

**What is New Innovation:**

**Marion Chips?**

## ●Marton System for the Improvement of the Global Environment

### What is the Marton System?

The earth has almost reached the stage where it is no longer able to purify itself. This is due to the fact that the waste produced by households and factories has spread not only in local areas but all over the world. Another problem is that it is taking an increasing amount of fossil fuel energy to clean this waste, thus producing additional pollutants.

It is recognised that a new system to reduce the contamination is needed and in order to fulfil this need 'Tsukuba Marton Chips' have been developed.

This new technology enables large amounts of organically contaminated sludge to be purified in a short amount of time, using cedar chips which contain microbes. The following are some of the special features of this system:

(1) The specially treated cedar chips are arranged in a cross section which forms a honeycomb structure for the bacteria (high density bio-colony).

(2) It does not require a large amount of energy to grow the high density bio-colony in the cedar chips.

(3) The high density bio-colony is composed of a simple structure, and assimilates organically to the contaminated sludge (the structure of the purifying device is simple).

Is it possible to use the catchphrase 'bio-colony cedar chips save the earth' since this technology and system is 'fast, energy efficient and uses bio-colonies'.

① Marton Chips are made from high quality cedar chips, very different from ordinary sawdust. The structure inside the chips is porous. Both the inside and outside of the chips is sterile. The Marton Chips themselves are not bacterial but provide a place for the bacteria to live while they decompose the organically contaminated substances. In other words, the inside of the chips can be said to giving accommodation to the bacteria. Both aerobic and anaerobic bacteria, in the form of an amphimicrobe, are compatible inside the chips. This is one of the primary reasons why the organically contaminated sludge can be purified.

② The Marton Chips contain organic compounds and as you can see in figure 1, there are 4 features worth noting:

(a) water holding property, (b) adsorptive, (c) filterability, and (d) hydrophobic are possessed naturally as the second feature.

③ Thirdly it should be noted that Marton Chips have a:

(a) rapid adjustment of liquids/ (b) porosity and intake of oxygen/ (c) high ability of moisture retention

## ● A New Development: Effluent Treatment by Tsukuba Environmental Technology

### **Tsukuba Marton System**

The newly developed 'Marton Chips' (organic filter medium containing microbes) is a microbe medium which takes the solid substance (SS) in the organic wastewater from households or factories and substances containing liquid from protein, fat, and carbohydrate and so forth, and transforms them into water and carbon dioxide by the fermentation, decompose and digestion of the microbes.

So called, the chips seem to be regarded as a contaminated sludge digestion medium.

### **The Process of the Marton Chips Device**

Discharged sewage water comes into the reactor tube of the device, and the water contacts the Marton Chips. The Marton Chips react by themselves: they make BOD cling and which separates solid and liquids (the percentage of the water will contain 60 – 70%). This is the necessary condition of the fermentation, decomposition, digestion in the medium bacteria. The bacterial medium is not aerobic bacteria and is not anaerobic bacteria, either, but an aptitude bacteria containing aerobic and anaerobic bacteria (some call the bacteria porous bacteria). This is what we are not able to see even by microscope, because the bacteria are very small like soil bacteria.

The Marton Chips are a carbon organic filter medium being composed of 65% of cellulose, 25% of lignin and 10% of pentosan. When the sewage water goes through the organic filter medium following the natural principal, a tremendous amount of bacteria colony (billions of bacillus and coccus a  $\text{cm}^3$ ) is produced. These bacteria for decomposition are composed of the medium bacteria such as the minimal bacillus and coccus. The bacillus works by fermenting and decomposing (corroding) the corpse including plants and animals, and the coccus eats the entire bacillus as well as the corroding corpse and as a result gas is produced. When all food has gone, the coccus suspend activities temporally and wait for the next feed.

The water produced by this process is purified dramatically. For example sewage water drained from a small village will become under BOD 10 ppm.

### **The Marton Chips**

Marton Chips are specially treated wooden chips. The treatment makes the inside of the wooden chips porous and as a result the surface area and porosity percentage are increased. Therefore, the chips seem to be the digestion and extinguishment medium BOD source containing the contaminated sludge. Their purpose is to make a suitable condition which promotes expansion in the microbe

## ● The Outline of the Tsukuba Marton System

### **The Purpose of the Tsukuba Marton System**

This technology allows the production of aerobic and anaerobic bacteria at the same time by using

Mokushitusaihen (the wooden chips: this is the name used when the system was handed into the Patent Office), the name of merchandise (Marton Chips). I strongly believe that this system is able to provide future solutions to environmental problems in our society such as.

(1) The disposal of industrial garbage

The system can decompose all the organic waste, such as organically and surplus contaminated sludge, waste from coffee, Shochu (wheat liquor), soy sauce, fish, grease trap, and tofu (bean curd).

(2) The purification of rivers and lakes

In Japan, there are many rivers and lakes on which we have great depended over the years. However, over time, the development of the industry and concentration of the population has caused pollution of the water. It is possible to use the Marton Chips as a purifying medium, for rivers and lakes.

### **The Theory behind the purification of Contaminated sludge and wasted water**

The newly invented Marton Chips (microbe inhabitable organic oxidizer) is a microbe medium to transform the solid substances (SS) and sludge liquid from animal and plant protein, fat, and carbohydrate, which are found in organically contaminated sludge and water from houses or factories. Marton Chips transform this sludge into water and CO<sup>2</sup>.

The theory behind this purification is as follows:

Three conditions are required to ferment the organic substance; an optimal temperature, 63% water and the appropriate amount of oxygen. The Marton Chips which a certain physical and chemical treatment are processed for hold a bust amount of the surface area and porosity rate. Moreover, balanced ingredient of the lignin the pentosan, and cellulose is a special material containing three elements: to drain the water (drainage affect), to adjust the temperature and to supply oxygen.

Therefore, when the contaminated sludge and water is infused in the decomposing device and comes in contact with the Marton Chips, the sludge is divided into water and solid substance immediately. At the same time, the source of BOD contained in the sludge and water adheres to the Marton Chips temporarily, and it assumes an adhesive effect. When SS and BOD are separated into solids and water, the condition for fermentation which is the water rate 63% is formed. The bacteria medium produced here is a special minimum organism (the size is one thousandth - one 10 thousandth ), thus as bacteria can eat the entire source of sludge, and any waste produced can not be choked the system. The sludge is eaten by the bacteria, the Marton Chips are also eaten by the bacterial, yet the amount of the consumption seems to be minimal. It is enough to refill 3% extra chips a year. In the purified water, since there are a large number of bacteria for decomposing contaminated sludge, the bacteria is combined with the soil bacteria under the ground again. The fourth treatment is proceeded promptly, after that, the compound evaporates and becomes partially water, the water seems to protect the soil around the area. The bacteria appeared in the organic filter medium which holds the surface area of the Marton Chips 30m<sup>2</sup>/g inhabit in the Marton Chips, in which naturalized bacteria composed of both aerobic and anaerobic bacteria also inhabit. In the Marton Chips, the bacteria produce ammonia which causes the nitric acid and nitrous acid reaction, then by the denitrification, water

and CO<sup>2</sup> are released. At that time, a few phosphorus potassium may remain and can be reused as fertilizers.

### The Feature of the Marton Chips A

Marton Chips A invented by Tsukuba Institute for Environmental Studies (microbe inhabitable organic oxidizer) are specially physically treated wooden chips. By making the chips porous, the surface area and porosity percentage are increased, and as a result, a suitable condition which promotes microbe expansion is formed inside the chips. The chips are able to digest and extinguish BOD which is contained in the contaminated sludge. Marton chips provide a medium for microbes which fermentation, decompose and digest the solid substance (SS) in the organic wastewater from households or factories. The wastewater contains sludge liquid from protein, fat, and carbohydrate and so forth and is transformed into water and carbon dioxide by the of the microbe.

In other words the chips can be known as a contaminated sludge digestion medium.

Marton Chips A



Table 1 The Feature of the Marton Chips A

the main ingredient	cellulose	65 - 85%	porosity percentage	75 - 80%
	lignin	10 - 25%	surface area	1g (about 30m <sup>3</sup> )
	pentosan	5 - 10%	size	0.5mm - 5mm

### The Process of Decomposing Contaminated sludge and waste water

Discharged sewage water comes into the reactor pipe on the device, and the water contacts the Marton Chips. Then, the feature of the Marton Chips themselves is to accelerate the separation of solid and liquid (to make BOD cling and attach), water percentage will be 60-70%. This is the necessary condition of the fermentation, decomposition, and of the bacteria medium. The bacterial medium is not aerobic or anaerobic,

either, but an aptitude bacteria containing aerobic and anaerobic bacteria (some call the bacteria porous bacteria). This is what we are not able to see even by microscope, because the bacteria are very small like soil bacteria.

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The water produced by such process is purified dramatically. For example, sewage water drained from a small village will become under BOD 10 ppm.

### ● The Several Usages of the Marton Chips

Essential Industries	Usage	Necessary Device to use the chips medium
The Housing Industry	Detached houses Tenement houses Apartment/ Condominium Hotel	the wasted water decomposing device kitchen garbage machine the Integrated the wasted water decomposing device large-sized kitchen garbage decomposing machine
The Food Service Industry	Restaurants/ Grilled meat restaurant Chinese noodle restaurants School lunch	the wasted water decomposing device the contaminated sludge decomposing machine large-sized kitchen garbage decomposing machine
The Leisure Industry	Beach for leisure Mountain huts Ski and golf places Camping places	the contaminated sludge decomposing device/ portable toilet the Integrated the wasted water decomposing device kitchen garbage decomposing machine and device
The Food Processing Industry	Ham factories Frozen food factories Soybean paste/ soy sauce/ soy curd Ready made food factories Other food processing factories	the wasted water decomposing device the contaminated sludge decomposing device large-sized kitchen garbage decomposing machine
Fish and Stockbreeding	Fish washing factories	the wasted water decomposing device

Industry	Marine processed food factories Slaughterhouses/ pig farms/ poultry farms Caw farms/ pets	the contaminated sludge decomposing machine
Medical Institution etc	Hospitals Old people's homes Others	the wasted water decomposing device the contaminated sludge decomposing device the Integrated the wasted water decomposing device large-sized kitchen garbage decomposing machine
Others	Lakes and ponds Rivers Ocean Others	the wasted water decomposing device the contaminated sludge decomposing device the Integrated the wasted water decomposing device

## ●The Explanation of the New Invention: Tsukuba Marton System

### How the Contaminated sludge and waste water is purified

The newly invented Marton Chips (microbe inhabitable organic oxidizer) are a microbe medium which can transfer solid substance (SS) and sludge liquid into water and CO<sup>2</sup>. The sludge can come from houses or factories and usually contains animal and plant protein, fat, and carbon hydrate, It s known as a contaminated sludge decomposing medium.

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decomposing contaminated sludge, the bacteria is combined with the soil bacteria under the ground again. The fourth treatment is proceeded promptly, after that, the compound evaporates and becomes partially water, the water seems to protect the soil around the area. The bacteria appeared in the organic filter medium which holds the surface area of the Marton Chips 30m<sup>2</sup>/g inhabit in the Marton Chips, in which naturalized bacteria composed of both aerobic and anaerobic bacteria also inhabit. In the Marton Chips, the bacteria produce ammonia which causes the nitric acid and nitrous acid reaction, then by the denitrification, water and CO<sup>2</sup> are released. At that time, a few phosphorus potassium may remain and can be reused as fertilizers.

### The Theory of Decomposing

The bacteria itself which appeared in the organic filter medium within the surface area of the Marton Chips 30m<sup>2</sup>/g is a naturalized bacteria composed of both aerobic and anaerobic bacteria. The bacteria inhabit in the Marton Chips, and ammonia causes the nitric acid and nitrous acid reaction. After that, by the denitrification, water and CO<sup>2</sup> are released. At that time, a few phosphorus potassiums remain and can be reused as the fertilizers.

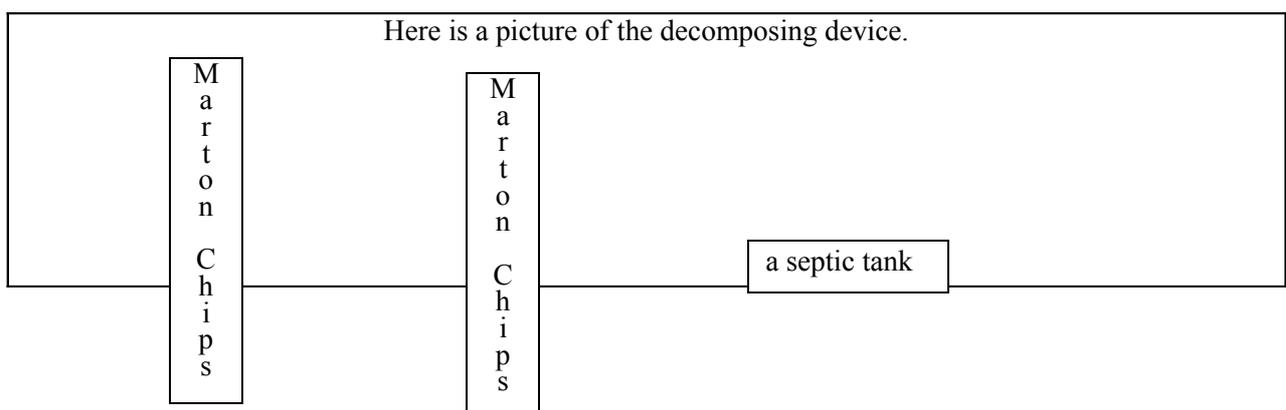
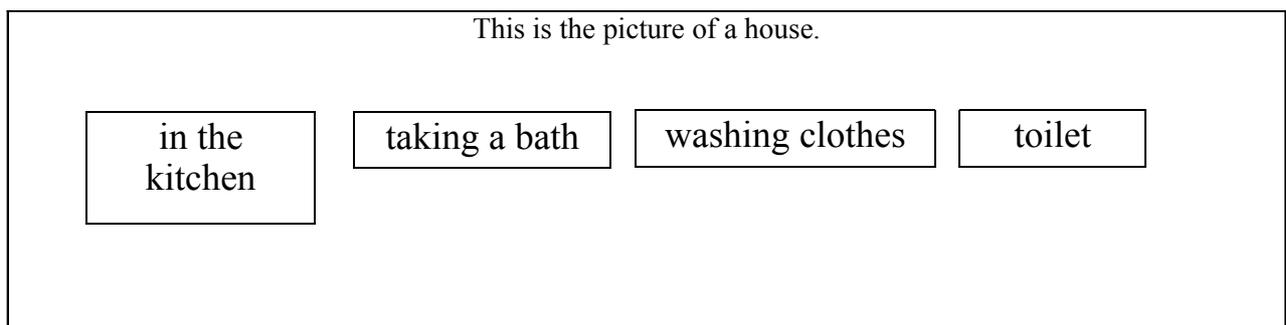
### ● Tsukuba Marton System helping to decompose contaminated water and garbage from houses

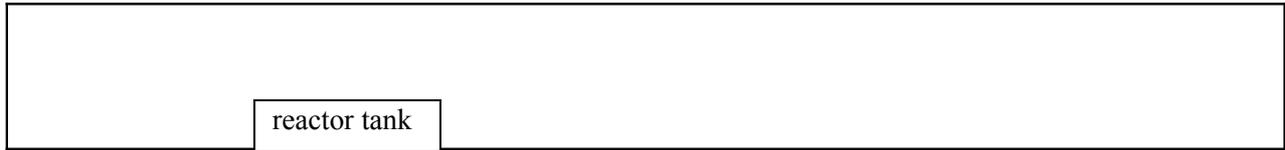
It is not necessary to throw away the kitchen garbage, because it can be decomposed inside a household's kitchen sink.

The water purified at the disposal tank helps a septic tank for sewage work easily.

The system reduces surplus contaminated sludge.

The system is suitable for tenement houses, apartments and condominiums.





## ● The Technical Terms for Decomposing Contaminated Sludge

### The active contaminated sludge system

The aerobic biological disposing of contaminated water and sludge makes use of the capability of microbes. The chart below shows principle of the system.

Organic substance 1g (1000mg)



water 1 ℓ



BDD (CDD) 1000mg/ 1 ℓ



Blower (Starting aeration)



The sludge or sewage in the water reduces the same amount of propagated microbe



Stop the blower



Stopping the blower makes the microbes settle at the bottom of the tank because of its weight



Release the purified water by the process

### Decomposition of the Organic Substance and Multiplication of the Microbes

The microbes purifies the contaminated sludge and water by using organic substances in the sludge and water as a source of nutrition (the energy of the multiplication).

### The Flowchart of the Active Contaminated Sludge System

Influx ⇒ Water tank ⇒ Water amount adjusting tank ⇒ Blower tank

⇒ Settlement tank ⇒ Sterilizing tank ⇒ Release

(※) By being attached the bacteria and blowing it in the blower tank of the active contaminated sludge system, the blowing tank adopts the adherent blowing system.

### The Trench System

The Trench System is the system which releases and filters the water through the soil with small stones, after the water has been through the blower tank and the settlement tank. However, the soil with small stones needs to be replaced within 2 or 3 years, and there should be a wide square measure to decompose contaminated sludge and water, thus this is one of problems amongst construction companies.

### **The Tsukuba Marton Chips System**

The Tsukuba Marton Chips System does not need to contain the blower tank and settlement tank, but instead the reactor tank which utilize the Marton Chips A and B. The contaminated water and sludge through the reactor tank purifies under BOD 10ppm, as a result, to release the water is available and it is also possible to reuse the water (by recycling the water from the first tank: to be able to use as dilution water). Hence, this is a recycling system which does not drain any water.

### **● The Technical Terms for the Environment**

#### **PPM (Parts Per Million) the Unit Representing One-Millionth**

$$1\text{PPM} = 1\text{mg} / \ell = 10\text{mg} / 10\text{mg} / 10\ell$$

For example, in the case that there are 2mg of chromium (VI) in 1ℓ of the water, its consistency is 2PPM.

#### **BOD (Biochemical Oxygen Demand)**

The oxygen demand to decompose and oxidize the organic substance in the household wastewater. The low level BOD means that as the amount of oxygen used by aerobic microbe does not need to be consumed largely, it signifies a small content of organic substance.

BOD usually represents the oxygen consumption 4 days of trial dilution water with BOD<sub>4</sub>, yet the proceeding speed of decomposing and oxidizing the nitrogenous substance, for example, is different from that of carbohydrate substance. In addition, since it takes a long time for the oxygen demand substance in the water to be met, it is better to compare the oxygen consumption in a certain time as a water quality index number.

#### **COD (Chemical Oxygen Demand)**

This is oxygen demand (PPM) in the case where the organic and inorganic ingredients in water are oxidized. The difference from BOD is, in this method the oxidizer such as potassium permanganate and chromium potassium is used, the substance related to BOD is not necessary to be involved in COD index number, the inorganic substance is partially involved, and so forth.

For instance, in the case that there is large amount of interfering substance such as a lot of deliquescent salt in the seawater to carry out BOD examination, the COD method is conducted.

## **PH (Potential of Hydrogen)**

(Red)      (Green)      (Blue)

Acidity <1> ← neutralization <7> → alkalinity <12>

The consistency of hydrogen ion is acidity when PH7 is neutralization and the level of the consistency shows smaller than PH7. The consistency of hydrogen ion is alkalinity when the level of the consistency illustrates is more than PH7.

The acid waste water is mainly produced from the chemical industry, metallic finish industry, organic and food industry. The alkalinity waste water is mainly produced from chemical industry, paper manufacturing industry, textile industry, and leather industry. For example, when there is 10 - 3g of the hydrogen ion in 1ℓ water, PH7 becomes neutralization at the 25 degree and this is the important condition to cultivate the microbes as well as the water temperature, mainly PH7 (neutralization), but the range of 6 - 8, is the appropriate for cultivate the microbe.

Although each type of microbe has its own appropriate PH for cultivation and most of the microbe's proper HP is between 6 - 5, in many cases, the condition of the PH tend to be under PH3 of strong acid and over PH9.5 strong alkalinity. However, by the CO<sup>2</sup> which is the product of the microbe, bicarbonate is formed, PH in the blower is likely to be kept near the centre. Hence, when PH becomes temporarily higher, there is a need for attentive control.

## **BOD load**

BOD load is the ratio with devices and BOD level (food) in the waste water for the microbe. Therefore, the higher BOD load means that there is a lot of food for the microbe and the level of contaminated sludge is higher, on the other hand, the lower BOD load shows less food for the microbe.

## **MLSS (Mixed Liquor Suspended Solid)**

MLSS is the consistency of the suspended solid (SS) in the blower tank for the active sludge decomposing process. Mainly, it is the amount of the active sludge (the combined sludge of the active sludge produced in the blower tank and returned sludge from the settlement tank).

## **Aeration**

It is called 'kibaku' or 'bakuki' in Japanese. The air sent into the waste water, and contacts with the water molecules. It is also an operation to remove iron in water, manganese, hydrogen sulphide, the effluvium from water, methane gas and CO<sup>2</sup>.

When the decomposing contaminated water and sludge with the activated contaminated sludge System is carried out, the air is blown into the water and by supplying the air into the sludge, aerobic bacteria propagates, the way of proceeding decomposition of the organic substance is important for applied aeration.

## **Normal Hexane**

Under normal temperature and pressure, colourless and transparent liquid is used as an extracting solvent for all kinds of grease. To know the amount of containment of animal fat, vegetable oil, mineral oil, the extraction with the normal hexane is prescribed drainage by standard.

### **SV (Sludge Volume)**

In the active contaminated sludge System, 1ℓ of water as a sample is taken from the blower tank, then left for 30 minutes, this is a numerical value which represents the amount of settled sludge with the degree of millilitre. When the numerical value is higher, bulking tends to happen.

### **SV (space velocity)**

In the method of filtering and absorbing water, the unit of space velocity is used. For example, when 1 ton of sampling water gets through the tank of settlement filter medium which is 1 cubic meter square, it is called space velocity 1.

### **Bulking the technical term concerned with the flocculent ability of the decomposing active contaminated sludge to settle**

When the SV1 of flocculent during precipitation is 50 – 150 millilitre, the flocculent ability to settle is good, but if it is 300 – 400, it is difficult to subside and bulking occurs.

### **DO (Dissolved Oxygen)**

The oxygen which is dissolved into water. As the activated contaminated sludge process decomposes the contamination from waste water by the aerobic metabolism, DO is indispensable. The oxygen in the air is mainly dissolved into the water, and the amount of dissolved oxygen is dependant on the temperature of the water. At a high temperature, the amount of dissolution decreases. There is less amount of oxygen in the higher contaminated sludge and water. In addition to this, although DO is changed depending on the amount of air supply, absorbed amount into the tank, blower time and BOD concentration level, the oxygen consumed by microbe from the absorbed air into the water is detected as a DO. The oxygen absorbing speed of the activated contaminated sludge becomes stable when DO is over 0.3mg/ℓ, but in fact, there is no problem with about 1mg/ℓ. \*It can not be over 7 – 9.

### **TOD (Total Oxygen Demand)**

Normally, BOD is represented as oxygen consumption in the water sample for 5 days. To get a result, it takes a long time, moreover, this does not show the whole oxygen consumption of the water sample. As it were, this is likely to be the side of not trustable numerical value, it is also not possible to know the applicable value for the BOD quickly. This is why, by the automatic detection equipment for the amount of organic substance in the water, the whole oxygen consumption (demand) which analytical value received in 3 – 5 minutes is called TOD.

### **SCI (Sludge Volume Index)**

This is the volume (milliliter) of the sludge 1g after 30 minutes settling, it is taken as a sample of a mixture of liquids in the aeration tank of the activated contaminated sludge process..

When the concentration of the suspended solids, which SV is the volume (MLSS) of the settled sludge after 30 minutes leaving, in the liquid is higher, the ability of the sludge to settle is not in a good condition.

Between 50 – 150 seems to be good condition, and between 300 – 400, bulking tends to happen.

### **Dilution and Condensation**

In the case of the wastewater treatment, the level of 'dilution' or 'condensation' which is required by the pre-treatment and the reduction of water, amount must be considered at the same time. In other words, the increased amount of water means the waste of the water supply. Moreover, the size of the facility for this system becomes so big that it is not economical due to the costs of construction. Depending on the type of wastewater treatment, the dilution and the condensation should be carried out properly.

For example, in the case that the wastewater treatment of a food factory is conducted by the activated contaminated sludge process, when the concentration of the raw water is BOD 2,000, the process is not able to be carried out. To do so, the appropriate concentration should be diluted until 500ppm.

Moreover, in the contrary, in the case that the treatment is conducted by the anaerobic digestion process, BOD 2,000 is impracticable numerical value to carry out the process. To condense into 10,000ppm, which is uneconomical, should be taken into consideration. In the case of the dilution, the process needs to be done before the main process. In addition to this, there is the possibility that the treated water is send back to the pre-process tank and is used as a dilution water, yet due to bacterial changes, care must be taken to prevent this.

### **Bacteria**

There are three kinds of bacteria; coccus, bacillus and spirillum depending on the shape of unicellular microbe. They are distributed widely throughout the air, water and soil, and are useful to prevent pollution, when they are put into practical use. The activated contaminated sludge process and the sprinkling filter process being made use of for wastewater treatment is one of the typical processes. There are specially adapted bacteria for the effluent water treatment which contains cyanogen, mercury and so on.

### **The Protozoa**

This is a general term for unicellular animals. For example, amoeba, Mastigophora, ciliate. The types of protozoa are aerobic, they prey on the organic substances and bacteria in the wastewater, and are able to oxidize and decompose inside their bodies.

### **Oxidation**

Generally, oxidation is to combine chemically a substance with oxygen.

The oxidizing reaction for the wastewater treatment plays a important role. The typical examples are as follows: the case that by cyanic acid, chlorine water and ozone, the wastewater is decomposed into carbon dioxide, the case that organic substance giving off a bad smell is decomposed by ozone with oxidation and become scentless, and the case that the organic dyestuffs from a dye works is decomposed by ozone with oxidation.

### **Lagoon Process**

A waste reservoir facility for the wastewater treatment within close proximity to the natural environment.

Wastewater flows into a wide and shallow land. Lagoon process is composed of the following three types:  
① aerobic lagoon, ② blower lagoon, ③ anaerobic lagoon.

## **Oxidant**

The principal component (accounting for approximately 90%) is ozone.

## **Ozone**

It exists as a form of gas and is also insecure. Its chemical formula is  $O_3$ , its colour is light blue, and it has a special offensive smell. Oxygen turned into with ozone's resolution possesses a very strong oxidative effect. Therefore, with this strong oxidative effect, purifying the air, purifying and bleaching the bacteria in the drinking water supply and the contaminated water is carried out, but when it becomes over a certain concentration level, it will be detrimental.

## **Activated Sludge**

In the wastewater treatment, when the aeration and precipitation are carried out again and again, the flocculation is developed rapidly. This precipitation is called the activated sludge.

## **Coagulant**

Chemicals to impregnate and flocculate the suspended material into the water. The coagulants normally used to decompose the wastewater are the inorganic coagulants, such as aluminium sulfate, ferric sulfate, and ferrous sulfate.

## **The Third Treatment**

By the first and second treatment, BOD is purified to 30ppm, but when, by the rule of the discharged water, BOD has to be lowered to 15ppm, the additional treatment needs to be carried out. This third treatment hopes to be carried out with the form of adsorptive filtration.

## **Active Carbon**

There are two ways to make active carbon. The first method is by heating up charcoal and other carbon materials to a high temperature (approximately 1000 degrees) and part of the charcoal oxidizes through the carbon dioxide gas and aqueous vapour and it becomes a product material. The second method is by conducting heat treatment with soaking the charcoal and peat in hygroscopic materials such as phosphoric acid, sulphuric acid and zinc chloride, the active carbon is produced directly.

As both types of active carbon absorb gas and liquid, they are made use of for preventing pollution such as deodorization of water for industry and agriculture and from factories and houses.

## **Diatomaceous Earth → Filtration aids**

The material that comes from the corpse of diatom deposit on the bottom of the ocean. The main component is silicate acid hydrate, which is a white or greyish white powder. This is used widely in

filtration aids.

### **Diatomaceous Earth Filter**

This is a precoat filter which filters and precoats the diatomaceous earth. Beforehand, agitation of water with diatomaceous earth is conducted, then the mixture is precoated and filtered.

Since this process carries out the filtration within the diatomaceous earth's own porous, and therefore allows fine filtration.