VARIOUS METHODS INVOLVED IN WASTE WATERTREATMENT TO CONTROL WATER POLLUTION

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ABSTRACT: Due to industrialization and urbanization disposal of industrial as well as domestic effluents become more and more complex. Hence various techniques were developed for purification of water. Pollution of water streams causes due to by different inorganic, organic and biological contaminates, among which pesticides are very common and introduced due to agriculture source, represents a serious environmental problem. Several usual methods of water treatment exist such as activated carbon adsorption, chemical oxidation, biological treatment, etc. and as such have found certain practical applications.For example, activated carbon adsorption involves phase transfer of pollutants without decomposition into another pollution problem. Chemical oxidation mineralizes all organicsubstances and is only economically suitable for the removal of pollutants at high concentrations.

KEY WORDS: Natural water, wastewater treatment processes, reuses desalination processes.

1. INTRODUCTION

Pollutants in wastewater effluent from industrial manufacturers and normal households, and in landfill lactates. They can be found in ground water wells and surface waters. In all cases they have to be removed to protect our water resources or to achieve drinking water quality. Therefore, many processes have been proposed over the years and are currently being employed to destroy these toxins. This paper presents a review of the various methods and treatments used for water and waste water treatment in order to remove the various constituents of the pollution cycle: solids, organic carbon, nutrients, inorganic salts and metals, pathogens. Waste-water generally contains high levels of organic material, numerous pathogenic microorganisms, as well as nutrients and toxic compounds. It thus entails environmental and health hazards and, consequently, must immediately be conveyed away from its generation sources and treated appropriately before final disposal. The ultimate goal of waste-water management is the protection of the environment in a manner commensurate with public health and socio-economic concerns. Fundamental studies in the fields of chemistry and microbiology and findings from research into process techniques provide the foundations on which new methodologies for planning and laying out wastewater treatment systems are currently built. In the earth's crust only 0.01% of total water exists as surface fresh water. Thus fresh water contaminated by inorganic and organic substances such as dissolved solids, metals, detergents, pesticides, Fertilizers, industrial toxic effluents, domestic & agricultural waste etc. At several places on earth there is scarcity of ground water [1, 2]. The quality of water in an aquatic environment depends on the physical, chemical & biological interactions of environment surrounding it [3].

a) Physical Characteristics:
i) Temperature
ii) Turbidity
iii) Colour

b) Chemical Characteristics:
i) PH
ii) Hardness
iii) Dissolved Solids
iv) Organic Characteristic

c) Biological Characteristics:
i) Algae
ii) Bacteria
iii) Protozoan
iv) Viruses

d) Radiological Characteristics.

Pesticides present in nearby farms & chemical effluents given out by industries largely affect growth of micro-organisms. Degradation of organic matter in the presence of bacteria leads to depletion in level of oxygen. Large amount of calcium & magnesium present in water makes the water hard & there by destroying its portability & use for domestic purpose. Chemical oxygen Demand (COD) is a measure of organic compounds & other oxidisable elements present in water. This is directly related to aesthetic quality of water. The minerals and impurities are normally present in very small concentrations are measured either as parts per million (ppm) (how many parts of impurities in a million parts of water) or milligrams per liter (mg/l). The terms are equivalent at low concentrations and are used interchangeably in the water and wastewater. Some parameters are measured in parts per billion (ppb) or micrograms per liter (µg/l). These terms are also essentially equivalent at low concentrations. The case studies outline the current status of our country with respect to its waste-water treatment efforts and look at its future plans. For the development of waste-water treatment facilities [3].

2. PARAMETERS OF NATURAL WATER AND WASTEWATER:

Natural water can be divided into two categories: surface water, such as rivers and streams (Moorland surface drainage) torrents, natural lakes, reservoirs, ponds (lowland surface drainage) And subterranean water such as springs and ground water. The composition of natural water is determined by a sequence of physical chemical and bio-chemical processes which occur during different stages in hydrologic cycle.
Atmospheric agents play an active role in these processes. For this reason the quality of natural water is greatly influenced by atmospheric conditions and seasonal variations in temperature, as, for example, the water in basins with a low replenishment rate. Here we are presenting some standards parameters for water characterization as shown in Table I and II.

3. POLLUTION CONTROL IN INDIA:

In 1992, the CPCB has launched a water pollution control agenda in order to tackle the problem of industrial pollution. It has identified 1551 large and medium industries, and given a time schedule for compliance with the prescribed standards. The progress report is presented in the Table III and IV. According to these figures, a drastic reduction can be observed in the number of Non-compliant industries. Doubts may remain, however, concerning the actual operation of the installed treatment units. There are indeed evidence that many industries only run their effluent treatment plant (ETP) during the inspections [6].

Table I: Standards parameters for water characterization [18, 19]

Sr. No.	Parameter	Standard Values		
		ISI*	WHO**	NIPDWS***
1	P^H	6-9 -	6.5-8.5	6.5-8 -
2	Specific Conductance (mho/cm)	- -	-	- -
3	Total solid (mg/l)	3	-	- -
4	Total dissolved solids (mg/l)	- -	500-100	- -
5	Dissolved oxygen	- -	-	- -
6	Biological Oxygen demand (mg/l)	-	-	-
7	Total alkalinity (mg/l)	1000	120-250	-
8	Total hardness (mg/l)	600	100-500	-
9	Calcium hardness (mg/l) Magnesium	-	75-200	
10	hardness (mg/l)		30-150	
11	Sulphate (mg/l)		400	
12	Chloride		250	
13	Turbidity (NTU)		-	

*ISI: Indian Standard institute, WHO**: World health organization, NIPDWS***: National Interim primary Drinking water standards*

Table II: Standard parameters of water characterization [20]

Sr. No.	Parameters	IS: 10500, 1991, 1991	
		Requirement (desirable limit)	Permissible limit in the absence of alternate source
1	Colour	5 HU	25 HU
2	Odour	UO	UO
3	Temperature	-	-
4	P^H	6.5-8.5	No relaxation
5	Turbidity	5	10
6	Conductivity	-	-
7	Dissolved Oxygen	-	-
8	Total Hardness As $CaCO_3$	300	600
9	Total solids	500	2000
10	Total alkalinity	200	600
11	Chloride	250	1000
12	Sulpate	200	400
13	Calcium as $CaCO_3$	200	400
14	Magnesium	30	100

4. POLLUTION BY SMALL SCALE INDUSTRIES:

As mentioned in section 2, the toughest choice that Indian authorities have to face in term of industrial pollution control is posed by pollution small scale industries (SSIs). Indeed, the smallest facilities are the one for which adaptation to the environmental standard are less affordable. The number of SSIs is estimated to be over 0.32 million units, of which many are highly polluting. The share of the SSIs in term of wastewater generation among several of the major polluting industries was reported to be about 40%...

5. METHODS FOR WASTE WATER TREATMENT:

The various methods are available for the treatment of hazardous waste.

Physical method: Physical treatment process include gravity separation , phase change system such asAir steam stripping of volatile from liquid waste , adsorption, reverse osmosis, ion exchange , electro dialysis.

Chemical method: Chemical methods usually aimed at transforming the hazardous waste into less hazardous substances using techniques such as PH neutralization, oxidation or reduction and precipitation.

Biological methods: Biological treatment method used micro organisms to degrade organic pollutantin the waste stream.

Thermal methods: Thermal destruction process that are commonly used include incineration and pyrolysis incineration is becoming more preferred option in pyrolysis the waste material is heated in theabsence of oxygen to bring about chemical decomposition.

Fixation/ immobilization/stabilization techniques involved the dewatering the waste and solidifying the remaining material by mixing it with stabilizing agent such as Portland cement or pozzolanic material, or vitrifying it to create a glassy substance. For hazardous inorganic sledges, solidification process is used. [1] recharging methods can be applied to both superficial and deep waters; natural water can be used as well as purified wastewater provided that all the necessary precautions have been taken and thorough checks carried out. If purified wastewater is used, the refining process should focus mainly on the removal of suspended solids, the destruction of toxic solutes and on the microbiological load. The type of tertiary treatment necessary will depend not only on the quality of the purified sewage and the selected feeding system, but also on the quality of the ground and of the aquifer and hence on the system 'capacity for natural purification, especially where organic and inorganic micro-organisms and dissolved solids are concerned. In the model as shown in figure 1 filtration operated in ground consisting of a mixture of sand and gravel with clay deposits in the first layer, and diffusion is used to reach deeper layers of extremely low permeability[5].

Table III: Status of Pollution Control in 17 Categories of Highly Polluting Industries, India, 1995 and 2000 [5, 6]

State	BOD (mg/l)			Total Californ (MPN/100 ml)			Fatal Californ(MPN/100 ml)		
	<3	3-6	>6	<500	500-5000	>5000	<500	500-5000	>5000
Andhra Pradesh	202	56	19	16	25	0	37	0	0
Assam	113	4	9	15	49	23	22	21	0
Bihar	146	3	1	15	48	82	35	106	2
Daman & Diu	28	0	0	11	13	0	12	9	0
D & N Haveli	16	0	0	3	11	0	6	7	0
Delhi	11	4	14	0	6	14	10	5	5
Gujarat	224	82	125	200	63	164	214	90	116
Goa	33	15	0	48	0	0	44	0	0
Himachal Pradesh	88	1	0	61	27	1	83	6	0
Haryana	28	4	9	0	0	0	0	0	0
Karnataka	247	49	52	94	283	0	113	136	1
Kerala	275	1	0	10	238	24	71	192	12
Lakshadweep	6	2	0	3	5	0	6	2	0
Maharashtra	0	326	123	375	73	0	391	0	0
Manipur	30	2	0	27	5	0	0	0	0
Meghalaya	0	4	16	12	6	2	9	8	0
Madhya Pradesh	345	114	48	373	124	0	209	0	0
Orissa	22	298	57	234	143	0	299	0	789
Punjab	26	26	20	72	0	0	71	1	0
Pondicherry	15	1	3	0	0	0	0	0	0
Rajasthan	71	5	2	36	42	0	78	0	0
Tamil Nadu	260	38	6	168	72	63	219	53	31
Tripura	30	1	1	4	17	0	18	3	0
Uttar Pradesh	210	165	176	29	123	161	114	123	49
West Bengal	110	24	0	89	0	0	89	0	0
Total	2536	1225	681	1895	1373	534	2150	840	216

Table IV Estimated water pollution load (in tons) by industry [7]

Industry	Estimates using Output Intensities	Ranking	Estimates using Employment Intensities	Ranking
Aluminium	47469	3	0	16
Copper	16035	6	44495	9
Zinc	7737	8	22923	12
Iron and Steel	1639368	1	8093409	1
Cement	5168	11	28000	11
Oil Refinery	4340	12	16805	13
Drugs	5889	10	44736	8
Petrochemicals	1818	13	3805	14
Fertilizers	31480	4	106644	7
Pesticides	7366	9	37927	10
Caustic Soda	836	15	135691	5
Pulp and Paper	86245	2	801764	3
Leather	894	14	5316058	2
Dyes	0	16	1198	15
Distillery	7740	7	110334	6
Sugar	16747	5	217639	4

6. SUSTAINABILITY CRITERIA FOR THE ASSESSMENT OF WATER TREATMENT TECHNOLOGIES:

Functional Performance: Expressed in removal of BOD/COD, heavy metals, organic micro pollutants, pathogens and nutrients.

Adaptability: Indication of possibilities for implementation on different scales,Increasing/decreasing capacity, anticipated changes in legislation, etc.

Durability: Lifetime of installation.

Flexibility: Indication of sensitivity of the process in terms of toxic substances, shock loads, seasonaleffects etc.

Maintenance required: Indication of maintenance required: frequency/costs and time needed formaintenance.

Reliability: Indication of sensitivity of the process in terms of malfunctioning equipment andinstrumentation.

Affordability: Costs in relation to national/regional budget. Foreign exchange required in relation to national/regional foreign exchange requirements.

Costs: Net present value of the investment costs (specified for land, materials, Equipment and labor),maintenance costs and cost for destruction.

Cost effectiveness: Performance relative to costs.

Labor: Number of employees needed for operation and maintenance. Willingness to pay the amount of money spent by users on sanitation in relation to their total budget. Indication of the amount of money the user is willing to pay for (improved) sanitation. [6]

Acidification: Acidification potential

A biotic: Mineral material depletion potential (ADP, yr-1), Biotic: Biodiversity Depletion of fossil: Fossil energy carrier depletion potential (EDP, GJ) fuels

Global warming: Global warming potential (GWP, kg aq. CO2)

Ozone Depletion: Ozone depletion potential (ODP, kg aq. R11)

Photochemical air pollution: Photochemical ozone creation potential (POCP, kg aq. C2H4) Toxicity:

Aquatic: (ECA, m3 aeta), Human : (HT, kg hta),

Terrestrial: (ECT, kg teta)

Waste production: Final waste (kg), Toxic final waste (kg), nuclear final waste (kg).

Additional detailed information on emissions during operational phase:

Heavy metals: Balances of Cu, Cr, Zn, Pb, Cd, Ni, Hg, Ar

Nutrients: Balances of N P, K Organic matter: Balance of C, S

Organic pollutants: Indication of emissions of pesticides and other toxicsPathogens: Bacteria, viruses, intestinal parasites

Energy: Energy used, produced and 'lost' during installation, operation and destruction of the Waste-water treatment system. Energy 'lost' indicates the amount of energy no longer available due toemissions of waste disposal. Indications of feasibility of applying sustainable energy sources.

Land area: The total land area required. Indication of the feasibility of integrating the waste-water treatment system (partly) in green areas.

Nutrients: Amount of nutrients suitable for reuse. Indication of nutrient quality.

Organic matter: Amount of organic matter recycled through sludge reuse. Indication of sludge quality. Amount of organic matter recycled through biogas production.

Resource effectiveness: Performance relative to resource utilization.

Water: Amount of water suitable for reuse.

Social indication of water quality:

Institutional requirement: Indication of the effort needed to control and enforce existing regulations. Indication of embedding of technology in policymaking.

Cultural Acceptance: Indication of the cultural changes and impacts, convenience and compatibility withlocal ethics.

Expertise: Number of engineers needed for installation and operation. Indication whether a system can be designed and built or can be repaired, replicated and improved locally (in the country) or only by specialized manufacturers.

Stimulating: Indication of possibilities for technical stimulation of sustainable behavior.

Sustainable behavior: Indication of possibilities for economic stimulation of sustainable behavior, indication of possibilities for participation by the end user.

TableV wastewater generation by SSIs in selected industrial sectors [8]

Industry	**Wastewater Generation (MLD)**
Engineering	2125
paper and board mills	1087
textile	450
organic chemicals	60
tanneries	50
pharmaceuticals	40
dye and dye intermediates	32
soaps, paints, varnishes, and petrochemicals	10
edible oil and vanaspati	7

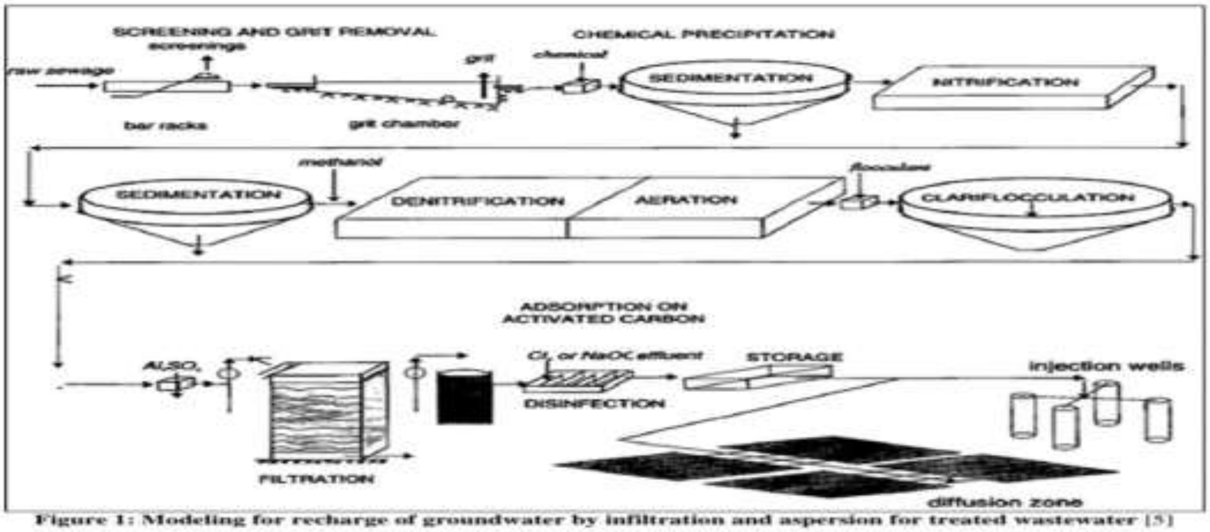

Figure 1: Modeling for recharge of groundwater by infiltration and aspersion for treated wastewater [5]

7. CONCLUSION

Extensive research activity in this field has led to significant improvement and diversification in the processes and methods used for waste-water treatment and sludge management. It is generally recognized that the main economic burden associated with water pollution is the effect of pollution on health alternative methods can be used to further treat or distribute the treated effluent. Due to continuous increase in its demands, rapid increase in population and expanding economy of the country we need some advanced well equipped and low cost and easily generable techniques. Above technique is useful for all wastewater and natural water to remove pollutants and impurities from water and reuse this wastewater to reduce stress of economy on country and it also affect the environment and indirectly it helpful to reduce water pollution.

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