

## **Chemical Waste Management in Hospital; Impact on Environment and Health**

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### **Abstract**

This article discusses the chemical management of wastewater in hospitals. Liquid waste is all wastewater including feces originating from hospital activities which may contain pathogenic microorganisms, toxic chemicals and radioactive substances that are harmful to health. Therefore, the potential impact of hospital wastewater on public health is very large, so each hospital is required to treat its wastewater until it meets the applicable standard requirements. Good wastewater management is not only for sharp medical wastes but covers hospital waste as a whole. With the increasing number of health service facilities, it will result in an increasing potential for environmental pollution, because waste disposal activities, especially waste water, will contribute to decreasing the level of human health. Hospital waste is all waste generated from hospital activities in the form of solid, liquid and gas. It is better if hospital waste has a waste storage and treats the waste first before discharging it into the environment, so that the environment is not polluted and the government should build a monitoring system.

**Keywords:** Waste, Public Health, Hospital

### **Introduction**

Waste is waste resulting from a production process. Hospital waste is all waste generated by hospital activities and other supporting activities. Ineffective wastewater management can cause various problems. Several diseases that attack humans are caused by ineffective management of lymph. Waste water management is very important to do, so as not to interfere with activities in the environment where the waste water source is generated.

Moreover, if the source of the waste water is in an environment with high activity levels. Especially wastewater management in several community service places such as hospitals. The waste produced by the hospital can endanger public health, namely waste in the form of viruses and germs originating from the Virology and Microbiology Laboratory, which until now there is no antidote so it is difficult to detect. Liquid waste and solid waste originating from the hospital can serve as a medium for disruption or disease to be found for officers, sufferers and the community. These disturbances can be in the form of air pollution, water pollution, soil pollution, food and beverage pollution. These pollution are environmental health agents that can have a major impact on humans.

### **Types of Hospital Waste**

Abd El-Salam, M. M. (2010), Hospital waste is all waste generated from hospital activities in the form of solid, liquid, gas. Solid waste, all hospital waste in solid form as a result of hospital activities consisting of solid medical waste and non-medical waste. Solid medical waste, solid waste consisting of infectious waste, pathological waste, sharps waste, pharmaceutical waste, cytotoxic waste, chemical waste, radioactive waste, tiled container waste, and waste with high heavy metal content. Non-medical solid waste, solid waste generated from activities in hospitals outside of medical originating from kitchens, offices, parks and yards which can be reused if there is technology.

Liquid waste, all wastewater including feces from hospital activities which may contain microorganisms, radioactive toxic chemicals that are harmful to health. Gaseous waste, all waste in the form of gas originating from burning activities in hospitals such as incinerators, kitchens, generator equipment, anesthetics and manufacturing of cytotoxic drugs. Infectious waste, waste contaminated by pathogenic organisms that are not routinely present in the environment and these organisms are in sufficient quantity and virulence to transmit disease to susceptible humans.

Highly infectious waste, waste originating from cultures and stocks of highly infectious materials, autopsies, animal organs, experiments and other materials that have been inoculated, infected or come in contact with highly infectious materials. Cytotoxic waste, waste from contaminated material from the preparation and administration of cytotoxic drugs for cancer chemotherapy that have the ability to kill or inhibit the growth of living cells (Prüss-Üstün & Townend 1999). Waste minimization, an effort made by hospitals to reduce the amount of waste produced by reducing materials, reusing waste, and recycling waste.

### **Chemical Hospital Waste Management Methods**

#### ***Arsenic (As) and Cadmium (Cd)***

Arsenic has a variety of colors according to its shape, namely arsenic trioxide ( $\text{As}_2\text{O}_3$ ) is white and gray, but this form is rarely found (Miguel et al., 2009). Cadmium is a heavy metal which is silver white in color (Morrow 2000). Cadmium is often used in the metal plating industry, and is the final product in the ore processing industry. Cadmium has bad effects on the environment and humans, because it can cause breast cancer, respiratory problems, stool failure, and death. The technology that we can use is based on the results of research research from ITS University, namely several technologies that can be developed to reduce levels of arsenic and cadmium.

#### ***Arsenate and arsenite removal with zerovalent iron***

Arsenate ( $\text{As (V)}$ ) and arsenite ( $\text{As (III)}$ ) can be removed with zerovalent iron present in aqueous solutions. This is evidenced from a study conducted, where the effectiveness of decreasing arsenate and arsenite content in two reactors was seen. We combined 4 types of Fe0 (zerovalent iron) to obtain a suitable ratio in 0.01 M NaCl. Fisher electrolysis of Fe0 showed a very fast movement of arsenic. Fe0 damages the surface of the aqueous iron solution then forms a kind of magnetic corrosion on the Fe0 surface. This in turn creates interactions between metals, namely between Fe0 and As. In this experiment, pH has a very strong effect where pH below 7 is the most effective pH in helping ion interactions between metals. Furthermore, at pH 8 the ion reaction was more stable until the time was determined for 120 hours after administration of zerovalent iron.

#### **Mercury (Hg)**

All mercury deposits form from hydrothermal solutions in all types of rock caused by tertiary volcanism (Smith et al, 2008). Hg can also be formed as a trace element in most other mineral deposits. Minerals that contain mercury (Hg) are sinabar, metasinabarite, calomel, linguait, eglestonite, montroidite, and pure mercury. In precious metal mining business with amalgamation, mercury, or quicksilver (liquid form) processing methods it is used in large quantities as a gold and silver solvent / cap (Jensen et al., 1981). This processing process is in the spotlight because it produces tailings with a significant Hg content.

Mercury (Hg) which is formed as a fine fraction, trace elements, and ions should be watched out if it accumulates in significant amounts because it can have negative impacts on the environment (Kabata-Pendias et al., 2007). This element has been recognized as a

poisonous substance. Naturally, tailings consist of various types and are usually disposed of in the form of a slurry with a high water content. The tailings may also be composed of coarse grained dry matter in the form of floating fractions originating from the processing plant. The disposal of tailings is a major problem for the environment, which becomes even more serious when its existence is associated with increased exploitation and consequences of the processing of metallic minerals. The impact on ecology, especially on water pollution by solid materials, heavy metals, chemicals, sulfur compounds, and others.

The development of the use of disposal methods occurs because of the impact on the environment, changes in the processing process and the realization to gain production benefits. The conventional method that is still used by mining business actors to date is the discharge of tailings into river bodies and / or disposal on the ground after drying. Other techniques then developed much of the damage caused by using this method. The more finer grained ore is needed, the most appropriate way is needed in tailings reprocessing to create added production value.

In some subsurface mining, tailings are commonly used to stockpile ex-mining areas. Tailings are also used for back-filling in a mining activity by first going through separation because not all types of tailings can be used as fill material for openings. The tailings may expand or shrink after being used as fillers, and also have adhesive properties so they are very useful for cementing activities in subsurface mining. Tailings are also temporarily stockpiled during the mining period and then stored in dams. The construction of a landfill / dam must be in a safe and economical condition to accommodate the volume of tailings and function as a control for environmental pollution.

Serious problems arising from tailings disposal are mainly related to the release of polluted water due to the dissolution of heavy metals (including As, Hg, Pb, and Cd), acidity (low pH), chemicals / reagents from processing plants and suspension materials can form solid substances. In mineralogy, alkaline impurity minerals in the tailings often act as natural pollution controllers; where one of them is the role of calcium (Ca) in limestone which can facilitate the coating of metals and neutralize the results of oxidation. The tailings refining process is also often carried out by liming with the aim of neutralizing acidity, thereby encouraging flocculation (clumping) and deposition of heavy metals (in the form of hydroxides) before being flowed into the dam. Tailings handling involves thickening and draining the liquid and releasing heavy metals, then returning them to the processing plant thereby reducing the supply of water and pollutants / pollutants in the tailings dam.

### **Lead (Pb)**

Elemental Pb is generally found in association with Zn-Cu in the seed body. (Salama & Radwan 2005). This metal is important in the modern industry used for the manufacture of water pipes because of its corrosion resistance in all conditions and over a long period of time. Pb pigments are also used for the manufacture of paints, batteries, and tetraethyl gasoline blends (Jensen et al., 1981). The use of gasoline has decreased due to its impact on the environment.

Lead metal ore Pb can be formed in deposits such as massive stratabound sulfide, replacement, veins, sedimentation, and metasomatism in contact with the main minerals consisting of: galena (PbS), cerusite (PbCO<sub>3</sub>), anglesite (PbSO<sub>4</sub>), wulfenite (PbMoO<sub>4</sub>), and pyromorphite [Pb<sub>5</sub>(PO<sub>4</sub>, AsO<sub>4</sub>)<sub>3</sub>Cl]. Pb-carrying solutions include condensate water, artesian meteoric water, and hydrothermal solutions that rise to the surface; with most of the Pb coming from hydrothermal solutions which form ore deposits at low temperatures, in the form of filling the cavities of the host rock.

## **Chromium (Cr)**

It is an element that is silver or steel gray, lustrous and hard. The earth's crust contains about 100 mg / kg of chromium (Moore, 1991). Chromium is never found in nature as a pure metal. There are very few natural sources of chromium, namely chromite ( $\text{FeCr}_2\text{O}_4$ ) and chromium oxide ( $\text{Cr}_2\text{O}_3$ ) (Novonty & Olem, 1994). Chromium salts are used in the steel industry, paints, dyes, explosives, textiles, paper, ceramics, glass, photography, as a corrosion inhibitor and as a mixture for drilling mud (drilling mood).

### **Impact of Wastewater Contamination on the Environment**

A hospital is a health service institution that provides complete individual health services that provide inpatient, outpatient and emergency care (Gilmer 2010). In addition to health service activities to cure patients, hospitals are also a medium for exposure and / or disease transmission for patients, officers, visitors and the surrounding community who live near the hospital which is caused by agents (components that cause disease) in the hospital environment. With the increasing number of health service facilities, it will result in an increasing potential for environmental pollution, because waste disposal activities, especially waste water, will contribute to decreasing the level of human health. Hospital waste is all waste generated from hospital activities in the form of solid, liquid and gas. Liquid waste is all wastewater including feces originating from hospital activities which may contain pathogenic microorganisms, toxic chemicals and radioactive substances that are harmful to health. Therefore, the potential impact of hospital wastewater on public health is very large, so each hospital is required to treat its wastewater until it meets the applicable standard requirements.

Good waste water management is not only for sharp medical wastes but covers hospital waste as a whole. However, based on the results of the 2002 Rapid Assessment conducted by the government in the field of Water Supply and Sanitation involving District and City Health Offices, it was stated that as many as 648 hospitals out of 1,476 existing hospitals, 49% of which have new incinerators and those with installations. Wastewater Treatment as much as 36%. Of this amount, the quality of liquid waste that has gone through a processing process that meets the requirements has only reached 52%.

### **Chemical Waste Inspection Methods**

The tool used is a spectrophotometer which is a tool used to measure absorbance by passing light with a certain wavelength on a glass or quartz object called a cuvette. Part of the light will be absorbed and the rest will be passed. The absorbance value of the light passed will be proportional to the concentration of the solution in the cuvette (Cairns, 2009). AAS (Atomic Absorption Spectrophotometer) / SSA (Atomic Absorption Spectrophotometer). One type of spectrophotometer is the atomic absorption spectrophotometer (AAS). Spectrophotometry is a quantitative sequence analysis method whose measurements are based on the absorption of light with a certain wavelength by metal atoms in the free state.

AAS is intended to determine trace metal elements in the analyzed sample. The Atomic Absorption Spectrophotometer is based on the absorption of light energy by neutral atoms in the gaseous state, so heat is required. This tool is generally used for metal analysis while for non-metals it is rare. The working principle of AAS is to change the sample in the form of liquid into an aerosol or nebulae form, then with the fuel gas mixture it enters into the flame, here the analyzed elements become atoms in a ground state. Then the light coming from the cathode lamp with a wavelength corresponding to the element being tested will be passed to the atoms in the flame. The light that is not absorbed by the atom will be transmitted and emitted to the detector, then converted into a measured signal.

## How to Prevent Environmental Contamination

Waste generated by industrial, livestock and agricultural activities should be disposed of in a septic tank. Thus, the wastes that are formed do not pollute the environment, including waters. If in the end the waste is to be disposed of into the river, the waste must be treated first so that it is not toxic. The method that can be used to remove toxins from waste is filtering, diluting it, depositing it, then neutralizing it. When it is neutral, it is hoped that the waste will not have a bad impact on the environment.

## Impact to Health

Regarding human health problems, hospital medical waste is mainly due to various types of bacteria, viruses, chemical compounds, disinfectants, and metals such as Hg, Pb, Chrom and Cd originating from the dentistry department (Tufail & Khalid, 2008). Health problems can be grouped into direct disturbances, which are effects caused by direct contact with the waste, for example toxic clinical waste, waste that can injure the body and waste that contains pathogenic germs so that it can cause disease and indirect interference can be felt by the community, both those who live in the vicinity of hospitals and communities who often pass through sources of medical waste due to the process of decomposition, burning and disposal of this waste.

Hospital medical waste can also cause genetic and reproductive disorders. Although the mechanism of interference is not fully known with certainty, some compounds can cause disturbances or damage to genetic and human reproductive systems, for example pesticides (for the eradication of flies, mosquitoes, cockroaches, mice and other insects or animals) and radioactive materials.

Hospital medical waste can also cause cross-infection (Singh et al., 2012). Medical waste can be a vehicle for the spread of disease-carrying microorganisms through a cross-infection process either from patient to patient, from patient to officer or from officer to patient. In the environment, there is the possibility of releasing waste into the groundwater, surface water and air pollution, causing environmental pollution due to hospital waste.

## Conclusion

Liquid waste parameters that exceed quality standards are discharged into the environment can have an impact on the environment and health. For example, Cd metal also carries toxic properties that can be very detrimental to all living organisms including humans. The method used in examining the contamination level of a waste is spectrophometric which aims to see what the value of contamination is in a waste

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