An Effective Approach for the Treatment of Contaminated Water during Floods

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Abstract **- Hydrological disaster is a natural disaster occurs most commonly due to flood. Flood water consisting harmful contaminants such as animal wastage, salts, oils and grease, pesticides, sewage, Toxic chemicals, and soil which can affect potentially drinking water. Flood can contaminate the water sources such as wells, rivers, lakes and streams and decreases the water quality. The contaminated water supports the growth of parasites which leads to spreading of communicable diseases like Water-borne diseases like Typhoid, Cholera, Hepatitis A and Leptospirosis. Vector –borne diseases like malaria, dengue, west Nile fever and Yellow fever.**

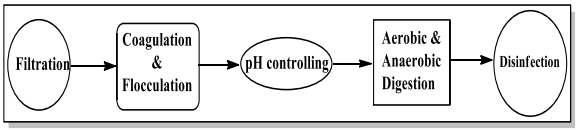
Index Terms **- Flood water, FWTP (Flood Water Treatment Plant), communicable diseases.**

1.INTRODUCTION

Flood takes place due to tropical cyclones, rapid snow melting, failure of dams, costal storm surges. Flood is associated with overflow of water that submerges the surface of earth. The primary effects of flooding include loss of life and damage to buildings and other structures, including bridges, sewerage systems, roadways, and canals. Floods also frequently damage power transmission and sometimes power generation, which then has knock-on effects caused by the loss of power. Floods have large social consequences for communities and individuals [1-4]. As most people are well aware, the immediate impacts of flooding include loss of human life, damage to property, destruction of crops, loss of livestock, and deterioration of health conditions owing to waterborne diseases. A flood is a body of water that covers land which is normally dry. Floods are common natural disasters that can affect millions of people around the world. Floods can also contaminate drinking water and lead to diseases. They are often caused by rivers, but overflowing lakes and seas can also cause floods [5-8].

Natural water can be divided into two categories: surface water, such as rivers and streams torrents, natural lakes, reservoirs, ponds and sub-terranean water such as springs and ground water. 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. Here we are presenting some standards parameters for water characterization as shown in Table 1. Flood water consisting harmful contaminants such as animal wastage, salts, oils and grease, pesticides, sewage, toxic chemicals, and soil which can affect potentially drinking water. Flood can contaminate the water sources such as wells, rivers, lakes and streams and decreases the water quality [8-12]. The contaminated water supports the growth of parasites which leads to spreading of communicable diseases like Water-borne diseases like typhoid, cholera, hepatitis A and leptospirosis. Vector –borne diseases like malaria, dengue, west Nile fever and Yellow fever [12-15]. Emergency and relief agencies, with the assistance from National, state-wide, and local volunteer organizations play a primary role in disaster preparedness and recovery including the supply of emergency water. They often use surface water as a drinking water source for disaster-affected populations. They are also involved in the designing and testing of emergency water treatment systems and learn through experience from a stream of emergencies [16]. During an emergency, the treatment of water of uncertain quality is an unavoidable choice when reliable clean water sources become unavailable. Different emergency water treatment (EWT) methods have been developed and practiced, such as membrane filtration, the use of ceramic filters, bio-sand filtration,

use of disinfectant powders, boiling, distillation, solar disinfection and disinfection with chlorine among all processes FWTP(Flood Water Treatment Plant) method is efficient to purify the contaminated water. Compared to the conventional treatment systems [17] FWTP need lesser material and energy, are easily operated and can be maintained by untrained personnel. Further these systems have lower construction, maintenance.



Flow chart of Flood Water Treatment Plant (FWTP)

2. STAGES OF TREATMENT FWTP

- Filtration of impurities
- Chemical Treatment
- Coagulation & Flocculation
- pH controlling
- Aerobic Anaerobic Digestion
- Disinfection

2.1. Filtration of impurities: Separation of big size impurities such as plastic materials, polythene covers, wood logs, papers, cloth etc are removed by using a screen with openings of uniform size. Generally maximum 10 mm is used. The suspended solids are removed by the physical water treatment process using gravity is known as sedimentation.

2.2. Chemical Treatment: In this stage floating and settled materials like suspended solids and organic substances are removed by chemical operations. Adding of suitable chemicals changes the quality of contaminated water through the processes such as coagulation, pH controlling.

2.3.1. Coagulation: Coagulation refers to collecting the minute solid particles dispersed in a liquid into a larger mass. Chemical coagulants like Alum($Al_2(SO_4)_3$ or $Fe_2(SO_4)_3$)or poly aluminium chloride(PAC or liquid alum)or Ferric chloride are added to contaminated water to facilitate the attraction among the dispersed fine particles so that they come together and form larger particles called flocs.

2.3.2. Flocculation: chemical flocculent is a polyelectrolyte which enhances the flocculation process by bringing particles together to form larger flocs, which settle out more quickly.

2.4. pH controlling pH of the wastewater has controlled by neutralisation of acidic wastage by the addition of NaOH, Na_2CO_3, $CaCO_3$ or Ca $(OH)_2$ and alkali wastage by H_2SO_4, HCl.

2.5.1. Aerobic Digestion: Aerobic treatment processes take place in the presence of air (i.e. oxygen) by utilizing those micro-organisms (aerobes), which use molecular/free oxygen to assimilate organic impurities i.e. convert them into carbon dioxide, water, and biomass.

2.5.2. Anaerobic Digestion: The anaerobic treatment processes take place in the absence of air by utilizing micro-organisms (i.e. anaerobes) which do not require air to assimilate organic impurities. The final products are methane and biomass.

2.6. Disinfection: Final cleaning process improves the quality of wastewater before it is reused or discharged to the environment. Bacteria, viruses, and parasites, which are harmful to public health are killed at this stage by using chlorine or ultraviolet light. Flood water includes many thousands of E. Coli per 100 ml. To make free from bacteria water is treated with chlorine gas followed by ultraviolet irradiation for best results. Parameters of the resulting water has shown in table 2.

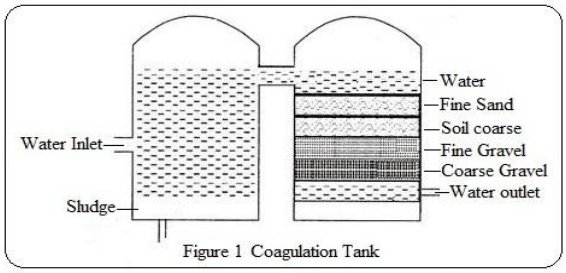


Figure 1 Coagulation Tank

Fig. 2: Comparision of water quality before and after treatment

Table 1: Standard parameters of water characterization

S. No.	Parameters	IS: 10500(1991)	
		Requirement (desirable limit)	Permissible limit in the absence of alternate source
1	Colour	5 HU	25 HU
2	Odour	UO	UO
3	pH	6.5-8.5	No relaxation
4	Turbidity	5	10
5	Total Hardness as $CaCO_3$	300	600
6	Total solids	500	2000
7	Total alkalinity	200	600
8	Chloride	250	1000
9	Sulphate	200	400
10	Calcium as $CaCO_3$	200	400
11	Magnesium	30	100

IS 10500 (1991), Indian standards for drinking water.

Table 2: Parameters of the resulting water after treatment

S. No.	Parameter	Concentration
1	BOD	1250 mg/L
2	COD	2250 mg/L
3	pH	6-7
4	Total Suspended solids	600 mg/L
5	Total Dissolved solids	2000 mg/L
6	Total volatile solids	1300 mg/L
7	Oil and Grease	60 mg/L
8	Sulphates	500 mg/L
9	Phosphorus	60 mg/L
10	Chloride	60 mg/L
11	Calcium	180 mg/L
12	Magnesium	80 mg/L

3. CONCLUSION

Hydrological disasters such as floods creates a great damage to water sources such as rivers, wells, stream, lakes, and ponds. Water is contaminated with sewage, animal wastages and toxic materials which leads to growth of parasites. This results in the transformation of communicable diseases. To purify this kind of contaminated water the above-mentioned method is efficient to purify water. Compared to the conventional treatment systems FWTP need lesser material and energy, are easily operated, and can be maintained by untrained personnel. Further these systems have lower construction, maintenance. Above technique is useful for all wastewater and natural water to remove pollutants and impurities from bulk water and reuse this wastewater to reduce stress of economy on country and indirectly helpful to reduce water pollution. The parameters of resulting water shown in table 2 are almost near to the standard parameters of a good water.

REFERENCES

[1] MSN Encarta Dictionary, Flood, retrieved on 2006-12-28, Archived on 2009-10-31.

[2] Glossary of Meteorology (June 2000) Flood Archived 2007-08-24 at the Wayback Machine, Retrieved on 2009-01-09.

[3] Jones, Myrtle (2000). "Ground-water flooding in glacial terrain of southern Puget Sound, Washington". Retrieved 2015-07-23.

[4] Hjalmarson, Hjalmar W. (December 1984). "Flash Flood in Tanque Verde Creek, Tucson, Arizona". Journal of Hydraulic Engineering. 110.

[5] Werner, MGF; Hunter, NM; Bates, PD (2006). "Identifiability of Distributed Floodplain Roughness Values in Flood Extent Estimation". Journal of Hydrology. 314 (1–4): 139–157. Bibcode:2005J Hyd. 314.139W. https://doi: 10.1016 /j.jhydrol.2005.03.012.

[6] Stephen Bratkovich, Lisa Burban, et al., "Flooding and its Effects on Trees", USDA Forest Service, Northeastern Area State and Private Forestry, St. Paul, MN, September 1993

[7] Indoor Air Quality (IAQ) Scientific Findings Resource Bank (IAQ-SFRB), "Health Risks or Dampness or Mold in Houses" Archived2013-10-04 at the Wayback Machine

[8] Center for Neighborhood Technology, Chicago IL "The Prevalence and Cost of Urban Flooding", May 2013

[9] A Suitable and Effective Method for the Treatment of Effluents Discharged for Sugar Plant, Int.J.Inn.Res.Sci.Eng.Tech.Vol.8, Issue8, 2019, 8426-8430. https://doi.org/10.15680/ IJIRSET.2019.0808079

[10] "Protecting Your Businesses", last updated March 2013.

[11] "National Flood Insurance Program". FloodSmart.gov. Retrieved 2015-07-06.

[12] WMO/GWP Associated Programme on Flood Management, "Environmental Aspects of Integrated Flood Management", 2007.

[13] Extension of the Flood Pulse Concept Retrieved on 2012-06-12.
[14] Birdlife soars above Botswana's floodplains Archived 2011-02-09 at the Wayback Machine (2010-10-15), Retrieved on 2012-06-12.
[15] Eychaner, J.H. (2015) Lessons from a 500-year record of flood elevations, Association of State Floodplain Managers, Technical Report 7, Accessed 2015-06-27.
[16] B. Clarke and A. Steele, Desalination, 2009, 248, 64–71.
[17] Dyhouse, G., "Flood modelling Using HEC-RAS (First Edition)", Haestad Press, Waterbury (USA) 2003.