The possible consequences of perchlorate accumulation in fresh water bodies due to floods and its effect on fishes

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Despite the catastrophic notoriety, floods bring in some inherent benefits. Floods and landslides play an important role in modifying several features and dynamics of natural ecosystems. Soil erosion is an accompanying process of floods. Floods transport the eroded soil containing organic matter and minerals down to low lying areas (Poff et al., 1997), mostly near river mouths resulting in the formation of highly fertile delta and sand bars. During floods, the river overflows and submerges a large area of land and fills wetlands, thus facilitating groundwater recharging. Flood water also establishes connectivity between aquatic habitats. For many species, floods trigger breeding, migration and dispersal.

There are different routes through which aquatic pollution happens. Based on the source, pollution can be of two types namely point source pollution and nonpoint source pollution. In point source pollution there is a direct contamination of waterways. An example is the discharge of industrial waste from a factory drain into a river. When pollutants are washed along from a distant place by runoff due to heavy rains and floods into a water body, it is called nonpoint source pollution. Pollution caused by storm water runoff from nonpoint source is one of the most serious threats to aquatic systems. As the flood water runs over and through the watershed, it picks up and carries several contaminants and pollutants such as plastic grocery bags, pesticides, fertilizers, detergents etc together with eroded soil. These contaminants then get into lakes

parastating Floods and Oriented Environment

and oceans. The fear during floods by the same mechanic and oceans. The featuring floods by the same mechanism, in enter the water how and roadside ditches often contain. enter the water toxical and roadside ditches often contain stagnamers, the storm drands and polluted with organic units of the storm drands oxygen and polluted with organic units of the storm oxygen and polluted with organic units of the storm oxygen and polluted with organic units of the storm oxygen and polluted with organic units of the storm oxygen and polluted with organic units of the storm oxygen and polluted with organic units of the storm of the storm oxygen and polluted with organic units of the storm oxygen and polluted with organic units of the storm oxygen and polluted with organic units of the storm oxygen and polluted with organic units of the storm oxygen and polluted with oxygen and polluted wit areas, the storm drawn and polluted with organic waste characterised by low oxygen and floods clean up the characterised by low oxygen and floods clean up the drain and other pollutant. Heavy rains and floods clean up the drain and other pollutants of the drain and other pollutants. River and streams, River and streams. and other pollutant, and soil into nearby rivers and streams. Rivers in Kanthappellutant, and soil into nearby rivers and streams. Rivers in Kanthappellutant, and soil into nearby rivers and streams. Rivers in Kanthappellutant, and soil into nearby rivers and streams. Rivers in Kanthappellutant, and soil into nearby rivers and streams. Rivers in Kanthappellutant, and soil into nearby rivers and streams. Rivers in Kanthappellutant, and soil into nearby rivers and streams. flush pollutant, and some little due to thoughtless dumping of slaus are found to be highly polluted due to thoughtless dumping of slaus. are found to be figure. They have also become the sites for discharge and organic wastes and organic wastes of pollutants from both industrial and and organic washing pollutants from both industrial and done sewage and a variety of pollutants from both industrial and done sewage and a variety and done sources. Nonpoint source pollution is associated with the formation sources. Nonpoint source with minimal oxygen) in the occur large 'dead zones' (areas with minimal oxygen) in the ocean and photostage in the coral rock large dead zones and especially to the coral reef ecosystem around the world.

Increased delivery of water into fresh water bodies by floods resmi in a decrease in water conductivity (a measure of the concentration in a decrease in tandem with a change in pH, depending on nature of the contributing water sources. The temperature of the receive water body may also be affected by the gushing water, although degree and direction of influence vary according to the nature of source of receiving waters. The strong erosive power of water during floods increases the movement of sediment as well as mobilise pollulan within the sediment (e.g. heavy metals, pesticides, organic compounds which may be transported along with the flood water. During flood larger fish tend to seek refuge in areas of lower water velocity, offer moving into backwaters or side channels. When overbank flooding occurs, fish will colonise in the floodplain and may get trapped as the water recedes. However, the small fish, particularly the early life stage (eggs and fry) are most vulnerable to the impacts of floods as they last the strength to swim to areas of low flowing water. Other effects severe flood include loss of habitat and biodiversity, dispersal of week species, pollution, lower fish production, changes in the structure and functions of wetlands etc.

The severe flood that happened in Kerala on the month of August 2018 resulted in the overflowing of several rivers and lakes including the major rivers, Periyar, Pampa and Bharatapuzha. Aluva is one of the major Industrial centres of the state situated on the banks of river Penyz The ammonium perchlorate experimental Plant (APEP), situated on the

banks of river waters. It is found that the samples taken from the into the point have a high level of toxic pollution with a BU bank Kochi back a high level of toxic pollution with a pH value of into the point have a high level of toxic pollution with a pH value of loading point have near Keezhumad have revealed that home it loading caveral studies near Keezhumad have revealed that home it into point may be a considered pollution with a pH value of loading point studies near Keezhumad have revealed that here, the wells several studies with perchlorate. The famous Sivararbei contaminated with perchlorate. load several studies with perchlorate. The famous Sivarathri festival is are contaminated on the sand banks of Periyar, with fireworks Society and the sand banks of Periyar, with fireworks Society and the sand banks of Periyar, with fireworks Society and the sand banks of Periyar, with fireworks Society and the sand banks of Periyar, with fireworks Society and the sand banks of Periyar, with fireworks Society and the sand banks of Periyar, with fireworks Society and the sand banks of Periyar, with fireworks Society and the sand banks of Periyar, with fireworks Society and the sand banks of Periyar, with fireworks Society and Society a are contaminated on the sand banks of Periyar, with fireworks. So is the case celebrated on the sand banks of periyar, with fireworks. So is the case celebrated on the sand banks of Periyar, with fireworks. celebrated on the same In general, it can be said that fireworks are a part with Thrisur pooram. (Utsavams and Poorams) as well temple festivals (Utsavams and Poorams) with Thrisur poolan. Can be said that fireworks are a part with all temple festivals (Utsavams and Poorams) as well as some of almost all temple festivals. Perchlorate is widely used in firework. of almost all temple of almost church festivats. There are hundreds of quarries operating contaminates air, soil and water. They also use large quarries operating contaminates of the State. They also use large quarries contaminates and so the State. They also use large quantities of toxic in several parts of the State and perchlorate for rock crack inc. in several parts in several parts and perchlorate for rock cracking explosives

The Impact of perchlorate on water bodies

This study examines the flood related issues of pollution due to This state of ponution due to perchlorate containing compounds in water bodies. Studies on halo perchlorate such as chlorate and parable of soids such as chlorate and parable of soids. perchiorate control as chlorate and perchlorate assume significance oxygenated acids, such as chlorate and perchlorate assume significance oxygenated as of international concern with respect to water quality, as they are opening consists of a tetrahedral assume assume significance as they are of water quality, perchlorate anion consists of a tetrahedral array of oxygen atoms around Percinolate atom. Perchlorate is a strong oxidizing anion and has a central gained public attention following its detection in well water and drinking water in several areas. Perchlorate is ubiquitous and has been found to be present in soil, vegetation, ground water and also in surface water in several places. The non-volatile and stable nature of perchlorate anion has allowed it to be present in drinking water aquifers. Perchlorate is commercially available as ammonium perchlorate (AP) which is a highly energetic compound. It is used as an oxidizer in solid rocket propellant. It is also used as an oxidizer in flares, pyrotechnics, explosives and numerous other applications. AP is highly water soluble and mobile in aqueous environment. The primary toxicity of this compound is attributed to its effect on disruption of iodide uptake in the thyroid gland owing to its similarity in ionic radius to iodide. Several treatment technologies such as ion exchange, air stripping, carbon adsorption etc. are employed for the removal of perchlorate from contaminated water.

Properties of perchlorate

Perchlorate salts have low vapour pressure and hence cannot solatilize

and oceans. The pesticides from plantations and agricultural fields in enter the water bodies during floods by the same mechanism. In units areas, the storm drains and roadside ditches often contain stagnant was characterised by low oxygen and polluted with organic waste, plasto and other pollutants. Heavy rains and floods clean up the drains at flush pollutants and soil into nearby rivers and streams. Rivers in Keral are found to be highly polluted due to thoughtless dumping of slaught and organic wastes. They have also become the sites for dischargen sewage and a variety of pollutants from both industrial and domestic sources. Nonpoint source pollution is associated with the formation of large 'dead zones' (areas with minimal oxygen) in the ocean and poss threats to the marine life and especially to the coral reef ecosystem around the world.

Increased delivery of water into fresh water bodies by floods results in a decrease in water conductivity (a measure of the concentration) ions in the water) in tandem with a change in pH, depending on the nature of the contributing water sources. The temperature of the receiving water body may also be affected by the gushing water, although the degree and direction of influence vary according to the nature of the source of receiving waters. The strong erosive power of water during floods increases the movement of sediment as well as mobilise pollutants within the sediment (e.g. heavy metals, pesticides, organic compounds which may be transported along with the flood water. During floods larger fish tend to seek refuge in areas of lower water velocity, often moving into backwaters or side channels. When overbank flooding occurs fight in occurs, fish will colonise in the floodplain and may get trapped as the water recedes. water recedes. However, the small fish, particularly the early life stages (eggs and free) (eggs and fry) are most vulnerable to the impacts of floods as they lack the strength to the strength to swim to areas of low flowing water. Other effects of severe flood includes severe flood include loss of habitat and biodiversity, dispersal of weed species, pollution species, pollution, lower fish production, changes in the structure and functions of wetlands etc.

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banks of river Periyar in Aluva, has been dumping the toxic effluent balloo the Kochi back waters. It is found that the samples taken from the loading point have a high level of toxic pollution with a pH value of 1.2. Several studies near Keezhumad have revealed that here, the wells are contaminated with perchlorate. The famous Sivarathri festival is celebrated on the sand banks of Periyar, with fireworks. So is the case with Thrisur pooram. In general, it can be said that fireworks are a part of almost all temple festivals (Utsavams and Poorams) as well as some church festivals. Perchlorate is widely used in fireworks and its use contaminates air, soil and water. There are hundreds of quarries operating in several parts of the State. They also use large quantities of toxic explosives like chlorate and perchlorate for rock cracking

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