1.51). Colorectal (1.14, 0.42-2.48), bronchial (1.40, 0.67-2.57) and prostate (1.15, 0.42-2.50) were the most frequently observed cancers. Five cases of bladder cancer were found in the total cohort (1.75, 0.57-4.09), with four of them occurring in the sewage sludge treatment area (6.82, 1.86-17.46). Allowing for a 10-year lag did not significantly change the results. The overall cancer experience among employees of the wastewater treatment plant was similar to that of the corresponding general population. The finding of an excess risk for bladder cancer in one subgroup of workers was unexpected with regard to the available literature. There is no straightforward explanation for this finding, and it may be due to chance. An extended follow-up of this cohort will take place after 5 years. Annual bladder cancer screening is offered to active and retired employees from this plant for the time being. The current working conditions and work practices have been re-assessed by occupational hygienists and deemed to be safe.

Int Arch Occup Environ Health. 2009 Jul;82(7):851-6.

Accumulation of polychlorinated biphenyls and brominated flame retardants in breast milk from women living in Vietnamese e-waste recycling sites.

This study investigated the contamination status of PCBs, PBDEs and HBCDs in human and possible exposure pathways in three Vietnamese e-waste recycling sites: Trang Minh (suburb of Hai Phong city), Dong Mai and Bui Dau (Hung Yen province), and one reference site (capital city Hanoi) by analysing human breast milk samples and examining the relationships between contaminant levels and lifestyle factors. Levels of PBDEs, but not PCBs and HBCDs, were significantly higher in Trang Minh and Bui Dau than in the reference site. The recyclers from Bui Dau had the highest levels of PBDEs (20-250 ng $g^{(-1)}$ lipid wt.), higher than in the reference group by two orders of magnitude and more abundant than PCBs (28-59 ng g(-1) lipid wt.), and were also the only group with significant exposure to HBCDs (1.4-7.6 ng $g^{(-1)}$ lipid wt.). A specific accumulation, unrelated to diet, of low-chlorinated PCBs and high-brominated PBDEs was observed in e-waste recyclers, suggesting extensive exposure to these compounds during e-waste recycling activities, possibly through inhalation and ingestion of dust. The estimated infant intake dose of PBDEs from breast milk of some mothers occupationally involved in e-waste recycling were close to or higher than the reference doses issued by the U.S. EPA.

Sci Total Environ. 2010 Apr 1;408(9):2155-62.

Genotoxicity of agricultural soils in the vicinity of industrial area.

Soil samples from agricultural fields (cultivated) in the vicinity of industrial area of Ghaziabad City (India) were collected. In this city, wastewater coming from both industrial and domestic sources and without any treatment is used to irrigate the food crops. This practice has been polluting the soil and pollutants might reach the food chain. Gas chromatographic analysis show the presence of certain organochlorine (DDE, DDT, dieldrin, aldrin and endosulfan) and organophosphorus (dimethoate, malathion, methyl-parathion and chlorpyrifos) pesticides in soil samples. Samples were extracted using different solvents, i.e. methanol, chloroform, acetonitrile, hexane and acetone (all were HPLC-grade, SRL, India), and the extracts were assayed for genotoxic potential using Ames Salmonella/microsome test, DNA repair defective mutants and bacteriophage lambda systems. TA98 and TA100 were found to be the most sensitive strains to all the soil extracts tested. Methanol extracts exhibited a maximum mutagenicity with TA98 strain {540 (-S9) and 638 (+S9) revertants/g of soil} and 938 (-S9) and 1008 (+S9) revertants/g of soil with TA100 strain. The damage in the DNA repair defective mutants was found maximum with methanolic extract followed by acetonitrile, chloroform, hexane and acetone at the dose level of 40 microl/ml culture after 6h of treatment. The survival was 25, 30, 32, 33 and 35% in polA strain after 6h of treatment when tested with wastewater irrigated soil extracts of methanol, acetonitrile, chloroform, hexane and acetone, respectively. A significant decrease in the plaque forming units of bacteriophage lambda was also observed when treated with 40 microl of test samples. Present results showed that methanolic extracts of soil were more toxic than other soil extracts. The soil is accumulating a large number of pollutants due to wastewater irrigation and this practice of accumulation has an impact on soil health.

Effluent from Industries

Mutat Res. 2009 Mar 17;673(2):124-32.

Soil metal concentrations and toxicity: associations with distances to industrial facilities and implications for human health.

Urban and rural areas may have different levels of environmental contamination and different potential sources of exposure. Many metals, i.e., arsenic (As), lead (Pb), and mercury (Hg), have well-documented negative neurological effects, and the developing fetus and young children are particularly at risk. Using a database of mother and child pairs, three areas were identified: a rural area with no increased prevalence of mental retardation and developmental delay (MR/DD) (Area A), and a rural area (Area B) and an urban area (Area C) with significantly higher prevalence of MR/DD in children as compared to the state-wide average. Areas were mapped and surface soil samples were collected from nodes of a uniform grid. Samples were analyzed for arsenic (As), barium (Ba), beryllium (Be), chromium (Cr), copper (Cu), lead (Pb), manganese (Mn), nickel (Ni), and mercury (Hg) concentrations and for soil toxicity, and correlated to identify potential common sources. ArcGIS was used to determine distances between sample locations and industrial facilities, which were correlated with both metal concentrations and soil toxicity. Results indicated that all metal concentrations (except Be and Hg) in Area C were significantly greater than those in Areas A and B ($p <$ or $= 0.0001$) and that Area C had fewer correlations between metals suggesting more varied sources of metals than in rural areas. Area C also had a large number of facilities whose distances were significantly correlated with metals, particularly Cr (maximum $r=0.33$; $p=0.0002$), and with soil toxicity (maximum $r=0.25$; $p=0.007$) over a large spatial scale. Arsenic was not associated with distance to any facility and may have a different anthropogenic, or natural source. In contrast to Area C, both rural areas had lower concentrations of metals, lower soil toxicity, and a small number of facilities with significant associations between distance and soil metals.

Industrial-Wastewater

Sci Total Environ. 2009 Mar 15;407(7):2216-23.

Quantification and distribution of heavy metals from small-scale industrial areas of Kanpur city, India.

Kanpur city has large number of small-scale industries (SSIs), primarily comprising of textile and leather industries. This study inventorises the presence of heavy metals in the samples collected from

Panki and Jajmau Industrial Areas of Kanpur city. The bulk concentration of heavy metals found in solid waste samples was Fe as 1885 and 2340 mg/kg, Mn 173 and 445 mg/kg, Zn 233 and 132 mg/kg, Cu 20 and 28 mg/kg, Cd 1.4 and 1.1mg/kg, Ni 26 and 397 mg/kg, Pb 107 and 19 mg/kg, Cr 1323 and 734 mg/kg, respectively. Heavy metal concentration was also found to be high in soil and road dust samples viz. Ni and Pb were in higher concentration in few samples, whereas Cr was found in higher concentration in all samples than the recommended values of USEPA and specifications for compost quality contained in the Indian Municipal Solid Wastes (Management and Handling) Rules, 2000. The heavy metal pollution so detected is indicative of contamination in ground and surface water and food chain. This raises concerns pertaining to adverse consequences to environment and human health.

J Hazard Mater. 2009 Dec 30;172(2-3):1145-9.

Engineered nanoparticles in wastewater and wastewater sludge--evidence and impacts.

Nanotechnology has widespread application in agricultural, environmental and industrial sectors ranging from fabrication of molecular assemblies to microbial array chips. Despite the booming application of nanotechnology, there have been serious implications which are coming into light in the recent years within different environmental compartments, namely air, water and soil and its likely impact on the human health. Health and environmental effects of common metals and materials are well-known, however, when the metals and materials take the form of nanoparticlesconsequential hazards based on shape and size are yet to be explored. The nanoparticles released from different nanomaterials used in our household and industrial commod-ities find their way through waste disposal routes into the wastewater

Agroindustrial WasteWater

treatment facilities and end up in wastewater sludge. Further escape of these nanoparticles into the effluent will contaminate the aquatic and soil environment. Hence, an understanding of the presence, behavior and impact of these nanoparticles in wastewater and wastewater sludge is necessary and timely. Despite the lack of sufficient literature, the present review attempts to link various compartmentalization aspects of the nanoparticles, their physical properties and toxicity in wastewater and wastewater sludge through simile drawn from other environmental streams.

Waste Manag. 2010 Mar;30(3):504-20.

Isolation of lipase and citric acid producing yeasts from agro-industrial wastewater.

Production of agro-industrial waste pollutants has become a major problem for many industries. However, agro-industrial wastes also can provide alternative substrates for industry and their utilization in this manner may help solve pollution problems. The aim of this study was to isolate yeasts from wastewater treatment plants that could be used to remove pollutants such as glycerol, paraffin and crude oil from the agro-industrial wastewater. In this study a total of 300 yeast isolates were obtained from samples of agro-industrial wastes, and two strains (M1 and M2) were investigated for their ability to produce valuable products such as lipase and citric acid. Identification tests showed that these isolates belonged to the species *Yarrowia lipolytica*. The *Y. lipolytica* M1 and M2 strains produced maximum levels of lipase (11 and 8.3U/ml, respectively) on olive oil, and high levels of citric acid (27 and 8g/l, respectively) on citric acid fermentation medium.

N Biotechnol. 2010 Sept. 30; 27(4): 337-40.

Electrochemical oxidation and reuse of tannery saline waste-water.

In this present work, electrochemical treatment of saline wastewater with organic (protein) load was studied. The influence of the critical parameters of electro-oxidation such as pH, period, salt concentration and current density on the reduction of organic load was studied using graphite electrodes. It was found that current density of 0.024 $A/cm^{(2)}$ for a period of 2 h at pH 9.0 rendered best

Tannery Pollution

results in terms of reduction in COD and TKN. The energy requirement for the reduction of 1 kg of TKN and 1 kg of COD are 22.45 kWh and 0.80 kWh respectively at pH 9 and 0.024 $A/cm^{(2)}$. Reuse experiments were conducted at commercial scale. One of the saline waste streams in leather manufacturing process, pickling was treated and reused continuously thrice. The characteristics of the waste stream and the quality of the leathers indicate that the reuse of saline streams with intermittent electrochemical treatment is feasible.

J Hazard Mater. 2010 Aug 15;180(1-3):197-203.

Vermifilters: a tool for aerobic biological treatment of herbal pharmaceutical wastewater.

Herbal pharmaceutical wastewater possesses high chemical oxygen demand (COD) (21,960-26,000 mg/l) and biochemical oxygen demand (BOD) (11,200-15,660 mg/l) and suspended solids (SS) (5,460-7,370 mg/l). It cannot be directly discharged into surface water bodies, due to its highly biodegradable nature. Herbal pharmaceutical wastewater has been treated by using vermifilter, which is an ecosystem consisting of biosoil with bacteria and earthworms producing vermicastings. In the present studies a cost-effective, eco-friendly and sustainable method has been applied for the treatment of herbal pharmaceutical wastewater using earthworms. Studies were carried out at different organic loadings, ranging between 0.8 and 3.2 kg COD/$m^{(3)}$day at three different hydraulic loadings of 1, 2 and 4 days. Vermifilters packed with 1:1:1 ratio of soil, sand and vermicast as media matrix along with the twenty adult earthworms in each reactor was used for the experiments. Treated effluent was colour and odour free. Efficient COD/BOD removals in the range of 85.44%-94.48% and 89.77%-96.26% were obtained respectively at 2 days hydraulic retention time (HRT). Heavy metal removals were also observed and no sludge production problem was encountered, only nutrient rich vermicast from the filters were removed and analysed after the experiments. It showed higher manurial value than control in terms of available nitrogen, phosphorus and potassium (NPK) and were in the range of 178.75-278.75 Kg/hectare available nitrogen, 16.12-50.4 kg/hectare of available phosphorus and 19.3-28.6 kg/hectare of available potassium at maximum HRT and at different organic loadings. This paper discusses in detail the feasibility of vermifilters in herbal pharmaceutical wastewater treatment at different organic and hydraulic loadings.

Water Sci Technol. 2010;61(9):2375-80.

Wet air oxidation of epoxy acrylate monomer industrial wastewater.

Epoxy acrylate monomer industrial wastewater contained highly concentrated and toxic organic compounds. The wet air oxidation (WAO) and catalytic wet air oxidation (CWAO) were used to eliminate pollutants in order to examine the feasibility of the WAO/CWAO as a pre-treatment method for the industrial wastewater. The results showed that in the WAO 63% chemical oxygen demand (COD) and 41% total organic carbon (TOC) removals were achieved and biological oxygen demand ($BOD_{(5)}$)/COD ratio increased from 0.13 to 0.72 after 3h reaction at 250 ^{0}C, 3.5MPa and the initial concentration of 100$g_{(COD)}$/L. Among homogenous catalysts ($Cu^{(2+)}$, $Fe^{(2+)}$, $Fe^{(3+)}$ and $Mn^{(2+)}$ salts), $Cu^{(2+)}$ salt exhibited better performance. CuO catalyst was used in the CWAO of the wastewater, COD and TOC conversion were 77 and 54%, and good biodegradability was achieved. The results proved that the CWAO was an effective pre-treatment method for the epoxy acrylate monomer industrial wastewater.

J Hazard Mater. 2010 Jun 15;178(1-3):786-91.

Potential of constructed wetland systems for treating tannery industrial wastewater.

This paper reports on findings of a study on the performance of two units of a Horizontal Sub-Surface Flow Constructed Wetland (HSSFCW) units in treating wastewater effluent from a tannery industry. One of the HSSFCW units was planted with macrophytes, while the other was used as a control (without plants). Wastewater was fed into the wetland units at the mean flow rate of 0.045+/-0.005 $m^{(3)}$/day. The studied parameters were chromium, turbidity, salinity, Total Dissolved Solids (TDS), Electric Conductivity (EC), pH and temperature. The mean Hydraulic Retention Time (HRT) was 1.60 days (in the control) and 1.80 days (in the vegetated) units, obtained as a ratio of the volume of the wastewater and the volumetric flow rate of wastewater through the units while taking into consideration the porosity of the media. The vegetated HSSFCW exhibited higher chromium removal efficiency (99.83%), than the control unit with the removal efficiency of 92.53%. High chromium removal was associated with both high temperature as well as high pH values in the HSSFCW units. The reduction in turbidity was found to be 71% in the vegetated wetland unit while the corresponding value for the control unit was 66%. Results obtained indicated low reduction efficiencies of both EC (0.3% in the vegetated unit and 1.6% in the control unit) and salinity (11% in the vegetated unit and 22% in the control unit) in the two mesocosms. However, the study demonstrated that constructed wetlands can be used as an option for improving the quality of tannery effluents especially in the removal of chromium. Chromium removal might have been effected by, among others, gravitational settling of solids and formation of co-precipitation with insoluble compounds as well as adsorption on the substrates and plant surfaces.

Water Sci Technol. 2010;61(4):1043-52.

EXAMPLES OF HAZARDOUS WASTE GENERATED BY INDUSTRIES AND BUSINESSES	
WASTE GENERATOR	**WASTE TYPE**
Chemical Manufactures	Acids and Bases Spent Solvents Reactive Waste Wastewater Containing Organic Constituents
Printing Industry	Heavy Metal Solutions Waste Inks Solvents Ink Sludges Containing Heavy Metals
Petroleum Refining Industry	Wastewater Containing Benzene & other Hydrocarbons Sludge from Refining Process
Leather Products Manufacturing	Toluene and Benzene
Paper Industry	Paint Waste Containing Heavy Metals Ignitable Solvents
Construction Industry	Ignitable Paint Waste Spent Solvents Strong Acids and Bases
Metal Manufacturing	Sludges containing Heavy Metals Cyanide Waste Paint Waste

Source: *Environmental Protection Agency,* Solving the Hazardous Waste Problem: EPA's RCRA Program *(Washington, DC: EPA, November 1986), 8.*

DID YOU KNOW ?

India is the first country that has made constitutional provisions for protection and improvement of the environment. In the Directive Principles of State Policy of the Constitution, Article 48-A of Chapter IV enjoins the state to make endeavour for protection and improvement of the environment and for safeguarding the forest and wild life of the Country. In Article 51 A (g) of the Constitution, one of the fundamental duties of every citizen of India is to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures.

Nek Chand's Industrial Waste Rock Garden in Chandigarh, India is one among the worlds most radical recyling projects

http://webecoist.com/2009/01/06/creative-alternative-recycling-projects-art/

CURRENT CONCERNS

- There are no specific disposal sites where industries can dispose their waste.
- Mostly, industries generating solid waste in city and town limits are of small scale nature and even do not seek consents of SPCBs/PCCs
- Industries are located in non-conforming areas and as a result they cause water and air pollution problems besides disposing solid waste.
- Industrial estates located in city limits do not have adequate facilities so that industries can organise their collection, treatment and disposal of liquid and solid waste;
- There is no regular interaction between urban local bodies and SPCBs/PCCs to deal such issues relating to treatment and disposal of waste.
- Issuance of licenses in non-conforming areas.

REGULATORY TRENDS

In order to manage hazardous waste (HW), mainly solids, semi-solid and other Industrial wastes which are not covered by the Water & Air Acts, and also to enable the authorities to control handling, treatment, transport and disposal of waste in an environmentally sound manner, Ministry of Environment & Forests (MoEF). Government of India notified the Hazardous Waste (Management & Handling) Rules (HWM Rules) on July 28, 1989 under the provisions of the Environment (Protection) Act, 1986 and was further amended. Separate Rules have also been notified in continuation of the above Rules for bio-medical wastes as well as used lead acid batteries. India is a Party to the Basel Convention on transboundary movement of hazardous wastes.

ON THE LIGHTER SIDE

Chemical formula for water

Little Johnny's teacher asks, "What is the chemical formula for water?"
Little Johnny replies, "H I J K L M N O"!!
The teacher, puzzled, asks, "What on Earth are you talking about?"
Little Johnny replies, "Yesterday you said it was H to O!"

CONFERENCES

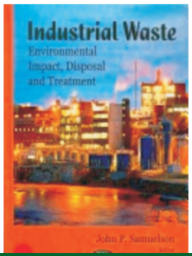
WASTE EXPO
May 9–11 2011
Dallas Convention Center,
Dallas, Texas
http://www.wasteexpo.com/wasteexpo2011/public/enter.aspx

The Second International Conference "Hazardous and Industrial Waste management"
October 5th - 8th, 2010.
Technical University of Crete
Department of Environmental Engineering University Campus, 73100, Chania Crete, GREECE
http://www.hwm1.tuc.gr/

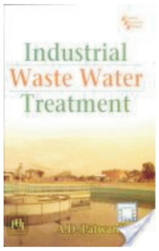
Waste & Recycle 2010 Conference
Our Generation: How does it measure up?
14–17 September 2010
The Esplanade Hotel Fremantle, Western Australia
http://www.wasteandrecycle.com.au/

BOOK STOP

Industrial Waste: Environmental Impact, Disposal and Treatment
Editor: John P. Samuelson
Nova Science Pub Inc, 2009
ISBN 1606927205, 9781606927205
420 pages



Industrial Waste Water Treatment
Patwardhan
PHI Learning Pvt. Ltd., 2008
ISBN 8120333500, 9788120333505
292 pages



MINI PROFILE OF CHLORINE

SYNONYMS: bertholite-/warfare-gas/-; chloor- (Dutch); chlore- (French); chlor- (German); chlorine-mol-; cloro- (Italian and Spanish)

CAS RN: 7782-50-5

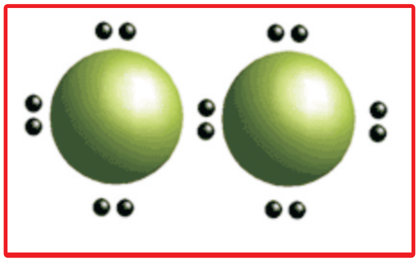
MOLECULAR FORMULA: Cl_2

MOLECULAR WEIGHT: 70.906

PROPERTIES: greenish-yellow; suffocating, pungent, irritating; bp -34.04 ^{0}C; mp -105.5 ^{0}C ; corrosive: chlorine will attack some forms of plastics, rubber, and coatings; solubilities: 310 cc/100 cc water @ 10 deg c.

ANALYTICAL METHOD: Ion Chromatography and Colorimetry

USES: manufacture of chlorinated lime used in bleaching all kinds of fabric; manufacture synthetic rubber and plastics; for purifying water; detinning and dezincing iron; disinfecting



MOLECULAR STRUCTURE:

OCCUPATIONAL SAFETY PARAMETERS: may be fatal if inhaled or absorbed through skin. Fire will produce irritating, corrosive and/or toxic gases. Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite. Runoff from fire control may cause pollution.

METABOLISM: Chlorine persists as an element only at a very low pH (less than 2), and at the higher pH found in living tissue it is rapidly converted into hypochlorous acid. In this form, it apparently can penetrate the cell and form N-chloro-derivatives that can damage cellular integrity.

TOXICITY DATA:
ihl-rat LC_{50} :293 ppm/1H
ihl-mus LC_{50} :137 ppm/1H
ACGIH TLV-TWA 0.5 ppm;STEL 1 ppm

Route	Symptoms	First Aid	Target Organ
Inhalation	Burning of eyes, nose and mouth; lacrimation, rhinorrhea; coughing, choking and substernal pain; nausea, vomiting; headache, dizziness; syncope; pulmonary edema; pneumonia; hypoxemia; dermatitis; eye and skin burns	Move to fresh air. If breathing has stopped, give artificial respiration (but NOT mouth-to-mouth). If breathing is difficult, give oxygen. Flush affected areas with plenty of water. Do not rub affected areas.	Respiratory system, skin, eye
Contact	Eye and skin burns	Flush affected areas with plenty of water	Eye, skin

PERSONAL PROTECTION: use impervious clothing, gloves, face shields (8 inch minimum), and other appropriate protective clothing necessary to prevent skin contact with liquid chlorine, and to prevent skin from becoming frozen from contact with vessels containing liquid chlorine.

HANDLING AND STORAGE: Spill or Leak: Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire. Do not touch or walk through spilled material. Keep combustibles (wood, paper, oil, etc.) away from spilled material. Stop leak if you can do it without risk. Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material. Do not direct water at spill or source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. Prevent entry into waterways, sewers, basements or confined areas. Isolate area until gas has dispersed. Ventilate the area. As an immediate precautionary measure, isolate spill or leak area for at least 100 meters (330 feet) in all directions. Keep unauthorized personnel away. Stay upwind. Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks). Keep out of low areas. Ventilate closed spaces before entering.

MAY WE HELP YOU

To keep abreast with the effects of chemicals on environment and health, the ENVIS Centre of Indian Institute of Toxicology Research, deals with:

- **Maintenance of toxicology information database on chemicals**
- **Information collection, collation and dissemination**
- **Toxic chemical related query response service**
- **Preparation of monograph on specified chemicals of current concern**
- **Publishing Abstract of Current Literature in Toxicology**

for further details do write to

Scientist In-Charge

ENVIS CENTRE

INDIAN INSTITUTE OF TOXICOLOGY RESEARCH

Post Box# 80, Mahatma Gandhi Marg, Lucknow-226 001 India.
Phone : (0522) 2284 591, Fax : (0522) 2628227
Email : itrc@envis.nic.in
web : http://www.itrcenvis.nic.in; http://www.envisiitr.org.in