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Unit – V

Characteristics and analysis of waste water, recycles of decomposition, physical, chemical & biological parameters. Oxygen demand i.e. BOD & COD, TOC, TOD, Th OD, Relative Stability, population equivalent, instrumentation involved in analysis, natural methods of waste water disposal i.e. by land treatment & by dilution, self-purification capacity of stream, Oxygen sag analysis.

Wastewater is simply that part of the water supply to the community or to the industry which has been used for different purposes and has been mixed with solids either suspended or dissolved. Wastewater is 99.9% water and 0.1% solids. The main task in treating the wastewater is simply to remove most or all of this 0.1% of solids.

Type of wastewater from household

Gray water washing water from the kitchen, bathroom, laundry (without feces and urine)

Black water from flush toilet (feces and urine with flush water)

Yellow water Urine from separated toilets and urinals

Brown water Black water without urine or yellow water

The process of decomposition — the breakdown of raw organic materials to a finished compost — is a gradual complex process, one in which both chemical and biological processes must occur in order for organic matter to change into compost.

Recycles of decomposition

The decomposition (stabilization) of organic matter by biological action has been taking place in nature since life first appeared on our planet. In recent times, man has attempted to control and directly utilize the process for sanitary recycling and reclamation of organic waste material. Such organic materials as vegetable matter, animal manure and other organic refuse can be converted from otherwise wasted materials to a more stable form for use as a soil amendment by this process. This process is called “composting” and the final product of composting is called “compost”. Generally speaking there are two processes that yield compost:

1. ANAEROBIC (without oxygen) decomposition.

2. AEROBIC (with oxygen) decomposition and stabilization.

In these processes, bacteria, fungi, molds, protozoa, actinomycetes, and other saprophytic organisms feed upon decaying organic materials initially, while in the later stages of decomposition mites, millipedes, centipedes, springtails, beetles and earthworms further breakdown and enrich the composting materials. The organisms will vary in the pile due to temperature conditions, but the goal in composting is to create the most favorable environment possible for the desired organisms. Differences between aerobic and anaerobic composting are discussed below.

Anaerobic Decomposition (Fermentation)

Anaerobic decomposition takes place in nature, as in the decomposition of the organic muds at the bottom of marshes and in buried organic materials to which oxygen does not have access. Intensive reduction of organic matter by putrefaction is usually accompanied by disagreeable odors of hydrogen sulfide and reduced organic compounds which contain sulfur, such as mercaptans (any sulfur-containing organic compound).

Putrefactive breakdown of organic material takes place anaerobically. Organic compounds break down by the action of living organisms that do not require air in the normal sense. These organisms use nitrogen, phosphorus, and other nutrients to live and to develop cell protoplasm, but they reduce the organic nitrogen to organic acids and ammonia. The carbon from the organic compounds which is not utilized in the cell protein is liberated mainly in the reduced form of methane ($CH4$). A small portion of carbon may be respired as carbon dioxide ($C02$).

Since anaerobic destruction of organic matter is a reduction process, the final product, humus, is subject to some aerobic oxidation when put on the soil, that is, it may appear to decompose further after being exposed to air. This oxidation is minor, takes place rapidly, and is of no consequence in the utilization of the material on the soil. In other words, much less heat is generated in anaerobic decomposition than in aerobic decomposition. The lack of heat generated in the anaerobic destruction of organic matter is a definite disadvantage if contaminated materials are used for composting. High temperatures are needed for the destruction of pathogens and parasites. In anaerobic decomposition the pathogenic organisms do eventually disappear in the organic mass, as a result of the unfavorable environment and biological antagonisms. The disappearance is slow, and the material must be held for periods of six months to a year to ensure relatively complete destruction of pathogens, such as the eggs of Ascaris, nematodes which are among the most resistant of the fecal-borne disease parasites in wastes. Therefore, make compost this year and use it next year. However, organic material can be decomposed anaerobically to produce compost. For instance, a heavy plastic bag can be used to decompose grass clippings or other high nitrogen materials, shredded leaves, kitchen trimmings, a small amount of stable manure or other compostable materials. However, as anaerobic compost can have a strong odor (and may need to be aired prior to using), it is not usually the first choice for home owners. For more details see Structures.

Aerobic Decomposition

When organic materials decompose in the presence of oxygen, the process is called “aerobic.” The aerobic process is most common in nature. For example, it takes place on ground surfaces such as the forest floor, where droppings from trees and animals are converted into a relatively stable humus. There is no accompanying bad smell when there is adequate oxygen present.

In aerobic decomposition, living organisms, which use oxygen, feed upon the organic matter. They use the nitrogen, phosphorus, some of the carbon, and other required nutrients. Much of the carbon serves as a source of energy for the organisms and is burned up and respired as carbon dioxide (C02). Since carbon serves both as a source of energy and as an element in the cell protoplasm, much more carbon than nitrogen is needed. Generally about two-thirds of carbon is respired as C02, while the other third is combined with nitrogen in the living cells. However, if the excess of carbon over nitrogen (C:N ratio) in organic materials being decomposed is too great, biological activity diminishes. Several cycles of organisms are then required to burn most of the carbon.

When some of the organisms die, their stored nitrogen and carbon becomes available to other organisms. As other organisms use the nitrogen from the dead cells to form new cell material, once more excess carbon is converted to C02. Thus, the amount of carbon is reduced and the limited amount of nitrogen is recycled. Finally, when the ratio of available carbon to available nitrogen is in sufficient balance, nitrogen is released as ammonia. Under favorable conditions, some ammonia may oxidize to nitrate. Phosphorus, potash, and various micro-nutrients are also essential for biological growth. These are normally present in more than adequate amounts in compostable materials and present no problem.

During composting a great deal of energy is released in the form of heat in the oxidation of the carbon to C02. For example, if a gram-molecule of glucose is dissimilated under aerobic conditions, 484 to 674 kilogram calories (kcal) of heat may be released. If the organic material is in a pile or is otherwise arranged to provide some insulation, the temperature of the material during decomposition will rise to over 170°F. If the temperature exceeds 162°F to 172°F, however, the bacterial activity is decreased and stabilization is slowed down. Initially, mesophilic organisms, which live in temperatures of 50°F to 115°F, colonize in the materials. When the temperature exceeds about 120°F, Thermophilic organisms, which grow and thrive in the temperature range 115°F to 160°F., develop and replace the mesophilic bacteria in the decomposition material. Only a few groups of thermophiles carry on any activity above 160°F. Oxidation at Thermophilic temperatures takes place more rapidly than at mesophilic temperatures and, hence, a shorter time is required for decomposition (stabilization). The high temperatures will destroy pathogenic bacteria, protozoa (microscopic one-celled animals), and weed seeds, which are detrimental to health or agriculture when the final compost is used. Aerobic oxidation of organic matter produces no objectionable odor. If odors are noticeable, either the process is not entirely aerobic or there are some special conditions or materials present which are creating an odor. Aerobic decomposition or composting can be accomplished in pits, bins, stacks, or piles, if adequate oxygen is provided. Turning the material at intervals or other techniques for adding oxygen is useful in maintaining aerobic conditions.

Compost piles under aerobic conditions attain a temperature of 140°F to 160°F in one to five days depending upon the material and the condition of the composting operation. This temperature can also be maintained for several days before further aeration. The heat necessary to produce and maintain this temperature must come from aerobic decomposition which requires oxygen. After a period of time, the material will become anaerobic unless it is aerated. In this manual the term “aerobic composting” will be used in its commonly accepted meaning of that process. It requires a considerable amount of oxygen and produces none of the characteristic features of anaerobic putrefaction. In its modern sense, aerobic composting can be defined as a process in which, under suitable environmental conditions, aerobic organisms, principally Thermophilic, utilize considerable amounts of oxygen in decomposing organic matter to a fairly stable humus.

Biochemical oxygen demand

(BOD, also called biological oxygen demand) is the amount of dissolved oxygen needed (i.e., demanded) by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period. The BOD value is most commonly expressed in milligrams of oxygen consumed per litre of sample during 5 days of incubation at 20 °C and is often used as a surrogate of the degree of organic pollution of water.

OR

The BOD test is used to measure waste loads to treatment plants, determine plant efficiency (in terms of BOD removal), and control plant processes. It is also used to determine the effects of discharges on receiving waters. A major disadvantage of the BOD test is the amount of time (5 days) required to obtain the results.

When a measurement is made of all oxygen consuming materials in a sample, the result is termed "Total Biochemical Oxygen Demand" (TBOD), or often just simply "Biochemical Oxygen Demand" (BOD). Because the test is performed over a five day period, it is often referred to as a "Five Day BOD", or a BOD5.

In many biological treatment plants, the facility effluent contains large numbers of nitrifying organisms which are developed during the treatment process. These organisms can exert an oxygen demand as they convert nitrogenous compounds (ammonia and organic nitrogen) to more stable forms (nitrites and nitrates). At least part of this oxygen demand is normally measured in a five day BOD.

Typical values

Most pristine rivers will have a 5-day carbonaceous BOD below 1 mg/L. Moderately polluted rivers may have a BOD value in the range of 2 to 8 mg/L. Rivers may be considered severely polluted when BOD values exceed 8 mg/L.[7] Municipal sewage that is efficiently treated by a three-stage process would have a value of about 20 mg/L or less. Untreated sewage varies, but averages around 600 mg/L in Europe and as low as 200 mg/L in the U.S., or where there is severe groundwater or surface water Infiltration/Inflow. The generally lower values in the U.S. derive from the much greater water use per capita than in other parts of the world.

Methods

There are two commonly recognized methods for the measurement of BOD.

Dilution method

This standard method is recognized by U.S. EPA, which is labeled Method 5210B in the Standard Methods for the Examination of Water and Wastewater. In order to obtain BOD5, dissolved oxygen (DO) concentrations in a sample must be measured before and after the incubation period, and appropriately adjusted by the sample corresponding dilution factor. This analysis is performed using 300 ml incubation bottles in which buffered dilution water is dosed with seed microorganisms and stored for 5 days in the dark room at 20 °C to prevent DO production via photosynthesis. In addition to the various dilutions of BOD samples, this procedure requires dilution water blanks, glucose glutamic acid (GGA) controls, and seed controls. The dilution water blank is used to confirm the quality of the dilution water that is used to dilute the other samples. This is necessary because impurities in the dilution water may cause significant alterations in the results. The GGA control is a standardized solution to determine the quality of the seed, where its recommended BOD5 concentration is 198 mg/l ± 30.5 mg/l. For measurement of carbonaceous BOD (cBOD), a nitrification inhibitor is added after the dilution water has been added to the sample. The inhibitor hinders the oxidation of ammonia nitrogen, which supplies the nitrogenous BOD (nBOD). When performing the BOD5 test, it is conventional practice to measure only cBOD because nitrogenous demand does not reflect the oxygen demand from organic matter. This is because nBOD is generated by the breakdown of proteins, whereas cBOD is produced by the breakdown of organic molecules.

BOD5 is calculated by:

- Seeded
- Unseeded

To determine the value of the BOD in mg/L, use the following formula:

BOD, mg/L = [(Initial DO   Final DO) x 300]/mL sample

For example:

Initial DO = 8.2 mg/L

Final DO = 4.4 mg/L

Sample size = 5 mL

BOD mg/L = [(8.2   4.4) x 300]/5 = (3.8 x 300)/5 = 1140/5 = 228 mg/L

Manometric method

This method is limited to the measurement of the oxygen consumption due only to carbonaceous oxidation. Ammonia oxidation is inhibited.

The sample is kept in a sealed container fitted with a pressure sensor. A substance that absorbs carbon dioxide (typically lithium hydroxide) is added in the container above the sample level. The sample is stored in conditions identical to the dilution method. Oxygen is consumed and, as ammonia oxidation is inhibited, carbon dioxide is released. The total amount of gas, and thus the pressure, decreases because carbon dioxide is absorbed. From the drop of pressure, the sensor electronics computes and displays the consumed quantity of oxygen.

The main advantages of this method compared to the dilution method are:

- Simplicity: no dilution of sample required, no seeding, no blank sample.
- Direct reading of BOD value.
- Continuous display of BOD value at the current incubation time.

Alternative methods

1. Biosensor: An alternative to measure BOD is the development of biosensors, which are devices for the detection of an analyte that combines a biological component with a physicochemical detector component. Enzymes are the most widely used biological sensing elements in the fabrication of biosensors. Their application in biosensor construction is limited by the tedious, time consuming and costly enzyme purification methods. Microorganisms provide an ideal alternative to these bottlenecks.

The vast variety of microorganisms are relatively easy to maintain in pure cultures, grow and harvest at low cost. Moreover, the use of microbes in biosensor field has opened up new possibilities and advantages such as ease of handling, preparation and low cost of device. A number of pure cultures, e.g. Trichosporon cutaneous, Bacillus cereus, Klebsiella oxytoca, Pseudomonas sp. etc. individually, have been used by many workers for the construction of BOD biosensor. On the other hand, many workers have immobilized activated sludge, or a mixture of two or three bacterial species and on various membranes for the construction of BOD biosensor. The most commonly used membranes were polyvinyl alcohol, porous hydrophilic membranes etc.

A defined microbial consortium can be formed by conducting a systematic study, i.e. pre-testing of selected micro-organisms for use as a seeding material in BOD analysis of a wide variety of industrial effluents. Such a formulated consortium can be immobilized on suitable membrane, i.e. charged nylon membrane useful for BOD estimation. Suitability of charges nylon membrane lies in the specific binding between negatively charged bacterial cell and positively charged nylon membrane. So the advantages of the nylon membrane over the other membranes are: The dual binding, i.e. Adsorption as well as entrapment, thus resulting in a more stable immobilized membrane. Such specific Microbial consortium based BOD analytical devices, may find great application in monitoring of the degree of pollution strength, in a wide variety of Industrial waste water within a very short time.

Biosensors can be used to indirectly measure BOD via a fast (usually <30 min) to be determined BOD substitute and a corresponding calibration curve method (pioneered by Karube et al., 1977). Consequently, biosensors are now commercially available, but they do have several limitations such as their high maintenance costs, limited run lengths due to the need for reactivation, and the inability to respond to changing quality characteristics as would normally occur in wastewater treatment streams; e.g. diffusion processes of the biodegradable organic matter into the membrane and different responses by different microbial species which lead to problems with the reproducibility of result (Praet et al., 1995). Another important limitation is the uncertainty associated with the calibration function for translating the BOD substitute into the real BOD

OR

Aerobic: A condition in which "free" or dissolved oxygen is present in an aquatic environment.

Anaerobic: A condition in which "free" or dissolved oxygen is not present in an aquatic environment.

Blank: A preliminary analysis omitting only the sample to provide an unbiased reference point or baseline for comparison.

Nitrification: An aerobic process in which bacteria change ammonia and organic nitrogen in wastewater into oxidized nitrogen (usually nitrate). The second-stage BOD is sometimes referred to as the "nitrification stage". (The first stage is called the "carbonaceous stage".)

Nutrient: Any substance used by living things that promotes growth.

Respiration: The process in which an organism uses oxygen for its life processes and gives off carbon dioxide.

Seeding: The process of adding live bacteria to a sample.

COD

In environmental chemistry, the chemical oxygen demand (COD) is an indicative measure of the amount of oxygen that can be consumed by reactions in a measured solution. It is commonly expressed in mass of oxygen consumed over volume of solution which in SI units is milligrams per liter (mg/L). A COD test can be used to easily quantify the amount of organics in water. The most common application of COD is in quantifying the amount of oxidizable pollutants found in surface water (e.g. lakes and rivers) or wastewater. COD is useful in terms of water quality by providing a metric to determine the effect an effluent will have on the receiving body much like biochemical oxygen demand (BOD).

Total organic carbon (TOC)

It is the amount of carbon found in an organic compound and is often used as a non-specific indicator of water quality or cleanliness of pharmaceutical manufacturing equipment. TOC may also refer to the amount of organic carbon in soil, or in a geological formation, particularly the source rock for a petroleum play; 2% is a rough minimum. For marine surface sediments, average TOC content is 0.5% in the deep ocean, and 2% along the eastern margins.

A typical analysis for TOC measures both the total carbon present and the so-called "inorganic carbon" (IC), the latter representing the content of dissolved carbon dioxide and carbonic acid salts. Subtracting the inorganic carbon from the total carbon yields TOC. Another common variant of TOC analysis involves removing the IC portion first and then measuring the leftover carbon. This method involves purging an acidified sample with carbon-free air or nitrogen prior to measurement, and so is more accurately called non-purge able organic carbon (NPOC.

Total Oxygen Demand

TOD is based on the same idea as COD, which is that all organic compounds shall be oxidized completely in order to determine the oxygen demand required. However, using thermal oxidation at 1,200 degrees C guarantees complete oxidation of all organic compounds and no chloride disturbances where the dichromate method is detectable. Table 1 shows a comparison of the different methods for the determination of oxygen demand in wastewater. Non-catalytic, high-temperature methods not only provide accurate results, they are also safer for the operator and environment.

For the determination of TOD, the sample is thermally oxidized at high temperature in a reactor of high-purity alumina and the oxygen consumption of this reaction is measured directly in the gas phase. Until this point, the sample is fed into a combustion furnace, similar to TOC analysis. The furnace has to be continuously pervaded by an oxygen-containing carrier gas in a “closed” system. During the sample injection, a gas exchange with the environment has to be prevented to avoid measurement failures. After cleaning the measuring gas, the oxygen content is measured directly with a zirconium oxide-based detector, and the reduction of the oxygen content is directly an extent for the oxygen consumption.

Within the furnace, the water of the injected sample will evaporate immediately and all organic compounds contained will be oxidized completely at the temperature of 1,200 degrees C. The used reactor is filled with inert ceramic material, which is not affected by ingredients of the sample water. No catalyst is necessary at the temperature used for the oxidizing process, and thus the risk of poisoning of the catalyst that may cause a malfunction of the oxidation process is avoided. The process takes only about one to two minutes, which allows the measurement frequency to be three to five minutes, depending on the application.

This is a clean and fast method of analysis to define oxygen demand of a water sample. Demanding developments of new, improved, and environmentally friendlier methods of COD measurements, as done in previous professional journals, is not necessary since this method has existed for decades already and is available on the market.

Wastewater treatment is a process used to convert wastewater which is water no longer needed or suitable for its most recent use - into an effluent that can be either returned to the water cycle with minimal environmental issues or reused. The latter is called water reclamation: instead of disposing of treated wastewater it is reused for various purposes. During the treatment process, pollutants are removed or broken down. The infrastructure used for wastewater treatment is called a wastewater treatment plant (WWTP), or a sewage treatment plant in the case of municipal wastewater (households and small industries).The treatment of wastewater belongs to the overarching field of sanitation, which also includes the management of human waste, solid waste and storm water (drainage) management. By-products from wastewater treatment plants, such as screenings, grit and sewage sludge may also be treated in a wastewater treatment plant.

The self-purification of natural water systems

It is a complex process that often involves physical, chemical, and biological processes working simultaneously. The amount of Dissolved Oxygen (DO) in water is one of the most commonly used indicators of a river health. As DO drops below 4 or 5 mg/L the forms of life that can survive begin to be reduced. A minimum of about 2.0 mg/L of dissolved oxygen is required to maintain higher life forms. A number of factors affect the amount of DO available in a river. Oxygen demanding wastes remove DO; plants add DO during day but remove it at night; respiration of organisms removes oxygen. In summer, rising temperature reduces solubility of oxygen, while lower flows reduce the rate at which oxygen enters the water from atmosphere. 12.1 Factors Affecting Self-Purification.

1. Dilution: When sufficient dilution water is available in the receiving water body, where the wastewater is discharged, the DO level in the receiving stream may not reach to zero or critical DO due to availability of sufficient DO initially in the river water before receiving discharge of wastewater.

2. Current: When strong water current is available, the discharged wastewater will be thoroughly mixed with stream water preventing deposition of solids. In small current, the solid matter from the wastewater will get deposited at the bed following decomposition and reduction in DO.

3. Temperature: The quantity of DO available in stream water is more in cold temperature than in hot temperature. Also, as the activity of microorganisms is more at the higher temperature, hence, the self-purification will take less time at hot temperature than in winter.

4. Sunlight: Algae produces oxygen in presence of sunlight due to photosynthesis. Therefore, sunlight helps in purification of stream by adding oxygen through photosynthesis.

5. Rate of Oxidation: Due to oxidation of organic matter discharged in the river DO depletion occurs. This rate is faster at higher temperature and low at lower temperature. The rate of oxidation of organic matter depends on the chemical composition of organic matter.

(i) Dilution:

In the beginning of twentieth century, waste water disposal practices were based on the premise that "the solution to pollution is dilution". Dilution was consid¬ered as the most economical means of waste water disposal. In this method relatively small quantities of waste are discharged into large bodies of water.'

Although dilution is a powerful adjunct to self-cleaning mechanism of surface waters, its success depends upon discharging relatively small quantities of waste into large bodies of water. Growth in population and industrial activity, with increases in water demand and wastewater quantities, precludes the use of many streams for dilution of raw or poorly treated wastewaters.

(ii) Sedimentation and Re-suspension:

Sources of suspended solids, one of the most common water pollutants, include domestic and industrial wastewater and runoff from agricultural or urban ac¬tivities. These solids may be inorganic or organic materials and/or live organ¬isms, and they may vary in size from large organic particles to tiny, almost invisible, colloids. In suspension, solids increase turbidity and the reduced light penetration may restrict the photosynthetic activity of plants, inhibit the vision of aquatic animals, interfere with feeding of aquatic animals that obtain food by filtration, and be abrasive to respiratory structures such as gills offish. Settling out or sedimentation, is nature's method of removing suspended parti¬cles from a watercourse, and most large solids will settle out readily in quies¬cent water. Particles in the colloidal size range can stay in suspension for long periods of time, though eventually most of these will also settle out. Re-suspension of solids is common in times of flooding or heavy runoff. In such cases, increased turbulence may resuspend solids formerly deposited along nor¬mally quiescent areas of a stream and carry them for considerable distances down¬stream. Eventually they will again settle out, but not before their presence has increased the turbidity of the waters into which they have been introduced.

(iii) Filtration:

As large bits of debris wash along a stream bed, they often lodge on reeds or stones where they remain caught until high waters wash them into the main¬stream again. Small bits of organic matter or inorganic clays and other sediments may be filtered out by pebbles or rocks along the stream bed.

(iv) Gas Transfer:

The transfer of gases into and out of water is an important part of the natural purification process. The replenishment of oxygen lost to bacterial degradation of organic waste is accomplished by the transfer of oxygen from the air into the water. Conversely, gases evolved in the water by chemical and biological proc¬esses may be transferred from the water to the atmosphere.

Oxygen sag analysis

Oxygen Sag Analysis The oxygen sag or oxygen deficit in the stream at any point of time during self-purification process is the difference between the saturation DO content and actual DO content at that time. Oxygen deficit, D = Saturation DO – Actual DO The saturation DO value for fresh water depends upon the temperature and total dissolved salts present in it; and its value varies from 14.62 mg/L at 0o C to 7.63 mg/L at 30o C, and lower DO at higher temperatures. The DO in the stream may not be at saturation level and there may be initial oxygen deficit 'Do'. At this stage, when the effluent with initial BOD load Lo, is discharged in to stream, the DO content of the stream starts depleting and the oxygen deficit (D) increases. The variation of oxygen deficit (D) with the distance along the stream, and hence with the time of flow from the point of pollution is depicted by the 'Oxygen Sag Curve' The major point in sag analysis is point of minimum DO, i.e., maximum deficit. The maximum or critical deficit (Dc) occurs at the inflexion points of the oxygen sag curve.

A water tank is a container for storing water. Water tanks are used to provide storage of water for use in many applications, drinking water, irrigation agriculture, fire suppression, agricultural farming, both for plants and livestock, chemical manufacturing, food preparation as well as many other uses. Water tank parameters include the general design of the tank, and choice of construction materials, linings. Various materials are used for making a water tank: plastics (polyethylene, polypropylene), fiberglass, concrete, stone, steel (welded or bolted, carbon, or stainless). Earthen pots also function as water storages. Water tanks are an efficient way to help developing countries to store clean water.

Types

Chemical contact tank of FDA and NSF polyethylene construction, allows for retention time for chemical treatment chemicals to "contact" (chemically treat) with product water.

The Tanka is used in Rajasthan as a traditional form of rainwater harvesting

Ground water tank, made of lined carbon steel, may receive water from a water well or from surface water, allowing a large volume of water to be placed in inventory and used during peak demand cycles.

Elevated water tank, also known as a water tower, will create a pressure at the ground-level outlet of 1 kPa per 10.2 cm or 1 psi per 2.31 feet of elevation. Thus a tank elevated to 20 metres creates about

200 kPa and a tank elevated to 70 feet creates about 30 psi of discharge pressure, sufficient for most domestic and industrial requirements.

Vertical cylindrical dome top tanks may hold from 200 litres or fifty gallons to several million gallons. Horizontal cylindrical tanks are typically used for transport because their low-profile creates a low center of gravity helping to maintain equilibrium for the transport vehicle, trailer or truck.

A Hydro-pneumatic tank is typically a horizontal pressurized storage tank. Pressurizing this reservoir of water creates a surge free delivery of stored water into the distribution system.

Design

By design a water tank or container should do no harm to the water. Water is susceptible to a number of ambient negative influences, including bacteria, viruses, algae, changes in pH, and accumulation of minerals, accumulated gas. The contamination can come from a variety of origins including piping, tank construction materials, animal and bird feces, mineral and gas intrusion. A correctly designed water tank works to address and mitigate these negative effects.

A safety based news article linked copper poisoning as originating from a plastic tank. The article indicated that rainwater was collected and stored in a plastic tank and that the tank did nothing to mitigate the low pH. The water was then brought into homes with copper piping, the copper was released by the high acid rainwater and caused poisoning in humans. It is important to note that since the plastic tank is an inert container, it has no effect on the incoming water. Good practice would be to analyze any water source periodically and treat accordingly, in this case the collected acid rain should be analyzed, and pH adjusted before being brought into a domestic water supply system.

The release of copper due to acidic water is monitored may be accomplished with a variety of technology, beginning with pH strips and going to more sophisticated pH monitors, indicate pH which when acidic or caustic, some with output communication capabilities. There is no "linkage" between the plastic tank and copper poisoning, a solution to the problem is easy, monitor 'stored rainwater' with 'swimming pool strips' cheap and available at, swimming pool supply outlets. If the water is too acidic, contact state/county/local health officials to obtain advice and precise solutions and pH limits and guidelines as to what should be used to treat rainwater to be used as domestic drinking water.

Articles and specifications for water tank applications and design considerations, the AWWA (American Water Works Association) provides details as required by many states to complete a certification process to insure the quality of water being consumed.

The American Water Works Association is a reservoir of water tank knowledge; the association provides specifications for a variety of water storage tank applications as well as design. The AWWA's site provides scientific resources with which the reader will be able to develop an informed perspective on which to make decisions regarding their water tank requirements.

