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Recent Trends in Waste Water Microbiology

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Microbial treatment of waste water is one of the most imperative biotechnological attentions, and acts as a crucial process driver; microorganisms are essential to its success. For this reason, the study of waste water microorganisms has obvious importance applied. Now is the time for waste water microbiology to be recognized as a full-grown and dynamic discipline in its own right, offering more towards a deeper understanding of life in complex microbial communities. Speculation about the future of waste water treatment remains a recurring subject in the water industry. As expected, the future will be shaped by proceedings that are not foreseeable, and which influence the future in ways that are impossible to predict. However, studying trends and forces shaping of current events, and use of this knowledge to develop possible boundaries for future conditions may result in better insight(s) into what might happen due to the heterogeneous nature of water courses by various domestic and industrial sources as well diverse nature of the contaminants, which may be physical, chemical and biological in nature, their therapeutic methods must also be of different natures. In response to these difficult situation(s) 'Recent Trends in Microbial Waste water Treatment' presents significant hypothesis, technologies and problems; essentially condensed information into exploitable treatments for different types of pollutants. Waste water industry faces many new challenges that complicate the short and long term planning decisions. Increasing energy costs, trace organic compounds, the final resources, water conservation, and inexorably tighter regulations must all be considered before investing in major improvements in facility.

As the future is never definite, an addition of calculated exercises, such as scenario planning and future mapping during the planning process can help define the boundaries of what the future may bring to treatment facilities. Futurists pointed out that the important trends of the future have their bowed seeds currently. It is this basis that will develop processing technology to solve five major trends in the field of waste water treatment: 1) Nutrient removal and recovery, 2) Trace organic compounds, 3) Energy saving and production, 4) Sustainability and 5) Community involvement. The water industry is historically much longer than other business sectors to develop and implement new expertise. However, much advancement is at present in progress with the advantages that could be convincing enough to shorten the length of the technology life cycle in the water sector. Implementation of these newer technologies would thoroughly alter the waste water treatment plants in the future. The concept of re-use of waste water is not new. Paris for the first time in 1868 used sewage farms for cleaning. Between 1850 and 1940, the main purpose of waste water treatment was focused on removal of organic matter and suspended solids, followed by unintentional removal of nutrients. Later in 1915 the Egyptians used sewage water for irrigation purposes. In developing countries 80% of household waste is currently used for seasonal irrigation of agricultural land. Latin America is given about 15% of the collected waste water after proper treatment. Out of 100%, 97% of the raw waste water being discharged into the environment in Venezuela. In Iran, the majority of the population discharges off untreated sewage into the city's groundwater. However, in US almost no waste water is discharged into the surrounding water areas without treatment. In New York City, a centrifuge is used in waste water treatment systems to obtain the maximum amount of water. In India, treated or partially treated or untreated wastewater is disposed into natural drains connected to the watercourse. This water is used for various purposes, such as irrigation and feed processing. In India the waste water, this is located outside in natural drains used in agricultural soils. In the Asian region, including India, current technology for wastewater treatment are employed, which consists of fluid Aerobics Bed, Anaerobic Filter, Expanded Granular Sludge Blanket, Sequencing Batch Reactor, membrane bioreactor fluidized Aerated Bed reactor, submerged aeration Fixed Film reactor, Biform (Biological Oxygenated filter reactor) and the Up flow Anaerobic Sludge Blanket process. UASB technology has been known as one of the most cost effective and promising wastewater treatment process taking into account the necessity of the environment in India.

Finally, I am inspired to write something about Environmental Microbiology whenever I look upon my son's shining smiling face. I guess it is the innocence and helplessness that I really see. I look at him and wonder if he understands the place in time that we now occupy on earth in relation to our environment and if he and his friends will have a place to live where the water is clean-free of disease and pollution free. Will he have a chance to grow to old age and gain the wisdom to understand that he was born of water and needs to be sustained by it?

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Wastewater Composition	Microorganism	Treatment Process	Initial COD Load (g/L)	COD Removal Efficiency (%)	Treatment Time (days)	Ref
Color (dark brown), pH (2-4), COD (146.38 g/L), TDS (8.9 g/L), sulphate (1.1 g/L), phosphorus (5.1 g/L), free chlorine (5.84 g/L)	*Pseudomonas sp.*	A pure culture of the isolate was transferred in medium with 10% diluted spent wash and incubated at room temperature.	146.4	63	3	[6]
pH (7.6), COD (12.1 g/L), BOD (6.88 g/L), TS (17.8 g/L), nitrogen (0.98 g/L), phosphorus (0.38 g/L)	*B. cereus*	Each bacterial isolate was immobilized on sodium alginate and degradation of anaerobically digested distillery wastewater was carried in batch experiment.	30	81	2	[1]
	X. fragariae			76		
	B. megaterium			76		
Color (brown), pH (3.85), BOD (40 g/L), COD (100 g/L), TDS (38.4 g/L), TSS (105 g/L), TVA (2.8 g/L)	*B. circulans*	Bioremediation of molasses spent wash was carried in medium supplemented with glucose, yeast extract, KH_2PO_4 and $MgSO_4.7H_2O$ and kept for incubation for 15 days.	100	80.8	15	[22]
	B. megaterium			80.9		
	B. firmus			78.9		
BOD (52.5 g/L), COD (112 g/L), TS (2.1 g/L), TDS (1.985 g/L), TSS (0.07 g/L), sulphate (6.26 g/L), phosphate (0.0024 g/L), phenol (0.584 g/L)	*Mixed culture of: B. thuringiensis, B. brevis, Bacillus sp. (MTCC6506)*	The decolorization of Sucrose-Glutamate-Acid (SGA) was carried out by the mixed bacterial culture supplemented with 15% glucose under shaking flask conditions (150 rpm) at pH 7.0 and 37°C.	112	63.39	1	[47]
pH (7.5), COD (20.6 g/L), TS (29.6 g/L), TN (1.7 g/L), Total phosphorus (0.1 g/L)	*Lactobacillus L-2*	The isolated bacteria was supplemented with 10 g/L glucose and bio-remediate 12.5% diluted anaerobically digested spent wash.	20.6	57	7	[10]
pH (7.5–8), BOD (8–10 g/L), COD (45-52 g/L), TS (72.5 g/L), TSS (40.7 g/L), phosphates (1.625 g/L), sulphates (3.875 g/L), chlorides (8 g/L), phenols (7.2 g/L)	A bacterial consortium of: *P. aerugenosa* A01, *S. maltophia, P. microbilis*	The degrading and decolorizing of anaerobically treated distillery wastewater was studied using isolated bacterial consortium.	45	51	3	[7]
pH (8.2), BOD (3 g/L), COD (54 g/L), phosphorous as P (0.07 g/L), TS (45 g/L)	Acetogenic bacteria of strain No. BP103	Decolorization of molasses wastewater was carried in replacement culture system.	54	70.9	7	[65]

Note: Total Solid (TS); Biological Oxygen Demand (BOD); Chemical Oxygen Demand (COD); Total Volatile Acid (TVA); Total Suspended Solid (TSS); Total Nitrogen (TN)

Table 1: Bacterial Cultures Employed for Treatment of Distillery Effluent.

Wastewater Composition	Microorganism	reatment Process	Initial COD Load (g/L)	COD Removal Efficiency (%)	Treatment Time (days)	Ref
Color (greenish dark brown), pH (7.2), BOD (5-6.5 g/L), COD (34.8 g/L), TDS (4.5-4.62 g/L), sulphates (0.16 g/L), free chlorine (0.8 g/L)	*C. cladosporioides*	The fungus was used in a batch experiment to decolorize 100 mL of 15 % diluted ADSW cultivation medium supplemented with carbon and nitrogen source.	34.8	62.5	10	[64]
pH (5.2), COD (80.5 g/L), TS (109 g/L), TSS (3.6 g/L), sulfates (5 g/L), Total phenols (0.45 g/L)	*Penicillium sp.* *P. decumbens*	Aerobic degradation of beet molasses alcoholic fermentation wastewater diluted to 50%.	52.1 50.7	57	5	[61]
Color (brown), pH (3.85), BOD (40 g/L), COD (100 g/L), TDS (38.4 g/L), TSS (105.2 g/L), TVA (2.8 g/L)	*A. fumigatus*	Bioremediation of molasses spent wash was carried in medium supplemented with glucose, yeast extract, KH_2PO_4 and $MgSO_4.7H_2O$ and with fungi and kept for incubation for 15 days.	100	84.0	15	[22]
	A. terreus			84.0		
Color (dark-brown), pH (4.1), COD (0.06 g/L), TS (52.4 g/L), SS (12.8 g/L)	*Trametes sp. I-62*	20% (v/v) of distillery effluent was added to the culture medium and incubated for 7 days at 28°C under sterile condition.	0.06	61.7	7	[32]
NR	*P. chrysosporium*	The fungus was immobilized on different support materials, such as polyurethane foam (PUF) and scouring web (SW), in rotating biological contactor (RBC).	NR	48	17	[39]
Color (dark brown), pH (4.3), BOD (42 g/L), COD (80 g/L)	*F. flavus*	The isolated fungi was immobilized on polyurethane foam cube and decolorized 10% diluted molasses wastewater.	80	50	5	[18]
Total phenols (0.54 g/L), pH (3.9), COD (25.5 g/L)	*T. pubescens MB 89*	The isolated fungus was used in flask cultures and a bubble lift bioreactor to treat 10% diluted wastewater.	25.5	79	15	[33]

Note: Total solid (TS); Biological Oxygen Demand (BOD); Chemical Oxygen Demand (COD); Total Volatile Acid (TVA); Total Suspended Solid (TSS); Anaerobically Digested Spent Wash (ADSW); Suspended Solids; (SS); Not Recorded (NR)

Table 2: Fungal Cultures Employed for Treatment of Distillery Effluent.

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