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Safe method of disposal of unused Pharmaceutical Product

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Research Article

Abstract

Pharmaceuticals are chemical products readily available at home. A large quantity of these chemicals is thrown out as waste due to unused and expiration before consumption. The present article summarizes the method of their disposal, which has scientific potential and is eco-friendly. The present article covers major classes of pharmaceuticals in different headings.

Keywords: Encapsulation, Incineration, Landfill, Pharmaceuticals

1. Introduction

India is one of the largest manufacturers of pharmaceuticals in the world. The capacity of Indian Manufacturer Company cross the country boundaries, and a large quantity of their products are exported to another country. In the covid pandemic, India is the first and biggest manufacturer of the covid vaccine. The capacity and potential are continuously increasing to all the segments of pharmaceuticals including raw material, active ingredient, and finished product and packaging materials production.

Apart from the production of pharmaceuticals, India is also the biggest consumer of Pharmaceutical products. A fact for this is based on the population of the country. Indian population is around 1.39 Billion; a significant percentage of the entire world is lives in a small portion of the earth.

Expiration of the Pharmaceutical in a drug distribution channel, alteration of therapy, change of therapy, patient recovery before completion of therapy, Incompletion of therapy, and patient death are a few reasons which generate a pharmaceutical waste product [1].

A chemical nature requires a specific treatment without affecting the environmental aspect. These chemicals are harmful to the ecological system of the environment. A scientific method of disposal is presented in this article.

2. Method of Disposal

2.1 Landfill

The selection of land is an essential factor for this method. Unused and nonfertile land above the water land and away from the

water source is commonly used for this purpose. Solid, semisolid, and powder pharmaceuticals can be landfilled [2]. If a recycling program exists to reuse materials such as glass, aluminum, or paper, then packing materials and glass can be separated from the pharmaceuticals. Liquid waste, healthcare wastes- such as infectious clinical wastes from hospitals, medical premises, or veterinary establishments, radiopharmaceuticals, wastes with dangerous characteristics including explosive, corrosive, flammable or oxidizing pharmaceutical.

2.2 Encapsulation

In this technique, solid, semisolid, powder anti-infective, anti-neoplastic, controlled release, etc., are treated. Pharmaceutical waste products are converted into a solid block by encapsulating nonreactive materials. A cement, plastic block are the best choice for this purpose some time stainless steel may also use. Initially, the block is about 75% filled with pharmaceuticals, then the remaining 25% space is filled with sand, lime, cement, plastic foam, or bituminous sand as per the availability. Finally, the prepared block is securely isolated.

2.3 Inertization

Inertization is a process of converting active pharmaceutical to an inactive form by treatment anti-infective drugs, anti-neoplastic drug controlled release formulation are preferably disposed of by inertization. This technique is suitable for solid and semisolid classes of dosage forms. In this technique, after removing reused packaging materials, pharmaceuticals are grind to convert into small particle size and mixed with water, cement, and lime in equal proportion. Highly oxidizing agents like potassium permanganate and hydrogen peroxide are initially mixed with active pharmaceuticals to convert into inactive and harmless. Finally, a mixture of cement and lime in a transformed liquid state is transferred to a landfill [3].

2.4 Sewerized

This technique is adopted only for liquid formulation. Especially a dilute liquid about 1 to 5% is suited. Mostly solution and parenteral fluid come under this heading. In this process, a minimal quantity of product is flushed into a sewer over a long time gap. Before adopting this treatment technique must be done, a functioning sewage treatment plant occurs in the channel before releasing into a river or other natural source of the water system. This method is highly restricted to antibiotics, anticancer, narcotic, and radiopharmaceuticals.

2.5 Incineration

Incineration is the most applied technique for the treatment of pharmaceutical products. Their applicability range is wide, covering almost all variety of products like solid, semi-solid, powder, liquid, antibiotic, anti-neoplastic, and controlled release products. Some perticular pharmaceuticals like gaseous, radiopharmaceutical, explosives, and aerosols are not treated by incineration due to the chance of explosion. Incineration of two types based on the temperature applied. In medium temperature incineration and high-temperature incineration, used temperatures about 850^0C and 1450^0C, respectively. Incinerators are divided into two-chamber. In the primary chamber, the

pharmaceutical product is placed. The adjusting chamber is interconnected with a primary chamber to escaping gas produced during the procedure. These toxic combustion products are absorbed into the cement or removed in the heat exchange equipment. In this process, a high temperature is applied for two seconds. Most advantageous is removing organic waste by safety process [4].

3. Disposal of a special class of Pharmaceutical

3.1 Biodegradable product – Vitamin and enzyme products are organic biodegradable materials. These products are removed and separated from reused materials and landfills or flush into the sewer after proper dilution over a long period [2].

3.2 Intravenous fluid – A vehicle for intravenous fluid usually contains salt like sodium chloride, potassium chloride, amino acid dextrose, and glucose. These compounds are obtained from mineral and plant sources, therefore considered safe for disposing of by flushing into the sewer. Before treating, an important consideration must be the nature of active pharmaceutical agents present in the intravenous fluid. The intramuscular injection contains an oily vehicle, therefore not flush into the sewer [5].

3.3 ***Disinfectants*** - Most disinfectants are chemical; WHO releases a composition table with disposal methods for disinfectants known as chemical safety. A small quantity may be disposed of to the sewer with proper dilution. A large amount may not be released into a sewer to prevent the aquatic biological cycle and necessary microorganism ecology. Other treatment methods like chemical waste disposal and cement kiln are adopted [6].

3.4 Ampoules – Ampoules are single-piece glass containers with a small quantity of liquid in a liquid state. Unused and expired ampoules are crushed on impermeable surfaces like plastic, rubberwood, or concrete connected to a filtration system to separate glass and liquid. Glass is reused after proper washing, and liquid products are subjected to treatment. Small quantities are mainly subjected to flush in a sewer after dilution. A large amount is subjected to encapsulation or internalization disposal method. A nebulizer ampoules contain volatile liquid, and it can be disposed of by evaporating into the open air [7].

3.5 Aerosols – Aerosols contain gases as a vehicle for the active ingredient. Mostly applied gas is harmful chlorofluorocarbons. This gas needs to be treated before releasing into the atmosphere. Aerosol containers are deep into the water and puncture them. After some time, all the gases are released into the water and water-filled into the container. Aluminum and glass are primarily used aerosol container which is easily reused. By this method, toxic gas could not release directly into the atmosphere. Incineration is not suitable for this aerosol because of its flammable and explosive nature [8].

3.6 Cytotoxic Drug – This is a drug that comes under the heading of anticancer pharmaceuticals. These drugs are potent, and toxic require a highly controlled disposal treatment. A high-temperature incineration technique is adopted for disposal. Typically poisonous gases are released during operation, cleaned by gas cleaning equipment fitted with a secondary chamber. In the secondary chamber,

products are packed after the removal of packaging and reusable materials. The temperature of the chamber is set at 1100^0C. At this temperature required only a few seconds to dispose of the product. In some cases, pharmaceutical products are converted into a high-temperature solution burnt on the primary incineration chamber. A complete disposition of the cytotoxic drug may be possible by a two-chamber incinerator [9].

3.7 Narcotics – Narcotics are habit-forming products, and the possibilities of drug abuse are also very high with this product. The disposal of these products is done under the presence of a Narcotic Officer or police supervision. These products are trying to dispose of in a single lot to prevent any misconduct during the process. High-temperature incineration is the best method to dispose of them. Landfilling and flush into the sewer are highly restricted for the disposal of narcotics.

3.8 Pressurized cylinder – An explosion-proof dismantling facility should be used to treat pressurized cylinders. It is recommended that the cylinders be stored securely and periodically taken to a military site to be destroyed in a controlled explosion and scrap metals recycled or dispose of in a landfill.

Conclusion

Pharmaceutical products are life-saving if taken in a controlled manner as suggested by physicians and Pharmacists. An accidental use pharmaceutical is highly dangerous; therefore recommended that do not be store in unused and expired products in the home. In case of unavailability of equipment and resources for disposal best attempt is a deposition at Pharmacy and pharmaceutical education institute where these pharmaceutical products are probably used for teaching, demonstration, and experiment function. So many charitable institutes are also working in this regard. They collect unused domestic pharmaceuticals from door to door and distribute them to the patient via the proper drug distribution channel. Ensure that do not mix pharmaceutical waste products with domestic waste products like kitchen bypass products like food and vegetables. This practice is highly harmful to insects, tiny organisms, and living things like a cat, dog, cow, and buffalo, which contact this domestic waste product. These are part of the food chain system of our biosphere. Do not be destroying the essential things with life-saving products like pharmaceuticals.

Conflicts of interest: Authors have no conflict of interest to declare.

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