Mechanisms of managing medical waste resulting from Covid19 in the Algerian legislation

آليات تسيير النفايات الطبية الناجمة عن كوفيد 19 في التشريع الجزائري

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***abstract**:*

Medical waste is a real danger, particularly those related to serious diseases (covid19 as an example), and its danger is even greater for individuals who deal with it directly, such as doctors, nurses, assistants employees and even patients, as well as workers in the field of support services such as cleaning staff, ambulance drivers and civil protection personnel, because the nature of their work makes them suscenptible to infection more than others, as well as individuals who are present in the vicinity of disposal facilities (places of burning, burial, or dumping dumps).

The disposal of these wastes such as masks, tissues, clothes, shoes and all means of examination used by doctors and pharmacists must be done carefully and in safe ways so as not to harm the environment since burning them cause pollution.

***Keywords:** Medical waste, covid waste, waste treatment, waste management*

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ملخص:

تشكل النفايات الطبية خطرا حقيقيا لاسيما تلك المتعلقة بالأمراض الخطيرة (من شاكلة كوفيد 19)، وتتضاعف خطورتها لدى الأفراد اللذين يتعاملون معها بشكل مباشر كالأطباء والممرضين والمساعدين الموظفين والمرضى، وكذا العاملين في مجال الخدمات المساندة كأعوان التنظيف، سائقي سيارات الإسعاف واعوان الحماية المدنية، فطبيعة عملهم تجعلهم معرضين للعدوى أكثر من غيرهم، وكذا أفراد آخرون متواجدون في محيط التخلص منها (أماكن حرقها او طمرها او مكبات رميها).

فالتخلص من هذه النفايات من كمامات، مناديل، ألبسة وأحذية وجميع وسائل الفحص المستعملة من طرف الأطباء والصيدلانية يجب أن يتم بعناية وبطرق أمنة غير مضرة بالبيئة مادام إحراقها يلوث البيئة.

الكلمات المفتاحية: نفايات طبية، نفايات الكوفيد، معالجة النفايات، تسيير النفايات.

Introduction :

The world governments face a problem other than prevention and treatment of the Corona virus, which is the emergence of tons of contaminated medical waste in many countries, whether developed or developing, and Algeria is one of them.

Who among us has not encountered the remnants of prevention from the virus Covid19 such as gloves and masks, blood test tubes, which are thrown everywhere in the street, even in departments and shops, and it has become a common thing and what is more dangerous than that is seeing children in the street playing in them, unaware of their danger, which poses a great danger to the health of citizens and the environment and leads to creating a new problem which is how to eliminate and dispose of used tools and any waste related to fighting covid19, besides working to eliminating the virus.

The problem of fighting the virus and limiting its spread and disposal of waste and being vigilant and careful is not a matter of the government and its institutions alone, that is, it does not concern only public and private hospitals, medical centers, clinics and ambulances, instead it is a common responsibility shared between the government and all citizens. .

So, getting rid of this waste, especially with the outbreak of the pandemic, has called upon greater awareness and rigorous management from the government and its health care institutions.

***Problematic**: What is the mechanism for managing medical waste during the repercussions of the Covid 19 virus? To answer this problematic, the descriptive analytical method was used through two chapters, under which subsections fall.*

***First main title:** Covid19 waste between the legal rooting and the concept*

***Second main title:** measures to confront Covid19 waste*

First main title: Covid19 waste between the legal rooting and the concept

All countries, including Algeria, are witnessing an increase in the number of daily infections, accompanied by piles of contaminated medical waste, remnants of infected patients' food and clothes, disinfectant bottles and sterilizers, masks and medical gloves, which in themselves are a factor in the spread of the virus if they are disposed of randomly., and it is what is happening now since the speed of the emergence and spread of the disease did not leave the countries the opportunity to contain the process of disposing of its remnants, as it depends mainly on the legal texts in force before the emergence of the virus.

First subtitle: Covid 19 waste is among the legal texts and regulatory related to waste management in general and those related to medical waste

In order to dispose of wastes , Algeria has issued many legal texts to meet the challenges posed by waste disposal, but when it comes to hazardous medical waste that threatens health, human and environment, legislation remains few and ineffective depending mainly on laws governing waste.

Section one: Legal and regulatory texts related to waste management

The most important legal text in Algeria is: Law No. 01-19 signed on Ramadan 27 -1422 corresponding to December 12, 2001, related to management, control and removal of waste[1] And which was followed by many regulatory texts related to waste in general, including:

**Executive Decree No. 05-315 dated September 10, 2005 specifying the modalities for declaring specific and hazardous wastes[2] .*

** Executive Decree No.06-104 of Muharram 29, 1427 corresponding to February 28, 2006, fixing the list of wastes, including special hazardous wastes.[3].*

** Executive Decree No. 09-19 dated Muharram 23, 1430, corresponding to January 20, 2009, includes organizing the activity of special waste collection.[4]*

** Executive Decree No.04-409 dated Dhu al-Qi'dah 2, 1425, corresponding to December 14, 2004, specifying the methods of transporting hazardous special wastes.[5]*

Section two: the absence of a legal or regulatory text that frames Covid196 waste

Despite the seriousness of the medical waste associated with the Corona pandemic, we note the absence of any legal or regulatory text to regulate and manage these wastes which remain subject to the laws on waste in general and medical waste in particular. Even when it comes to legal or regulatory texts on medical waste, we note the existence of modest texts, as we refer to three texts, which are:

Health Law No. 18-01[6] Handling medical waste in articles 115-116-117-118 and stressed the need to take the necessary measures in the collection of waste, taking into account the health of citizens and the preservation of the environment, as well as treatment and removal of waste according to legal standards and obligate hospital institutions to respect standards of hygiene and removal of activity waste treatment with high risk of infection in order to prevent infection associated with it.

- *Executive Decree No. 03-478 dated December 09, 2009 specifying the modalities of waste management resulted from treatment activities[7]. This decree classified waste into three categories:*

** Waste formed from body organs, which is waste formed from body organs and waste resulting from human biopsy operations and those resulting from operating rooms of surgery and delivery rooms.*

** Infectious wastes are those that contain fine particles or features that may harm human health.*

** Toxic waste, which is waste from expired leftovers of pharmaceutical and chemical laboratory materials, as well as waste containing high concentrations of heavy metals, acids, oils and solvents.*

- The joint ministerial decision dated on Rabi` al-Thani 30, 1432, corresponding to April 04, 2011, that specifies methods of treating waste made of body organs[8].

Second subtitle: the nature of Covid19 waste

Medical waste is related to the practice of a medical activity in health facilities, and it is a subject of interest for commercial companies concerned with dealing, treating and recycling waste, especially with the spread of the emerging corona virus (COVID-19) pandemic which strongly impacted the sector of disposal, treatment and recycling waste of all kinds.

Section one: Definition of Covid19 waste

To define Covid19 waste, we must first define medical waste, which the Algerian legislator defined as "all waste resulting from examination, follow-

up, treatment activities, and preventive treatment or treatment in the field of human and animal medicine."[9]**.**

The World Health Organization has defined medical waste as "by-products of health care that includes items such as sharp and blunt objects contaminated with blood, parts of the body and its tissues, chemicals, pharmaceuticals, and radioactive materials."[10]*. ; And it is the same definition that was given by the Red Cross International Organization, "They are all wastes resulting from the activity of treatment and diagnosis."*[11]*.*

As for the Human Rights Council, Covid waste is defined as "all waste resulting from health care facilities, and it includes waste left by medical practices or activities related to it."[12]*.*

In light of this, Covid19 waste can be defined as waste resulting from treatment, diagnosis, examination and follow-up of the Corona virus, which causes in humans respiratory diseases ranging in severity from the common cold and it is an infectious disease and the most common symptoms of Covid19 disease are: fever, fatigue and dry cough. Symptoms that are less common but may be experienced by some patients include: pains and aches, nasal congestion, headache, conjunctivitis, sore throat, diarrhea, loss of sense of taste or smell, and the appearance of a rash or discoloration of the fingers or toes. These symptoms are usually mild and begin gradually. Some people become infected with only very mild symptoms. The virus is characterized by its resilience and its ability to survive on hard surfaces for hours and even for several days, and this resilience and survival may vary according to temperature, humidity and other environmental factors, which may increase its survival time.

Section two: the status of Covid19 waste among types of medical waste

Researchers classify medical waste, or what is also called health facility waste into several categories, and we will focus on the classification that take into account the degree of its danger.

First: Medical waste without risk :

1-*They are waste materials that do not pose a biological or radiological hazard. They are the result of common operations practiced within health institutions as well as in homes and other institutions and include*[13] *:*

- *Waste from kitchens and places of food preparation, and this waste results from preparing and presenting food, including its packaging, in addition to the resulting waste, and excess and wasted food, in addition to cleaning substances and others, which do not pose a threat to humans and their environment.*

- *Other office and household waste: It includes waste generated in offices, such as wood, plastics, metals, plain paper, cardboard, liquid waste, and the drainage of laundry rooms.*

And these wastes can be recycled if there is a specialized institution in the concerned country to do so.

Second: dangerous medical waste:

Law No. 01-19 defined "Hazardous waste" as "all specific wastes due to their components, especially the toxic substances they contain, that are harmful to public health or the environment."However, this law didn't define hazardous medical waste.

The Basel Convention on controlling the transborder movements of hazardous wastes defined it as "the materials or things that are intended to be disposed of in accordance with national laws and regulations that need special methods for dealing with and treating them and they cannot be disposed of at the sites of dumping household waste due to their hazardous properties and their negative effects on environment and public safety. "[14]

And medical waste is one of the types of dangerous waste and includes many types under it, according to the World Health Organization[15]:

** Infectious waste, which is waste contaminated with blood and other body fluids (such as waste from discarded diagnostic samples), farms, and stocks of infectious agents left by laboratory work (such as waste from morgues and infected animals, resulting from laboratory work), or patients waste in isolation wards and equipments (such as a swab, bandage, and disposable medical equipment);*

** Pathological wastes and they are human tissues, organs, or fluids and body parts and butchered animals that are contaminated;*

** Chemicals: such as solvents used in laboratory formulations, disinfectants, heavy metals in medical equipment (such as mercury in broken thermometers) and batteries;*

** Medicinal preparations: This includes expired, unused and contaminated drugs and vaccines;*

** Genotoxic wastes: these are wastes of extreme risk, mutagenic, teratogenic or carcinogenic, such as cytotoxic drugs used to treat cancer, and their metabolites.*

** Radioactive wastes: such as products contaminated with radionuclides, including radioactive diagnostic materials or materials used in radiotherapy.*

Section three: People exposed to Covid19 waste

Covid wastes threaten a significant number of people, but directly and in particular people working in the medical corps, and they are:

- *Medical personnel: doctors, nurses, health technicians, and hospital maintenance workers.*

Outpatients and inpatients who receive treatment in health care facilities and their visitors.

- *Workers in support services associated with health care facilities such as laundries, waste collection and transportation services.*
- *Workers in waste disposal facilities, including cleaning staff.*
- *Residents of areas close to the place of waste disposal.*

Section four: field of application of Covid19 waste

Covid19 wastes are applied to all institutions active in the health field, including:

- *Hospitals and clinics.*
- *Institutions providing treatment.*
- *Labor and occupational medicine services.*
- *Dental medical offices.*
- *Medical and animal offices.*
- *Dental laboratories.*
- *Animal medical laboratories.*
- *Research laboratories.*
- *Biomedical diagnostic laboratories.*
- *Laboratories and pharmacies:*
- *Experimental laboratories.*
- *Corpses and legislation centers.*
- *Blood banks.*
- *Neighboring services*
- *Blood filtration centers.*

Second main title: measures to confront Covid19 waste

Covid19 wastes can affect humans or the environment. That's why they must be disposed of in a correct manner, to ensure the safety of people as well as people working in waste disposal, and the environment. But reality shows the opposite case, as medical wastes have ruined the environment in the absence of a special program to handle Corona virus wastes.

First subtitle : risks of Covid19 waste

As the Corona virus (Covid19) epidemic continues to spread and its effects on human health and the economy propagate day after day, the UNEP (united nation environment program) urged on March 24, 2020 Governments to address waste management, including medical and home treatment and other hazardous waste, as an urgent and necessary public service in order to

reduce potential secondary impacts on health and the environment [16] since the virus wastes are as dangerous as the virus itself.

Section one: risks of Covid19 waste on individuals' health

The dangers generated by medical wastes are directly related to health sector workers and take many forms[17]: infection, mental disorders and biological hazards and cause many diseases that affect individual health, especially infectious and acute waste.[18] .

Infection is one of the ways by which Covid is transmitted by using contaminated tools, as well as during the examination process PCR, blood tests, or due to the use of a scanner device, and the infection may lead to death.

The process of dealing with waste and their disposal may result in prejudice to the rights of the individual as a person who has the right to life and to enjoy an adequate standard of living.

***1-The right to life** The improper handling or disposal of hazardous medical waste may lead to death, permanent or temporary disability, or injury.[19] Moreover, permanent exposure to some hazardous substances present in medical waste or resulting from its burning may lead to eventual fatal diseases, including many forms of cancer.*

***2-The right to an adequate standard of living:** The improper disposal of hazardous medical wastes may adversely affect the enjoyment of the right to an adequate standard of living. Article 11-1 of the International Covenant on economic, social and cultural rights, states a number of rights derived from this right and necessary for its realization, including access to adequate food, clothing and housing, and although the right to access to safe drinking water is not explicitly mentioned in this list, but it clearly falls into the category of essential guarantees that ensure the provision of an adequate standard of living, especially as it is a necessity for survival.[20]*

Burning of medical wastes in low temperature may lead to a lot of pollutants being released into the air in a form of gas emanations, solid or volatile ash. And the disposal of solid ash in waste dumps may results in the contamination of foods and ground water used for drinking.

- When medical wastes are not disposed of inside the suitable health facilities, they are usually thrown with normal waste in municipal landfills or are illegally dumped, and therefore, heavy metals or other toxic substances are put into the soil, polluting the groundwater that the local population uses in drinking, farming or household purposes.

***3-The right to safe and healthy conditions** Many health care facilities lack an adequate scheme to safely dispose of, collect ,transport and treat*

wastes, as many people remain exposed to the risk of disease especially health professionals and waste disposal workers.

Section two: risks of Covid19 waste on the environment

The disposal and treatment of healthcare wastes poses indirect health risks due to the releasing of pathogens and toxic pollutants into the environment.

The first danger is related to removing waste from health centers and directing it towards random and chaotic discharges that can be accessed by citizens.[21]. This can lead to contamination of landfills and drinking water if they are not properly constructed.

And the danger of medical waste is apparent during wastes burning process, as burning of inappropriate materials causes pollutants to be released into the air as well as the remains of ash. Burned materials containing chlorine can generate dioxins and furans, which are human carcinogens that have been linked to dangerous health effects. The burning of heavy metals or materials containing a high proportion of metals (especially lead, mercury, and cadmium) can lead to the spread of toxic metals into the environment.[22].

Also, the quarantine imposed in some countries due to "Covid19" led to a significant increase in the use of masks, gloves and bottles of sterilization materials, which was followed by the increase in the daily use of plastic of some products to preserve the safety and health of people and fight disease. However, this has made the situation worse because plastic is known to be the main pollutant of the environment.

Second subtitle: A reading of the measures taken to confront the danger of covid19 wastes and a future vision for their disposal

The Algerian constitution stressed the importance of health care in an environment free from pollution, as Article (63) states: "The government shall ensure that the citizen has access to health care, especially for the needy, and to prevent and combat infectious and epidemic diseases." The constitution guarantees to everyone health care and the right to live in a safe environment free from diseases, and the government takes care of its people by fighting these diseases, especially infectious ones as is the case with the Corona virus.

However, reality indicates the opposite, as medical wastes have polluted the environment, and tons of gloves, masks and sterilization bottles have filled the streets in the absence of a special program to cope with Corona virus wastes.

And this unfortunate reality is not the case only in Algeria but all over the world where covid19 wastes are either handled improperly, or not treated at all.[23].

Section one: Safe disposal of Covid19 wastes and green technology

Several ways to get rid of the dangerous medical wastes have been invented, as follows:

** **Backfilling**: a place far from the population is chosen to be filled with wastes with great care so that none of it leaks out.*

** **Incineration**: a place is chosen by the competent authorities, and then wastes are placed in it to be incinerated.*

However, these traditional methods of medical waste disposal are no longer environmentally safe, even though they are commonly used. For example, the incineration technique results in the volatilization of toxic gases that are released into the air, such as furans, dioxins, and others. [24.]

In order to avoid the dangers of traditional methods of waste disposal, environmentally friendly alternatives methods are being searched for, including the use of so-called green technology. So, what is meant by green technology in the field of waste treatment?

Green technology means "the use of safe environmental sources such as plants and animals and natural resources to get energy from environmentally friendly sources so that it does not lead to any damage instead of other sources of fuel and energy that have left a lot of bad negative effects on humanity due to the production of a lot of toxic substances. This technology has been called green technology given that the green color represents nature "[25].

In the meantime, there are several environmentally friendly waste disposal techniques. For example, models of medical sterilization and shredding of steam and electricity are used to treat highly infectious hospital wastes on site without emitting harmful substances.[26.]

And among the most important techniques that can be used for corona wastes, we find:

***1-Steam sterilization:** this most cost-effective and environmentally friendly solution on a large scale is applied to disinfect sharp objects, syringes, and infectious waste such as contaminated waste, blood and other body fluids (such as disposable diagnostic samples), plantations for bacteria and infectious agents resulting from laboratory work (such as waste from autopsy and infected animals in laboratories), or waste from patients in wards from isolated sections and tools (such as samples, bandages, and disposable medical devices* [27.]

The integral autoclave with segmentation by MWI group – is one of the devices used in hospitals and health care centers for the disposal of infectious medical waste. This device is fully automatic and easy to operate, so that hospitals can use it safely to treat hazardous medical wastes in the same place where these wastes originate. The device is also very compact, featuring an automatic lift, tipper, vacuum pump, optional steam generator, etc., and requires little installation space and basic infrastructure to operate..[28]

2-Dry heat sterilization: *unlike steam sterilization, dry heat sterilization is exposing wastes to high temperatures for a period of time to ensure complete sterilization of all parts of wastes. Also, this method must be monitored by special indicators inside medical waste to know the quality of sterilization in the elimination of microbes and these ovens are equipped with equipments monitoring temperature and the entire process.*[29] *And dry heat sterilization is used for products that cannot be exposed to steam or gas, as hot air circulating inside the device is used as a sterilization agent.*[30]

3-Sterilization and Chemical disinfection*: this method relies on using chemical disinfectants such as chlorine and ethanol to eliminate microbes and their toxic effects. These chemical disinfectants are used in the disinfection of syringes, needles, sharpeners, and waste of surgical operations.*[31] *It is not preferable to rely on this method as a final solution of sterilizing medical wastes, except in cases where thermal methods are not feasible due to the nature and type of medical wastes.* [32]

4-Sterilization with irradiation and ultraviolet ions: *it consists of exposing waste to radiation, which causes chemical changes in the cells of the polluting microorganisms which leads to their destruction.*[33]

Section two: a reading of the current situation in Algeria regarding the disposal of Covid19 waste

Corona virus have largely impacted the service sector in terms of treatment, waste disposal, and recycling, not because medical wastes from hospitals and health facilities that provide health care to infected patients are more dangerous than medical wastes of other diseases, or that the liquid wastes of these patients pose a greater health risk to the surrounding community and need special disinfection methods and special treatment plants, but because workers can easily be infected if precautionary measures are not taken[34]*.And to face the disaster in Algeria, There are no measures to cope with the pandemic , no adequate future contingency plans have been put in place as a preventive and precautionary measure to ensure the continuity of proper services for medical wastes management in case the number of patients increases dramatically in short periods of time. If we take a look at the legal texts in force prior to the pandemic, we find that the Algerian*

legislator has precisely defined the types and methods of managing hospital wastes, and divided them into three divisions: the green division which means human organs, the yellow division pertaining to infectious waste, and the red division concerning toxic waste.

The National Agency of Wastes published in 2019 a national guide on hospital waste management,[35] which was prepared in coordination with the Prevention directorate of the Ministry of Health. This guide is considered a unified, binding "protocol" to which subject all actors involved in the waste management process, without exception, and is included in the national plan for environmental activities and sustainable development in accordance with Law No.01-19.

In Algeria, there are institutions specialized in collecting and transporting hospital wastes, which are approved by the ministry of environment and renewable Energies, and these institutions stipulate with treatment facilities, and it is a way to ensure a transparent movement of these wastes, which ends with the delivery of an official report on the wastes that have been transported in accordance with the Algerian laws and regulations.[36].

And during the Corona pandemic, the percentage of waste increased to 56 per cent, and in order to get rid of them, the ministry of environment and renewable energies put a strategy to collect it in coordination with 58 institutions and 289 burning units.[37] However, in reality, the desired goal could not be reached as shortcomings are still present due to the increasing quantity of waste, and the biggest problem is the illegal disposal of waste since the liquid materials for laboratories and hospitals are disposed of through sewage streams.[38] which constitutes a serious threat to health.

Section three: a future vision in avoiding the risks of Covid19 wastes

The medical waste that results from the quarantine of people infected with Corona is contagious and very dangerous, and it is known to be a carrier of the virus. Therefore, the waste resulting from virus infection cases must be dealt with according to the correct scientific methods, to ensure that the infection is not transmitted. the World Health Organization has issued recommendations regarding the treatment of Covid19 waste and insisted on the necessity of providing all materials and human means to eliminate these wastes safely.[39].

Therefore, the authorities must intervene at the organizational and operational level.

1-At the organizational level:

Developing a comprehensive guidance document regarding Corona waste that addresses organizational aspects, planning issues and determines waste that can be recycled.

Developing a program, plans and policies to maintain the safety of everyone from the risks of exposure to the virus through raising awareness, training, and guidance of health professionals.

2-On the practical level:

In fact, the best way to deal with medical waste is to dispose of it, as countries cannot benefit from it and recycle it as is the case with normal waste. So medical waste is a real problem because the traditional methods of disposal (incineration, backfilling) are ineffective[40].

In spite of that, with the lack of modern technologies for waste disposal, some measures can be taken to reduce its risk, including:

- Preparing incinerators and waste dumps to accommodate this waste and its danger and to maintain them periodically, due to the toxic gases that result from these wastes that cause various cancers and diseases if they are emitted into the air.

- Allocating special transport vehicles to transport waste and double check the public safety measures during its transportation, especially operations of transporting waste over long distances, which increase the likelihood of parts of it repelling and be a cause for the spread of the virus and transmission of infection.

- Refrain from using plastic, and start using non-toxic plastic or degradable plastic alternatives, such as glass, ceramics, natural fibers, paper, cardboard, rice husks, natural rubber and animal proteins. This will help create new job opportunities, especially in developing countries, as they are the main supplier of many plastic alternatives.

- Activating the role of environmental police, in cooperation with the Ministry of Health, in order to monitor and punish all those who violate the environmental health system, whether institutions or individuals.

- Providing cleaners with appropriate overalls that protect their bodies from the risks of the virus.

Conclusion:

Hazardous medical waste must be dealt with in a correct manner to ensure the safety of the environment, the people who deal with it, and the population. Therefore, incinerators and waste dumps must be prepared to accommodate this waste and its danger, and to maintain it periodically, as this waste produces toxic gases that cause various cancers and diseases if emitted outside.

Recommendations:

The disposal of medical waste is an essential part of the countries' war against the virus and diseases, and it is a matter of life or death. So, countries must put in place special measures and activate the environmental policing in cooperation with the ministry of health in order to monitor and punish anyone who violates the environmental health system, whether institutions or individuals, and also using modern technologies to get rid of these medical wastes.

Margins

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