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A brief analysis of different pollutants industrial effluents on growth and yield, biochemicals and bio-accumulations of heavy metals

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Abstract

This research work analysed the quality of some important physico-chemical parameters of industrial effluents collected from different industrial area. Various sources of pollutants industrial effluents containing heavy metals pose a threat to the ecosystem. These metals are present in the waste water of different industries such as metal cleaning, plating baths, refineries, mining, electroplating, paper and pulp, paint, textile and tanneries. Water used in these industries creates a waste that has potential hazards for our environment because of the introduction of various contaminants such as heavy metals into soil and water resources. Presence of pollutants in effluent is a common environmental hazard since the toxic metal ions dissolved can ultimately reach the top of the food chain and becomes a risk factor for human beings.

Keywords: pollutants industrial effluents, environment

Introduction

Industrial development is essential for the economic growth of every country. Unfortunately, many industries are not able to manage their wastes and so dispose them into nearby water bodies such as rivers and lagoons. Wastes from industries usually contain toxic substances which pollute the sink (water, air or land) in which they are released into. According to Kannj and Achi (2011) [6], effluent discharges from industries have polluted many water bodies in most part of the world. The chemicals in these industrial effluents are detrimental and threaten the lives of fauna and flora in the environment. For instance, heavy metals in industrial effluents can enter the food chain and bio-accumulate in organisms in higher trophic level which can be lethal to them at a certain concentration.

Tthat fresh water resources are important but are being contaminated uncontrollably through industrial effluent and anthropogenic activities. The rate at which industrial wastewaters are released into streams and rivers in Ghana is high so there is the need to check their quality before releasing them into the environment. For instance, reported that the Onukpawahe stream at the Tema Motorway Industrial Area in Ghana can no longer undergo the natural self-purification process as good quality water source. They attributed the cause to high release of industrial effluent. In their study, a general increase in concentrations of physicochemical and microbial parameters was reported.

Until recently, the ultimate aim of the companies were considered to be profit making. By maximizing profit they were considered to be serving best interests of the interest groups. Traditionally environmental protection was considered to be external to corporate affairs but in modern times, the traditional view has lot its value. Now companies are considered to be having some responsibility other than profit maximization. The private organization in recent times are expected to adopt environmentally sound behavior which must add some value to the society at large or at least they are expected not to adversely affect the environment around them. In the emerging global economy, where the internet, the mass media and the information revolution throw light on business practices around the world, companies are more frequently judged on the basis of their environmental practices. These new demands create immense pressure over the companies with regard to environment protection and sustainability.

The roles of companies have been changing in recent years. The classical belief that company's only aim is earning profit has taken a back seat with the companies becoming an active partner in environmental protection. Globalization, which resulted into economic growth, gave rise to a; number

of interrelated concerns in the social and environmental realms. These include destruction of the environment by the companies also. This pressurized the companies to behave in a socially responsible manner through corporate self-regulation and voluntary initiative. As a result neo-classical theory was accepted which viewed that environmental protection -and economic growth are not always in conflict and this led to the rise of concept called corporate social and environmental responsibility (hereafter referred to as CSR).

CSR is the continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families, as well as of the local community and society at large CSR stresses on achieving commercial success in ways that honour ethical values and respect the natural environment. It is usually taken to include environmental, social and human rights - based initiatives of companies which encourage environmental friendly trade practices.

Environment Protection And CSR: Reality

Always arguments are made by the corporations that they are making their industries environment friendly but it always becomes only to say, never comply with. The corporate houses claim that they are incorporating the CSR agenda for making their corporations environment and human friendly but the reality is somewhat different. Actually corporations wants there shareholders benefited. There are various reports which shows that main source of environment pollution is made by the industries. Industries for maximizing their profits, degrade the environment and pollute it, in the following way:

- Use of natural resources by industries, as it destroys nature and affects the natural environment. Cotton, textile, paper, iron, coal, oil, fodder, plywood, food processing, etc. all need natural products as raw materials. Thus increasing needs of industries have resulted in over exploitation and stress on natural resources.
- Residues of industries known as effluents are released in water and land without any treatment which pollutes the water and land, effecting the aquatic life and underground water.
- Fossil fuel used by industries like coal, kerosene, diesel, and atomic energy also pollutes the air in the form of smoke and radioactive particles.
- Noise, also a major by-product of industries and industrial products causes noise pollution.
- Industrial wastes – particularly hazardous waste and radioactive waste- have also become a major environment pollution problem.

There are variety of cases has been occurred which shows that due to over exploitation of natural resources and industrial wastes, the human generation was in danger. The Bhopal Holocaust (1984), where more than 3000 person died and about 2 lakh were affected by the leakage of MIC gas, Love Canal Incident of USA (1978) where residents of an area were evacuated and the US Government spent more than $30 million in a cleanup operation, Seveso Incident in North Italy (1976) where contaminated debris, contained in steel drums, were disposed of innocuously with barrels of vinegar in a pickle factory and it played havoc later on. Methyl-mercury poisoning in the Minamata Bay (Japan, 1956-80) caused by the industrial release of Methyl and Mercury compounds resulted in several deaths and several types of diseases including pre-natal brain damage, nuclear accidents at The Three Mile Island, nuclear power station of the USA in 1979 and Chernobyl in the then USSR are representative sample of the works kind of threat to the present generation and to posterity by the industrialization. Studies of these incidents reveal various kinds of short-term and long-term effects on human beings, flora and fauna. A complete list of the various kinds of ailments and reversible and non-reversible effects is still to be drawn up. Some ill effects have been identified and evaluated and some have not been realized. The evaluation is not easy.

Analysis of sensitivity potential of different cultivars of *Brassica juncea* L. to 10,50,75 and 100 percent concentrations of the distillery + sugar and organic industry effluents reveals that the effluents affect the plants adversely. Findings of the present investigation are regarding the effects of different effluents on germination seedling length, growth and yield, biochemicals and bio-accumulations of heavy metals among the various cultivars of *Brassica juncea* L. (Table 1, 4).

Different effluents showed inhibitory effects on seed germination. Reduction in seed germination percentage was observed as 7.29, 11.5 and 20.83 percent in cultivar Swarna treated with 50, 75 and 100 percent distillery + sugar effluents. Reduction in seed germination percentage was noticed as 21.26 percent in cultivar Pusa bold as 32.96 percent in Varuna and as 31.40 percent in Kranti at 100 percent concentration of distillery + sugar effluent, whereas in organic effluent, germination with 5.62 and 22.91 percent reduction was observed in 10 and 100 percent effluent concentration respectively, in Swarna. 27.90, 35.40 and 41.40 percent reduction was observed in cultivar Pusa bold, Varuna and Kranti at 100 percent concentration. Lowest (10%) concentration of distillery + sugar effluent had little or no effect on seed germination, though this concentration increased the growth.

Table 1: Bio-accumulation of heavy metals (ppm) in different parts of *Brassica juncea* cv. Swarna treated with different concentration of organic industry effluent. Plant Part – Stem

Attribute	Effluent concentration (%)				
	0	10	50	75	100
Cadmium	0.94	2.64	7.91	8.22	8.91
Arsenic	–	3.14	5.02	5.52	6.11
Nickel	0.55	1.11	5.16	5.81	6.02
Manganese	11.84	15.14	16.28	17.02	18.12
Zinc	22.11	22.68	29.12	31.56	32.81
Mercury	2.21	2.39	1.18	5.82	6.17
Lead	2.25	2.91	3.17	1.89	5.09

Plant Part – Leaf

Attribute	Effluent concentration (%)				
	0	**10**	**50**	**75**	**100**
Cadmium	0.87	1.17	6.21	6.81	7.62
Arsenic	–	5.12	5.93	6.23	6.58
Nickel	0.51	2.87	3.62	1.02	1.21
Manganese	19.51	20.18	21.17	25.11	26.84
Zinc	28.30	29.21	33.28	31.20	35.11
Mercury	1.62	1.87	2.91	3.20	3.59
Lead	1.08	2.17	3.82	3.97	1.24

Plant Part – Ear

Attribute	Effluent concentration (%)				
	0	**10**	**50**	**75**	**100**
Cadmium	0.83	3.82	1.17	1.62	1.91
Arsenic	–	2.10	3.87	1.11	1.54
Nickel	0.63	2.67	3.54	3.98	1.31
Manganese	7.54	9.62	11.52	11.97	12.81
Zinc	21.32	23.10	25.28	26.28	27.11
Mercury	0.92	1.12	2.09	2.62	2.91
Lead	1.06	1.71	3.11	3.54	3.87

Table 2: Bio-accumulation of heavy metals (ppm) in different parts of *Brassica juncea* cv. Pusa bold treated with different concentration of organic industry effluent.

Plant Part – Stem

Attribute	Effluent concentration (%)				
	0	**10**	**50**	**75**	**100**
Cadmium	0.91	3.87	7.17	8.67	9.32
Arsenic	–	2.51	5.91	6.58	7.24
Nickel	0.63	3.67	5.82	6.02	6.23
Manganese	15.93	16.87	18.91	19.54	20.12
Zinc	21.21	27.81	31.54	32.68	31.17
Mercury	2.42	3.11	5.81	6.52	6.91
Lead	2.43	3.58	1.11	1.91	5.51

Plant Part – Leaf

Attribute	Effluent concentration (%)				
	0	**10**	**50**	**75**	**100**
Cadmium	0.90	3.54	5.61	6.92	7.91
Arsenic	–	3.97	5.11	6.24	6.87
Nickel	0.58	2.51	3.92	1.29	1.91
Manganese	20.17	21.67	21.16	25.57	27.61
Zinc	29.87	30.91	31.28	36.17	37.28
Mercury	1.73	2.03	2.93	3.24	3.87
Lead	1.24	1.48	2.71	3.28	1.57

Plant Part – Ear

Attribute	Effluent concentration (%)				
	0	**10**	**50**	**75**	**100**
Cadmium	0.91	3.11	1.87	1.91	5.02
Arsenic	–	2.87	3.87	1.11	1.62
Nickel	0.71	2.91	3.91	1.04	1.34
Manganese	9.27	11.24	12.54	12.87	13.17
Zinc	21.91	23.68	25.97	27.11	28.27
Mercury	0.81	1.91	2.54	2.87	3.01
Lead	1.13	2.22	2.93	3.13	3.97

Table 3: Bio-accumulation of heavy metals (ppm) in different parts of *Brassica juncea* cv. Varuna treated with different concentration of organic industry effluent.

Plant Part – Stem

Attribute	Effluent concentration (%)				
	0	10	50	75	100
Cadmium	0.92	1.89	8.91	10.81	11.62
Arsenic	–	3.67	7.62	8.23	8.91
Nickel	0.68	1.80	5.29	6.23	7.68
Manganese	16.71	18.71	21.62	22.50	23.18
Zinc	25.28	28.13	33.18	35.17	37.14
Mercury	2.51	3.09	5.97	6.28	7.53
Lead	2.47	3.73	5.70	6.02	6.28

Plant Part – Leaf

Attribute	Effluent concentration (%)				
	0	10	50	75	100
Cadmium	0.90	1.79	7.51	7.93	8.27
Arsenic	–	5.90	6.90	8.75	9.28
Nickel	0.62	1.32	5.32	5.87	6.93
Manganese	21.62	27.49	28.87	29.73	31.62
Zinc	30.87	37.24	41.24	46.24	48.90
Mercury	2.01	3.11	1.08	1.54	1.68
Lead	1.54	2.87	1.82	5.11	5.79

Plant Part – Ear

Attribute	Effluent concentration (%)				
	0	10	50	75	100
Cadmium	0.93	3.91	5.08	5.12	6.91
Arsenic	–	2.87	1.93	5.13	5.90
Nickel	0.78	3.51	1.41	1.79	5.28
Manganese	9.32	12.11	11.20	15.82	16.71
Zinc	22.87	26.28	31.18	36.24	39.82
Mercury	0.91	3.81	1.91	5.22	5.62
Lead	1.34	1.11	5.27	5.91	6.30

Table 4: Bio-accumulation of heavy metals (ppm) in different parts of *Brassica juncea* cv. Kranti treated with different concentration of organic industry effluent.

Plant Part – Stem

Attribute	Effluent concentration (%)				
	0	10	50	75	100
Cadmium	0.90	6.24	11.71	13.67	15.93
Arsenic	–	7.11	9.62	10.44	11.81
Nickel	0.70	6.93	10.54	12.61	13.75
Manganese	15.67	20.60	28.24	31.28	31.87
Zinc	26.28	31.28	40.15	42.61	45.28
Mercury	2.62	6.13	8.24	8.62	9.28
Lead	2.71	5.28	7.13	7.94	8.24

Plant Part – Leaf

Attribute	Effluent concentration (%)				
	0	10	50	75	100
Cadmium	0.93	5.91	9.32	11.30	13.24
Arsenic	–	8.24	13.87	15.08	17.82
Nickel	0.69	1.73	7.28	8.67	9.71
Manganese	22.59	28.11	33.18	35.11	37.54
Zinc	28.24	33.71	47.31	51.02	55.93
Mercury	1.87	3.02	1.87	5.19	5.62
Lead	1.41	3.15	5.63	6.28	6.93

Plant Part – Ear

Attribute	Effluent concentration (%)				
	0	**10**	**50**	**75**	**100**
Cadmium	0.98	1.67	7.11	8.87	10.13
Arsenic	–	5.13	8.29	8.93	9.17
Nickel	0.83	3.87	8.87	7.83	8.29
Manganese	10.32	12.41	19.17	21.54	23.24
Zinc	27.17	31.24	40.28	43.83	48.93
Mercury	1.02	2.75	5.87	6.93	7.53
Lead	1.38	3.40	6.21	8.47	9.24

Defamation of CSR

The well accepted definition of CSR is not a common term; MNC's prefers sustainable development or sustainable business while several Indian companies talk about responsible business or Triple P (People, Planet and Profit). It is important to note that Indian companies and stakeholders grave a broader definition of CSR than MNC and stakeholders. According to the Indian Corporate: "Sustainable development implies optimizing financial position while not depleting social and environmental aspects and CSR implies supporting issues related to children, women and environment".

These corporate refer in its definition of CSR to community development. In the context of Western community, development is often seen as charity. In the Indian context it is seen as a large responsibility of a corporate, not only by stakeholders but also by the local Indian management. The background of this is that stakeholders see the large western companies as capitalist islands in a developing country. This position gives them a certain responsibility towards the community. Most of the MNC's leave room to their Indian daughter company to develop initiatives in this field; sometimes they have a special fund.

Nearly all leading corporate in India are involved in corporate social responsibility (CSR) programs in areas like education, health, livelihood creation; skill development, and empowerment of weaker sections of the society. Notable efforts have come from the Tata Group, Infosys, Bharti Enterprises, ITC Welcome Group, Indian Oil Corporation among others.

Theory of Environmental Social Responsibility

Milton Friedman as most known defender of the Classical theory of company's responsibility was of the view that "the social responsibility of business is to increase its profits'". Milton in his work stated "that there is one and only one social responsibility of business to use its resources and engage in activities designed to increase its profits, so long as it stays within the rules of the game, which is to say, engages in open and free competition without deception."

The proponents of this theory did not believe in any investment by the company other than those which accelerates the business of the company. Environment Preservation and Companies were considered as poles apart. Thus it was firmly accepted practice that anything which incurs liability on the company must be rejected. According to Des Jardins, "the classical model of social responsibility denies that businesses have any direct environmental responsibility." The classical model did advise companies to increase profits only so long as there was no deception or fraud. However, this did not hold corporations environmentally responsible for a great deal. The theory expounded that companies services the environmental goals not by taking on any special environmental responsibility, ·but by fulfilling its function within a free market economic system.

The classical approach failed to give explanation for the environmental degradation. Thus it can be said that the classical theory did not pay need to preservation of environment and it stood only for the profit maximization of the companies. Hence this view cannot be accepted in the present context when there is growing awareness for the preservation of the environment and fixing liability for its destruction.

But in recent times it is providing otherwise the company's orientation has changed from mere profit making to social developments. The Neoclassical approach emerged as an improved and further developed model of the classical model to overcome the deficiencies of the later. 'Rules of the game' given by Friedman are evolving quickly, and the range of issues that companies are expected to address are expanding over time. Friedman was right that companies must stay within 'the rules of the game' - but he did not predict how pervasive those rules would become. For the companies of the 21st century, a properly balanced approach to CSR issues is an essential component of success. "Doing" CSR enhances reputation, motivates staff, attracts customers and therefore, as Friedman required, increases profits. Friedman did not contemplate the cause and effect, but his famous quote rings true today- except nowadays companies increase their profits through responsible business practices, not as an alternative of them.

The Neoclassical theory of corporate social responsibility encourages companies to take notice not only of the economic and financial dealings in a company, but also the social and environmental consequences a business places on its stakeholders and society. Accordingly, companies have the duty to generate profit while remains environmentally and socially careful Companies follow certain leading practices to balance financial performance with social responsibility. The Neoclassical Model of corporate social responsibility advises companies to seek the maximum profits while obeying a moral minimum. This moral minimum is nothing but a basic freedom from exploitation and includes individual safety and protection of environment. Moral minimum has become part of customary business practice and it proves as a restraint on careless managerial practices. This practice increases the profit of company's by acting socially responsible.

International Cooperative Efforts.

Neoclassical model found its manifestation forty years ago,

in Stockholm Declaration of 1972; where it was established that there exists urgent need to respond. to the problem of environmental deterioration. This conference for the first time stated that all persons including corporations have the duty to protect the environment. Later on, at the United Nations Conference on Environment and Development, held in Rio, de Janeiro, it was decided that the protection of the environment and social and economic development are fundamental to sustainable development- Based on the Rio Principles the global comprehensive plan of action for a global partnership for achieving sustainable development entitled Agenda 21 was adopted. The Rio Conference was a significant milestone that set a new agenda for sustainable development.

Between Rio and Johannesburg, the world's nations deliberated in several major conferences under the ·auspices of the United Nations, including the International Conference on Financing for Development, as well as the Doha Ministerial Conference. These conferences defined for the world a comprehensive vision for the future of humanity.

Further Johannesburg Declaration on Sustainable Development reaffirmed the commitment to Neoclassical model through Johannesburg Plan of implementation. It was collectively decided by the world nations to advance and strengthen the sustainable development-economic development, social development and environmental protection-at the local, national, regional and global levels.

Also, at the ILO International Labour Conference of June 2007, employers' and workers' organizations, as well as governments, adopted a declaration on the role of the private sector in economic development, which provides solid and balanced guidance for policymaking on the conditions necessary to encourage businesses to operate In a more profitable, competitive manner while simultaneously fulfilling their social & environmental responsibilities. These recommendations constitute important guidelines for the development of policies that promote sustainable economic development with decent work.

The classical model of business only emphasized on the profit making aspect of a corporate institution. It denied any direct responsibility of corporate in preserving the environment and hence corporate environmental responsibility did not find place in corporate affairs of the company for a considerable period. All the more the classical model discouraged corporate to do any kind of investment which was not fruitful in fiscal terms and played unconstructive role of separating environmental concerns from company's objective. Moreover, the theory hard pressed that profit earning were part of the "rules of the game" and thus emphasized that company by making profit only contributed to the society. The weakness of this model was that it did not incorporate moral limit on business activities of the company.

Conclusion

The law of torts in India is definitely not unnecessary but merely, requires enactments to make it more ascertainable. Failure of aggrieved persons to assert their legal rights is perhaps to be ascribed not merely to insufficient appreciation of such rights but to other causes as well e.g. difficulties in proving claims and obtaining trustworthy testimony, high court fees, delay of courts. The elimination of difficulties which obstruct aggrieved parties in seeking or obtaining remedies which the law provides for them is a matter which is worthy of consideration. If these lacunae are removed, India could also witness a growth in tort litigation.

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