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LEARNING HOW TO MANAGE THE BIOLOGICAL- INFECTIOUS WASTE IDENTIFIED IN THE PHARMACEUTICAL MICROBIOLOGY GROUP OF UPIBI-IPN

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Abstract: In ancient times, Hippocrates mentioned that in order to maintain his health, man must respect and keep the environment clean. Over time, biological-infectious waste (RPBI) was generated in hospitals, in research and teaching. Therefore, the objective of this work was to identify the infectious biological waste generated in the pharmaceutical microbiology group. The students made a mental map of the Official Mexican Standard NOM-087-SEMARNAT-SSA1-2002, which establishes the classification of biological-infectious hazardous waste, as well as the specifications for its management. Subsequently, they carried out the identification of residues in the microbiology laboratory where: strains in test tubes, cultures in Petri dishes, microbial smears and micropipette tips were identified. The students concluded that said waste requires adequate treatment to eliminate its pathogenic characteristics prior to its final disposal. Reducing the amount of hazardous waste, through the use of smaller Petri dishes, would be a positive contribution to the effective management of this type of waste.

Keyword: Environmental protection, Environmental health, Biological-infectious hazardous waste, Classification and handling specifications.

Hazardous Biological-Infectious Waste (RPBI) is that generated during medical care services that contains biological-infectious agents and that can cause harmful effects to health and the environment. The following are considered biological-infectious waste: blood, pathological waste, non-anatomical waste, sharp objects, cultures and strains of biological-infectious agents (Official Mexican Standard NOM-087-ECOL-SSA1-2002, Environmental protection - Environmental health - Waste dangerous biological-infectious - Classification and handling specifications).

Blood and its components, only in its liquid form, also including hematopoietic progenitor cells and the cellular or acellular fractions of the resulting blood (blood products). Pathological waste is defined as tissues, organs and parts that are excised or removed during necropsies, surgery or some other type of surgical intervention that is not in formalin. Also biological samples for chemical, microbiological, cytological and histological analysis, excluding urine and excrement, corpses and parts of animals that were inoculated with enteropathogenic agents in research centers and vivariums. Non-anatomical waste: These include disposable containers that contain liquid blood, soaked healing materials, saturated or dripping blood, or could also be synovial fluid, pericardial fluid, pleural fluid, cerebrospinal fluid or peritoneal fluid. There are also disposable materials containing sputum, lung secretions and any material used to contain samples from patients with suspected or diagnosed tuberculosis or another infectious disease, as well as disposable materials from patients with suspected or diagnosed hemorrhagic fevers. Sharp objects include those that have been in contact with humans or animals or their biological samples during diagnosis and treatment, only capillaries, razor blades, lancets, disposable syringe needles, hypodermic acupuncture and tattoo suture needles, scalpels and catheter stylets, except for all broken glass material used in the laboratory, which must be disinfected or sterilized before being disposed of as municipal waste. In the same way, cultures and strains of biological-infectious agents generated in diagnostic and research procedures. Regarding this point, in the pharmaceutical microbiology laboratory we work with this type of microorganisms for the purpose of teaching students.

Hippocrates in ancient times mentioned that health was the unity of the human

being and his environment and that to preserve his health the environment must be respected and kept clean. This would seem simple and easy to do, but over time measures have been implemented to care for health and the environment. This way, biological-infectious waste that is produced in hospitals and in the educational sector produced in the area of research and teaching, entered into a classification in which, due to its characteristics, it must be managed in appropriate terms to protect the environment and health in general. Considering that human activities generate different types of waste (i.e. domestic, industrial and hospital waste), in this work the waste that is generated in a Microbiology group of the Interdisciplinary Professional Unit of Biotechnology of the National Polytechnic Institute was identified.

Although NOM-087-ECOL-SSA1-2002 was initially conceived with the purpose of making medical and support personnel safer when carrying out their activities and thus avoiding accidents or contamination derived from the mismanagement of biologically hazardous waste, infectious; Another relevant factor that later became relevant was environmental contamination or the personnel who subsequently managed the waste (inappropriate management). Currently, this standard applies beyond just medical establishments, since any industry can generate this type of waste, such as research laboratories, the food industry, factories that dispose of animal waste, tattoo artists, offices within companies and many more. For these reasons, it is very important to teach students the importance of applying NOM-087-SEMARNAT-SSA1-2002 from academic laboratories such as the pharmaceutical microbiology laboratory for the generation of microbial strains and use of agars.

Therefore, the objective of this work was to identify the infectious biological waste

generated in the pharmaceutical microbiology group and raise awareness of the implications and risks that this type of waste can cause infectious diseases and the environment.

METHODOLOGY

To begin this investigation, the students were asked to make a mental map of the Official Mexican Standard NOM-087-SEMARNAT-SSA1-2002. Environmental Protection-Environmental Health-Biological Hazardous Waste-Infectious-Classification and Management Specifications, in order to have a general overview of the quantities and types of infectious biological waste that are generated at the UPIBI. Although the microorganisms used in the microbiology laboratory are not pathogenic, they are handled with great care. Furthermore, the students formed the concept that a microbial strain is a culture of a group of microorganisms that descend from just one previously isolated cell or sample, that is, this group shares certain genetic characteristics that are not found in other representatives of the same species, which is why it is also called a lineage of organisms and has the capacity to cause serious diseases, which is why they must be handled with great care in microbiology laboratories. Microbial strains, being microorganisms capable of producing diseases when they are present in a sufficient concentration, in an environment conducive to survival and there is an entry route, as well as a susceptible host, are considered infectious biological agents by NOM-087-SEMARNAT-SSA1-2002. This way, an infectious biological waste is all that material generated during the practices of the Academy of Microbiology and that is contemplated and defined within NOM-087-SEMARNAT-SSA1-2002 and that may cause harmful effects to health and To the environment.

RESULTS

During the teaching of pharmaceutical microbiology, a certain amount of biological-infectious waste is generated. Figures 1 to 6 show the most common biological-infectious waste generated in the pharmaceutical microbiology laboratory.

Among the biological-infectious waste that the students identified were the following: strains in test tubes, cultures in Petri dishes, some microbial smears and micropipette tips.

In Figure 1 you can see some strains contained in test tubes and cultures carried out in Petri dishes. This material is used to practice staining in the pharmaceutical microbiology laboratory where different types of microorganisms are used in conjunction with certain nutritional requirements which are considered as dangerous biological-infectious waste (RPBI) because they have the capacity to generate some risk to health and spread in the environment according to the concentration they present.

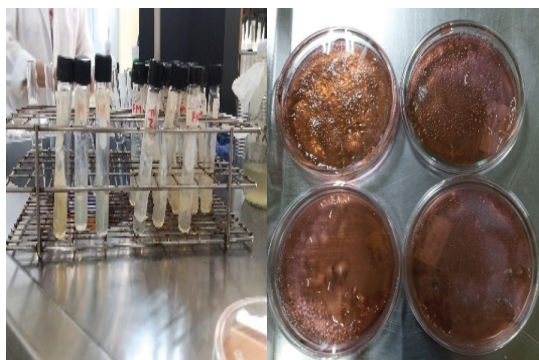


Figure 1. Microbial strains used for staining.

In Figure 2 you can see different types of molds grown in Petri dishes. As it is a microorganism with the presence of nutritional requirements, in the same way as the previous case in Figure 1, it is considered hazardous biological-infectious waste (RPBI).

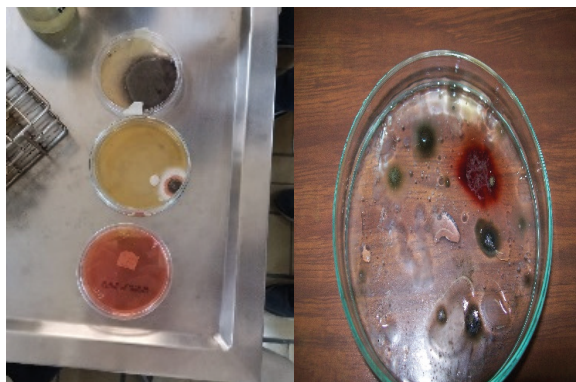


Figure 2: Cultivation of molds in different culture media.

Figure 3 shows the inactivation procedure for micropipette tips. This process is carried out because these, when used to contain, transfer, inoculate or mix cultures of biological-infectious agents, acquire a dangerous characteristic, in this case, for having contained a biological-infectious agent, therefore, these materials must undergo treatment as they are not for disposable use.



Figure 3: Micropipette tips placed in a container to be inactivated.

Subsequently, in Figure 4 you can see the making of a smear of different bacteria worked on in the pharmaceutical microbiology laboratory. A smear is made by spreading a sample or culture in order to separate the microorganism as much as possible and obtain a clearer image to observe under the microscope. Due to the above and because

they contain a microorganism, smears are also considered infectious biological waste.



Figure 4: Smears of different bacteria.

In Figure 5, you can see a container which contains waste dyes used in pharmaceutical laboratory practices. These dyes are in contact with different microorganisms, which is why they are also classified as infectious biological waste.

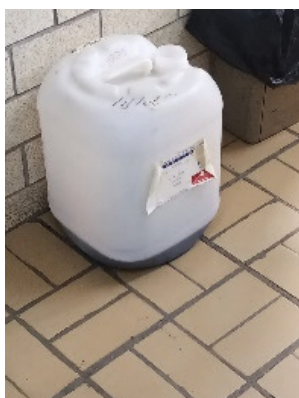


Figure 5: Collection of dyes that were in contact with the microorganisms.

Below are containers that contain syringe needles that are discarded once used in the pharmaceutical laboratory. Since these contain needles that have been in contact with humans or animals or biological samples during diagnosis and treatment, they are also considered biological-infectious waste, so the container that contains them must be labeled or labeled with all the criteria set forth. NOM-087-ECOL-SSA1-2002 and must undergo disinfection or sterilization treatment prior to disposal as waste.



Figure 6: Containers used for disposable syringe needles.

Finally, in Figure 7 you can see a mental map prepared by the students of the pharmaceutical microbiology subject. On the map, the students generalized and schematized in a clear and simple way the content of NOM-087-ECOL-SSA1-2002 which indicates the classification and management specifications of biological-infectious waste. This standard is of utmost importance in the pharmaceutical microbiology laboratory since we work with microorganisms on a daily basis and these give rise to the generation of said waste, which must be disposed of in a specific way since they can cause damage to health and the environment.

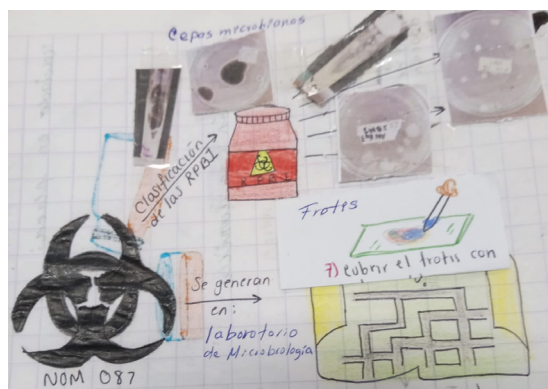


Figure 7: Mental map of the Official Mexican Standard NOM-087-SEMARNAT-SSA1-2002, prepared by the students of the pharmaceutical microbiology class.

ANALYSIS OF RESULTS

In microbiology research and teaching laboratories, the generation of hazardous biological-infectious waste is very common as part of routine analyzes and teaching activities. In the present study, it was observed that test tubes and Petri dishes that are more than 5 years old sometimes accumulate in the teaching laboratory. Although the Official Mexican Standard NOM-087-ECOL-SSA1-2002 was initially aimed at medical and support personnel so that their activity could be carried out safely, thus avoiding accidents or any contamination derived from the mismanagement of biological-infectious waste. hazardous, it is currently a fundamental tool in teaching laboratories so that students can learn to manage this type of waste.

The proper management of biological-infectious waste is of great importance since if for any reason a student had an injury, it could become contaminated. On the other hand, if these sharp objects are placed directly in the garbage containers, the health of cleaning staff could be put at risk. For these reasons, it is very important to treat the RPBI generated in the laboratory on a regular basis to avoid its danger and release into different environmental matrices such as soil and water.

Thus, in the microbiology laboratory the prior treatment that this type of waste must have is sterilization at 121°C for 15 minutes, so that it can be disposed of safely.

During the course, no one was infected with any strain since the students became aware of their health care through the proper management of the RPBI generated in the laboratory.

The management of hazardous biological-infectious waste from generators and service providers, in addition to complying with the applicable legal provisions, must comply with the provisions corresponding to the following management phases:

- a.- Identification of waste.
- b.- Packaging of the waste generated.
- c.- Temporary storage.
- d.- Collection and external transport.
- e.- Treatment.
- f.- Final provision.

Below, the treatment that must be given to each waste presented above in the figures is described in accordance with the provisions of NOM-087-SEMARNAT-SSA1-2002 and each stage of management must be authorized by the Ministry of the Environment. and Natural Resources (SEMARNAT).

1.- The microbial strains used for staining must be packaged in red polyethylene bags and stored temporarily for a maximum of 30 days in an area designated for metal or plastic containers with lids and labeled with the symbol. universal biological risk, with the legend Biological-Infectious Hazardous Waste. Subsequently, they will be collected and transported for treatment by physical or chemical methods that guarantee the elimination of pathogenic microorganisms and must be made unrecognizable for final disposal in authorized sites.

2.- Mold cultures in different culture media must be packaged in red polyethylene bags and stored temporarily for a maximum of 30 days in an area designated in metal or plastic containers with lids and be labeled with the symbol. universal biological risk, with the legend Biological-Infectious Hazardous Waste. Subsequently, they will be collected and transported for treatment by physical or chemical methods that guarantee the elimination of pathogenic microorganisms and must be made unrecognizable for final disposal in authorized sites.

3.- Micropipette tips placed in containers

to be inactive as they are utensils used to contain, transfer, inoculate and mix cultures of biological-infectious agents must be packaged in red polyethylene bags and stored temporarily with a maximum of 30 days in an area designated in metal or plastic containers with lids and be labeled with the universal symbol of biological risk, with the legend Biological-Infectious Hazardous Waste.

Subsequently, they will be collected and transported for treatment by physical or chemical methods that guarantee the elimination of pathogenic microorganisms and must be made unrecognizable for final disposal in authorized sites.

4.- The swabs obtained from different bacteria must be packaged in red polyethylene bags and stored temporarily for a maximum of 30 days in an area designated for metal or plastic containers with lids and labeled with the universal risk symbol. biological, with the legend Biological-Infectious Hazardous Waste. Subsequently, they will be collected and transported for treatment by physical or chemical methods that guarantee the elimination of pathogenic microorganisms and must be made unrecognizable for final disposal in authorized sites.

5.- For the collection container of dyes that were in contact with the microorganisms, it must be handled as two wastes, one is the container and the other is the dye where the container, being a solid, must be packaged in a polyethylene bag of red color and the liquid, that is, the dye, must be packaged in an airtight yellow container and both must be stored temporarily for a maximum of 30 days in an area designated in metal or plastic containers with lids and be labeled with

the universal symbol of biological risk, with the legend Biological-Infectious Hazardous Waste. Subsequently, they will be collected and transported for treatment by physical or chemical methods that guarantee the elimination of pathogenic microorganisms and must be made unrecognizable for final disposal in authorized sites.

6.- The containers used for disposable syringe needles are already established containers for sharp objects, so they will only be taken as solid waste, which must be packaged in red polyethylene bags and stored temporarily with a maximum of 30 days in an area designated for metal or plastic containers with lids and labeled with the universal biological risk symbol, with the legend Biological-Infectious Hazardous Waste. Subsequently, they will be collected and transported for treatment by physical or chemical methods that guarantee the elimination of pathogenic microorganisms and must be made unrecognizable for final disposal in authorized sites.

The agar used in the pharmaceutical microbiology laboratory is a gelling agent which is used in the preparation of culture media, which has the main advantage of the absence of inhibitors that can mask the optimal development of microorganisms, so it must be packaged. in red polyethylene bags and be stored temporarily for a maximum of 30 days in an area designated in metal or plastic containers with lids and be labeled with the universal symbol of biological risk, with the legend Biological-Infectious Hazardous Waste. Subsequently, they will be collected and transported for treatment by physical or chemical methods that guarantee the elimination of pathogenic microorganisms and must be made unrecognizable for final disposal in authorized sites.

CONCLUSIONS

The students understood that during pharmaceutical microbiology practices, RPBI is generated, so they must consider its proper management in order to prevent these wastes from accumulating and being a potential health risk. On the other hand, reducing the amount of hazardous waste by using smaller Petri dishes would significantly facilitate the management of this type of waste.

During the handling of biological-infectious waste there is a risk of contracting an infectious disease. In the case of the microbiology laboratory, students manipulate

bacteria and molds, so identifying potentially dangerous waste and following biosafety measures during their handling was of great importance so that they can apply this knowledge in their future work and reduce your risk of contracting a disease.

In addition to the importance of knowing and managing biological-infectious waste, the students investigated that this type of waste is under the supervision of SEMARNAT, PROFEPA, SSA and COFEPRIS and that these institutions are in charge of regulating and monitoring compliance in how much their classification, separation and final treatments.

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