



IMPACT OF DUMPING ON GROUNDWATER : A REVIEW

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Abstract- Groundwater is a precious natural source of water and a boon for all human beings. Its quality has paramount importance and various use for our daily life but many anthropogenic activities such as urbanization, pollution, industrialization, tremendous growth in the population produce a huge amount of solid waste, and their mismanagement and their open dumping deteriorate the quality of groundwater. In the present paper, it is shown that groundwater that is present near the dumping site is unfit for drinking and did not match the standard parameter of drinking water.

Index Terms- Groundwater, Leachate, Solid waste, Dumping, Landfills.

Introduction-

In developing countries like India rapid industrialization, urbanization and emerging population produce a huge amount of solid waste. Waste that arises from anthropogenic and animal activities and is thrown as useless or unwanted material and solid in nature are known as solid waste (Yusuff et. al., 2014). It is the by-product of our daily life (Rajkumar et. al., 2010). It is heterogeneous (Thitame et. al., 2010). It generally includes household wastes like Paper, plastics, clothes, metals, glass, vegetable and fruit peels, etc (Chavan et. al., 2019).

According to Goswami and Sharma, (2008) approximately 13 lakh tons of municipal solid wastes are arising in the municipal area of the city per year and it increases per day and it is estimated that it reaches approx. 2.2 billion tons in the year 2025 (Wafi. et. al., 2019).

Generation of solid wastes is mainly affected by population explosion, different income levels, variation in weather and living standard of peoples, etc. The tremendous growth in solid waste is a serious issue at the regional, local and global levels. This problem is more intense in developing countries than in the developed country. (Manfredi et. al., 2010).

The rising demand for food and other basic commodities increases the amount of waste that household generate. This contributes to the pollution of the environment and contaminates soil and surface water quality. Less than half of the waste produced in a city is collected and most of it is thrown away at random places, such as landfill sites and temporary areas like around the city at empty places. This causes indiscriminate degradation. (Mekonnen et. al., 2020). Solid waste management is essential for the healthy growth of the society of the world but it is neglected in developing and under-developing countries (Ilyas et. al., 2017). Their management become a major problem of human societies in the world. Rapidly increase their volume of solid waste and their diversity causes complexity in the disposal of solid wastes (Almasi et. al., 2014).

According to Dev and Sunyana (2017), the best way of solid waste management is to Reduce, Reuse and Recycle waste. For this process, wastes are collected from door to door and storage points then transfer to the transfer station for construction, operation and maintenance. Then transfer it to processing faculty for again construction, operation and maintenance and then dispose of by scientific landfill.

In developing countries reliance on open dumping is very convenient, the oldest and cheapest practice for disposal of solid wastes, but space of land area are limited nowadays (Pandey et. al., 2014). It is cheapest technique in which waste is decomposed under control conditions and prevent environmental adverse effects (Olusanya and Anthony, 2012). Landfills are considered a major threat to groundwater (Pandey et. al., 2013). But the current situation landfilling is not the best method because it covers large space and pollute the groundwater, produces toxins, bad odor, and attracts various pest, insects, rodents, and micro-organism which cause various diseases (Singh et. al., 2019). When waste is dumped into landfills, its physical, chemical and microbial changes occur and leachate formation takes place and leachate pollute groundwater (Rathod et. al., 2013).

Landfill leachate is highly concentrated complex sewage that contains dissolved organic and inorganic matter like ammonium, calcium, magnesium, sodium, potassium, iron, sulphates, chlorides and heavy metal for instances cadmium, copper, lead, zinc, etc (Ololade et. al., 2009).

Due to the disposal of solid wastes, both surface and groundwater are contaminated. Today study of the quality of groundwater is more important than quantity but the attention that is required is still not provided (Rajkumar et.al., 2010).

Unscientific and unsystematic dumping of solid waste produces leachate which contaminates groundwater. It disturbs the physio-chemical nature of water. During the post-monsoon season contaminant concentration decreases but in the pre- monsoon season its concentration increases (Kaliappan et. al., 2008).

LEACHATE

Unscientific and unsystematic dumping of solid waste gives an adverse impact on groundwater. There is various kind of water that percolates from the soil for instances water of wastes that already exist, water that is released after biodegradation of water and polluted rainwater. This percolation of impure water, contaminate the groundwater and disturb their physiochemical parameter (Nandwana and Chhipa, 2014).

After disposing of solid waste into landfills, various biological degradation and physiochemical changes combined with percolating rainwater generate highly contaminated liquid known as leachate. It is a toxic liquid that seeps through solid waste in a landfill in which micro-organisms, toxic substances and some heavy metals are present (Paruti and Santhaveeranagoud, (2019), Sudha and Uma, 2015).

Leachate is very complex in nature based on composition and volumetric flow. The composition of leachate is influenced by many factors which include kinds of waste, composition, moisture content, particle size, hydrology of the site, climatic condition, age and design of dumping site (Mekonnen et. al., 2020).

According to (Kumar et.al., 2017) groundwater near dumping sites is polluted almost every season so we can say that leachate is mainly responsible for groundwater pollution and its effect on groundwater can be checked by the water quality index (WQI). The flow rate of leachate from the dumping site varies from site to site and according to the season with climatic condition and amount of rainwater which is entering in dumping site (Lema et.al., 1988).

Leachate is a poisonous liquid that percolates through dumping waste in a landfill. Surface or rain which is available in waste percolates in soil and disturbs the quality of water and this waste release toxins and chemicals which cause water pollution. Water becomes non-potable without their treatment (Chavan et.al.,2019).

Percolation of rainwater provides a medium for degradation of solid waste mainly organic substances by the process of dissolution, hydrolysis, oxidation and reduction process into the simple substances (Kumar et.al., 2017).

Physiochemical characteristics of Leachate is mainly depending on waste composition and amount of water in total waste. It contains a large number of contaminants like organic, inorganic, anions, cations which pollute water resources (Rathod et.al., 2013).

Water which is obtained from biodegradation of wastes and rainfall causes percolation vertically or laterally and finds the way for groundwater contamination. Municipal solid waste leachate contains varieties of chemicals like detergent, inorganic and complex organic chemicals and metals (Bundela et.al., 2012).

When wastes are dumped in landfill site some wastes are dissolved after some days and that dissolved pollutants move downward with percolating pollutants soil water while organic liquid pollutant directly contaminates the groundwater (Chaudhary et.al., 2015). By improving the quality of leachate generation we can prevent any contamination of groundwater (Janani et.al., 2019).

According to (Olalade et.al., 2009) Leachate flow downward and upward from the dumping site. Downward flow contaminates groundwater while outward flow causes seepage at the periphery of the landfill. The pollutant of leachate is reducing due to precipitation and leachate lit also reduces (Gokceus et.al., 2020). leachate pollution index (LPI) and water quality index (WQI) are evaluated by physiochemical parameters of leachate and groundwater (Singh et.al., 2016).

Pre-treatment of solid waste like their segregation and sorting plays an important role in deciding the characteristic of leachate because waste contains papers, plastic, glasses and various hazardous medical and electronic waste in which more than a hundred chemicals are present which gives an adverse effect on all flora and fauna. So their regular monitoring is necessary for preventing harm to humans.

GROUNDWATER

Water is a natural resource that is very essential and most precious because the organism cannot survive without water for a long time. It is a most vital compound for all life forms on earth and its quality is described by its characteristics like physical, chemical and biological (Raman and Sathianarayanan, 2011). We all know that 70 percent of the earth's surface is covered by water but only 3 percent of water is fresh water in the form of aquifers, polar ice caps, rivers, lakes, clouds, streams, etc.

Water which is present under the ground in cracks and spaces in soil, sand rocks are known as groundwater. The main source of groundwater is rainwater which percolates through the soil which is used for drinking purposes, domestic, agriculture, etc.

But due to urbanization and domestic wastes and sewage release directly into water sources reduce the quality of water (Pires et.al.,2015). Generally, surface water is more polluted than groundwater because groundwater does not directly contact to external environment but due to deficiency of proper sanitation and planned management groundwater pollution increase (Iqbal and Gupta, 2009).

In the last few decades there has been an excessive increase in demand for fresh water due to population explosion, rapid urbanization and industrialization, and excess use of pesticides and chemical fertilizer (Chaudhary et.al., 2015).

The quality and portability of groundwater mainly depend on soil strata and the nature of aquifers which is a storage of groundwater. They become polluted or unfit for drinking due to many reasons like the dumping of solid waste and leachate formation and percolation (Chavan et.al., 2019).

Groundwater is a portion of sub-surface water that occupies the part of the ground that is fully saturated and flows into a storage area under pressure greater than atmospheric pressure. Groundwater occurs in a geological formation known as aquifer (Pandey et.al., 2013).

Groundwater is a safe source of water for domestic, agriculture, and industrial use, and improper solid waste management is one of the major sources of environmental pollution (Sugirtharan and Rajendran, 2015).

Unsystematic treatment of municipal solid waste created all types of pollution eg - air, water, and soil. In India, dumping on the open area is very common and these wastes cause contamination of ground and surface water that causes waterborne disease (Srigirisetty et.al., 2017).

Hydrogeochemistry is mainly controlled by water-rock interaction as well as man-made pollution. It disturbs the physicochemical parameters such as pH, EC, TDS, anion and cations, etc. of water (Kurakalva, 2016).

Maintenance of water quality in a rapidly increasing society become a big challenge for our environment. Various factor affects water quality. Water pollution is emerging and very hazardous pollution i.e. influenced by anthropogenic sources, in which solid wastes play the main role. Due to improper waste treatment surface and mainly affected (Kusari, 2018).

Water is the best gift of any ecosystem and their quality can be categorized by physical, chemical, and Biological characteristics and any change in this character can affect the quality of water and causes water pollution. Water pollution can decrease the number of aquatic organisms. So biodiversity is also depleted (Raman and Sathianarayanan, 2011).

(Raman and Narayanan, 2008) defines water pollutants as physical or chemical substances present in water bodies at an excessive level capable of causing harm to a living organism. Physical hazards may be dissolved or suspended solid and chemical hazards may be copper, manganese, lead, cadmium, phosphate, nitrate, etc. This is very harmful to the health of all living organisms. Groundwater which is the main source of our daily life should be free from these hazardous chemicals, But open dumps and unsanitary landfills mix these hazardous chemicals into it. So many water-borne diseases are emerging.

The risk of contamination becomes high in an area where the dumping site is near the water resources. The landfill leachate causes contamination of ground and surface water and it increases day by day in recent years. Landfills leachate disturb the physio-chemical characteristics of water (Mor et.al., 2006)

According to (Reja and Yousef, 2016) untreated and uncontrolled dumping of wastes has resulted in negative impacts on the river and affects their ecosystem. It also affected by the public living around the dumping area (Thayalnaki and Jayanthi, 2019). Many native species of that river are about to extinct due to irrational dumping of sewage and industrial wastes directly dump into the main river.

Effects Of Dumping on Ground Water-

Unscientific and unsystematic dumping of solid waste helps in the formation of leachate and their subsequent percolation causes contamination. Due to excessive growth in population, urbanization, industrialization changing living standards put pressure on sources of water for the satisfaction of water consumption rate at different areas. So fulfilling the demand for a better quality of water and their quantity becomes a challenging task nowadays for all human beings (Chavan et. al., 2014).

Due to the percolation of leachate, it is contaminated with heavy metals like copper, zinc, manganese, lead, chromium, and cadmium. These heavy metals are absorbed by soils and lead to a serious problem because of their non-biodegradable nature (Nazir et. al., 2014).

According to (Saini et. al., 2018) dumping area which is in the vicinity of the dumping site highly affected by salinity, high fluoride, high nitrate concentration, and Ni and Fe is more than the permissible limit of BIS, and Pb and Cd have highly affected the potability of Groundwater. It also creates a nuisance of odor, breeding site of rodents and insects, destroying the aesthetic nature of the environment and imperils the aquifers.

Illegal, uncontrolled and unscientific dumping produces leachate and various hazardous gases releases and if is not managed properly it gives adverse impact to our society and nature such as global warming, contamination of soil, deduction of vegetation, accidental fire, slope instability, unpleaseant odors, groundwater and air pollution etc. (Yadav et. al., 2018) (El Salam and Abu- Zuid, 2015). Uncontrolled dumping plays a crucial role in water pollution but mostly it is neglectable (Bundela et. al., 2012). When leachates percolate into the soil, it transfers the contaminant into the soil and reduces the strength, stability, fertility of the soil (Sharma et. al., 2018). And it also increses the concentration of various parameters such as hardness, BOD, Zinc, COD, Iron, Florine etc. (Ramesh et. al., 2009).

Groundwater which is obtained from the vicinity of the dumping site is non-potable and non-suitable for irrigation (Fatta et. al., 1999). Due to the addition of some disinfectants like Sodium Dichloroisocyanurate ($C_3N_3O_3Cl_2Na$) also known as water guard and weathering of feldspars in wells increase the amount of chloride and sodium. Contamination of heavy metals causes strong toxicity even at very low concentrations (Charles et. al., 2013).

Due to the unique chemical property of water like polarity and hydrogen bond, it can easily dissolve, absorb, adsorb, or suspend various types of compounds from its surroundings which is arise by an anthropogenic, animal, and biological activities. So contaminants that are released from leachate and soil easily dissolve in water and reduce the physiochemical characteristic.

Conclusion- Vigorous growth in population, rapid urbanization, industrialization causes many tons of solid waste per year and this amount increases per day. So their management becomes a hurdle for all countries of the world. We use open dumping for their management but a scarcity of spaces and unscientific dumping is not safe. Due to dumping, leachate formation takes place and it percolates from the soil into groundwater. So many contaminants like metals, heavy metals, ions, organic and inorganic compounds disturb the physicochemical parameter of groundwater as described by standard authority.

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