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Biomedical Waste Management Strategies during 2020-2021 Novel Covid-19 Pandemic Situation.

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ABSTRACT: In December 2019 the world suffer from corona virus disease (COVID-19) is an respiratory disease caused by newly-discovered virus in wuhan ,because of which there drastically increase in consumption of biomedical plastic i.e personal protective equipment , mask etc and other medical waste to forestall the spreading of disease . The PPE, testing kit, surgical mask cotton masks plastic gloves comprises of giant mass of waste volume to be decomposed. Although these biomedical plastic help during the critical condition but the right disposal of the material is extremely important if it's handle unsuitable then it can cause indirectly spreading of this fatal disease as this waste can act as vector for SARS-COV-2 on which virus can survive for seven days so proper disposal of this waste is straightly reduces the threat of pandemic condition and standing. This revive article gather the knowledge and illustrate the info of only disposal techniques for COVID-19 waste , recent valid guidelines provides by the WHO ,different world organization which may help in post covid situation management of waste and this might help to spice up the disposal knowledge of society

Keywords: COVID-19, Biomedical waste, Disposal techniques

I. INTRODUCTION:

It is believed that coronaviruses generally are originated from bats, but within the case of the SARS-CoV-2 virus, the humans must be infected via a host rather than from the bats directly. The term 'Corona' came from the Spanish word 'La Corona' meaning Crown or halo. The SARS-CoV-2 virus has triggered an epidemic worldwide and is extremely infectious among humans. The quantity of death tolls has been massive and remains to be continuing. Lockdowns and social distancing are being conducted during a very huge number of countries. The More vulnerable population seems to be children, elder patients, and immunosuppressed People

Coronaviruses belong to the Coronaviridae family within the Nidovirales order. Corona represents spikes on the outer surface of the virus thus; it absolutely was named as a coronavirus. Coronaviruses is microscopic with range of 65-125nm in diameter and contain single standard RNA as nucleic material, size from 26 – 32kbs in length

The subcategories of coronaviruses are:

1. Alpha (α)
2. Beta (β)
3. Gamma (γ)
4. Delta (δ) coronavirus.

The severe acute respiratory syndrome coronavirus (SARS-CoV), H5N1 influenza A, H1N1 2009 and geographical area respiratory syndrome coronavirus (MERS-CoV) cause acute lung injury (ALI) and acute respiratory distress syndrome (ARDS) which ends up in pulmonary failure and cause fatality. These viruses were considered to infect only animals firstly until the world witnessed a severe acute respiratory syndrome (SARA) epidemic caused by SARS-CoV, 2002 in Guangdong, China. Only a decade later, another pathogenic coronavirus, called countryside respiratory syndrome coronavirus (MERS-CoV) caused a deadly disease in geographical area countries. Recently at the highest of 2019, Wuhan an emerging site China experienced an epidemic of a singular coronavirus that killed quite 1800 and infected over 70000 individuals within the first fifty days of the epidemic. This virus was reported to be a member of the beta group of coronaviruses. The virus was named as 2019 novel coronavirus (2019-nCov) by the Chinese researchers. The International Committee on Taxonomy of Viruses (ICTV) named the virus as SARS-CoV-2 and thus the disease as COVID-19.

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It is Severe Acute Respiratory Syndrome Coronavirus 2 which is that the virus that produces the Disease COVID-19. The COVID-19 virus might be a highly virulent disease. Scientists all around the world are trying to ascertain the novel virus and to see effective management to manage and forestall the disease. The COVID-19 pandemic has urged main challenges for after receiving a report of a gaggle of occurrences of 'viral pneumonia' within the Wuhan region of China. It absolutely was announced that the outbreak could also be a Universal Health Emergency of world Concern on 30th January 2020 and as an epidemic on 11th March 2020 by the world Health Organization (WHO).As of 10 May 2021, there are a minimum of 3,293,120 confirmed deaths and over 158,334,639confirmed cases within the COVID-19 pandemic. The strain which was found in Wuhan shows similar activity as of (β) coronavirus from group 2B with 70% genetic similarity to the SARS-CoV. The virus features a 96% similarity to a bat coronavirus, so it's widely suspected to originate from bats furthermore

Classification:

Virus
Realm: Riboviria
Kingdom: Orthornavirae
Phylum: Pisuviricota
Class: Pisoniviricetes
Order: Nidovirales
Family: Coronaviridae
Genus: Beta coronavirus
Subgenus: Sarbecovirus
Species: Severe acute respiratory syndrome–related coronavirus
Virus: Severe acute respiratory syndrome coronavirus 2

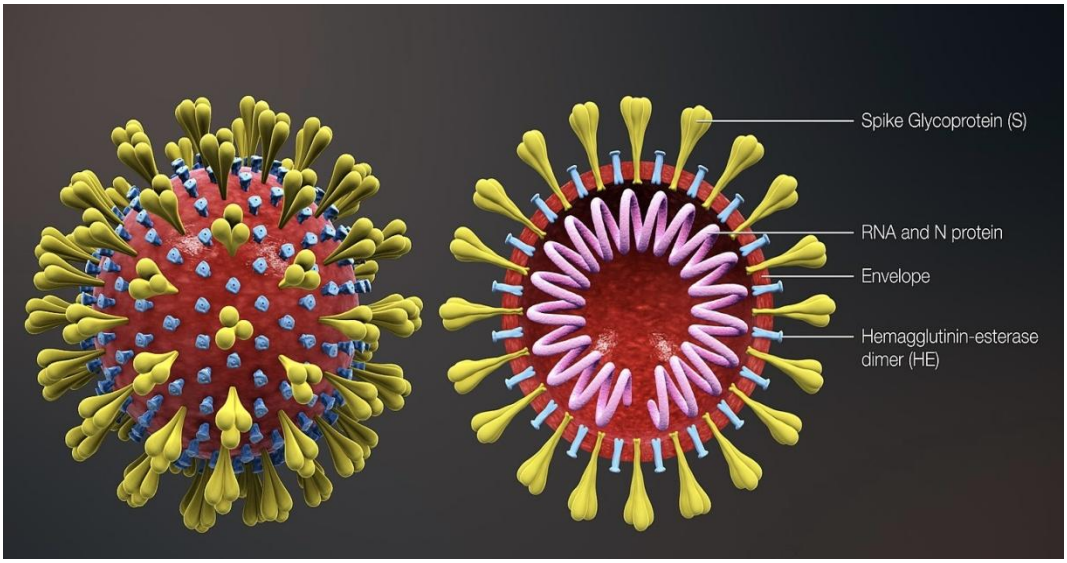

Fig. Structure of SARS-COV-2

Sign and symptoms:

It differs from mild illness to severe or fatal illness. The foremost common symptoms of COVID-19 were non-specific and mainly included fever, cough and myalgia. Other minor symptoms were disease, headache, chills, nausea or vomiting, diarrhea, ageusia and conjunctival congestion.

The COVID-19 was clinically classified into mi to moderate disease (non-pneumonia and pneumonia), severe disease (dyspnoea, respiratory frequency over 30/min, oxygen saturation but 93%, PaO2/FiO2 ratio but 300 and/or lung infiltrates over 50% of the lung field within 24–48 hours) and important (respiratory failure, septic shock and/or multi-organ dysfunction/failure).Many of the elderly patients who had severe illness had evidence of chronic underlying illness like upset, lung disease, kidney disease or malignant tumors

Preventions:

Preventive strategies are focused on the Isolation of patients and careful infection control, including appropriate measures to be adopted during the diagnosis and therefore the provision of clinical care to an infected patient. As an example - Droplet, contact, and airborne precautions should be Adopted during specimen collection, and sputum Induction should be avoided. The WHO

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and other Organizations have issued the subsequent general direction regarding the prevention of disease:

- Wash your hand frequently especially when you come in contact with infected person or their environment.
- Clean your hands with alcohol based sanitizer, soap.
- Don't touch your eye, nose, mouth frequently.
- Safe distance should be maintained from person who is coughing or sneezing.
- Wear mask when physical distancing is not possible.
- If you have high fever, cough, breathing problem should consult with doctor.
- Healthcare workers who are looking for infected Individuals should utilize contact and airborne Precautions to include PPE such as N95 or FFP3 Masks, eye protection, gowns, and gloves to prevent transmission of the pathogen.

Mask: - Respiratory mask is protective device that cover part of face. They are designed to protect person who wear from respiratory poison bacterial and viral pathogenic organisms. During a pandemic crisis every possible risk reduction strategy is useful. Government recommends the use of mask starting from March 2020. Face mask have been considered a first step to prevent spread of disease. Simple mask covering mouth and nose are primarily used to prevent transmission. Mask provides only limited self-protection for its wearer and this is only when they are used properly. Different type of mask is available in market. They are classified as: 1. Full mask 2. Half and quarter mask

Mask used in covid pandemic: 1.N95 face mask
2. Surgical face mass
3. Cotton face mask

1. N95 face mask:

N95 face respirators offer the most protection against novel coronavirus and other respiratory disease. N95 protect the person because they filter out 95% of particles from the air breathed in. KN95 respirators are made to china specification and standards and N95 are made to U.S. design standards. Both are 95% effective. Even more effective than N95 respirators are the N99 (99% filtration), N100 (99.97% filtration), R95 (95% filtration, and partially resistant to oil), and P95, P99 and P100 (95%, 99% and 99.97% filtration, respectively and strongly oil resistance).FFP2 face mask are similar to N95 face masks and both meet the WHO guidance for protection against COVID-19. FFP3 face masks, which are similar to N99 face mask, have a better filter performance based on the minimum filtration of 99%. These types of masks can block both liquid and solid aerosols.

2. Surgical mask:

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Surgical masks help to reduce the transmission of influenza, SARS-CoV, and COVID-19. Surgical face mask filter particles larger than 0.1to 5.0 micrometer and droplets that carry sarscov-2 are larger; it stands to reason that there should be adequate protection from transmission of COVID-19 in low risk circumstances. These are like flat, thin masks are usually white and light blue. According to a 2013 study published in aerosol science and technology, surgical face mask can filter out about 60% of smaller inhaled particles. These are primarily intended to stop droplets, spray and splatters, and studies have shown that diligently wearing surgical mask in public space can significantly reduce the spread of respiratory infection. Surgical masks are not designed to be used more than once as their efficacy is low .Ideally, you should dispose of mask. These findings have led many institutions to promote use of surgical masks in lower risk patient interactions, and advocate for futility of N95 respirator mask especially during times of scarcity. It should be noted, that the CDC recommends use of surgical face mask.

3. Cotton face mask:-Cotton mask is a mask usually made of cotton. When more effective mask are not available, and when physical distancing is impossible, cotton face mask are recommended by public health agencies in pandemic situations to protect others from virus. These are less effective than N95 mask, surgical mask, therefore they are not considered to be personal protective equipment by public health agencies. They are used by general public in household and community as protection against both infectious diseases and covid pandemic. Cotton mask were routinely used by healthcare workers starting from the late 19th century until the mid 20th century. During the covid-19 pandemic, their use in developed countries was increased due to shortage of surgical mask, as well as for environmental concerns. Most of the countries recommended the use of cotton mask to reduce the spread of virus. On June 5, 2020, WHO changed its advice on mask, recommending that public should were cotton mask where widespread covid-19 transmission exist and physical distancing is not possible.

Material (sources)	Structure	Initial pressure drop (Pa)	Initial filtration efficiency (%)	Filter quality factor
Polypropylene	Spun bond	1.6	6	16.9
Cotton	Knit	17	26	7.6
Polyester	Knit	12.3	17	6.8
Cellulose	Bonded	19	20	5.1
Silk	Woven	7.3	4	2.8
Nylon	Woven	244	23	0.4

Gloves: As the COVID-19 is spread via droplets, less data related to transmission of COVID-19 are focused on gloves, which the small part of PPE components of contact precautions. Hand washing has been unequivocally recognized as an essential measure to slow contact transmission.

Actual recommendation for medical glove use amid the COVID-19 pandemic:

- Health care :- reducing microbial contamination from hand Workers containing the transmission from health Worker to patient Containing the risk of microorganisms

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dissemination to the Environment and from one patient to other

- In the community :- providing care to someone sick , especially if making with organic Cleaning and disinfecting person, and surface frequently touched in the environment Frequently ,Removing gloves after any contact with the patient or any other material. Before touching other surface Hand washing before and after removing gloves.

Gloves never substitute hand washing and sanitization Wearing gloves while running errands is not Recommended Hand protection with gloves is required in any medical procedure. Because only skin disinfection does not remove all pathogens, especially when the contamination is high.

There are different types of gloves, depending on level of protection, tactility, risk of allergy, or cost. Although biohazard risk requires frequent glove changing the extended use of gloves, decontamination with hand disinfectants, and reuse are frequent. In resent investigation, the application of 70% ethanol or 63% isopropanol commercial disinfectants reduced the tensile strength of latex and nitrile gloves, with a higher impact on nitrile gloves.

Different glove materials and characteristics:

- Latex :- Used in maneuvers with high biological risk, that is, when it is necessary to handle Blood or body fluids in a repeated or prolonged way Good protection against pathogen and extremely flexible Contraindicated in latex allergy; should not be used with organic soils, oils, gas, or Grease
- Nitrile :- Alternative to latex, especially if allergic to latex, for high-biological-risk Procedures Moderate protection against pathogens High puncture and chemical resistance; good comfort, soft and flexible, but stiffer Than latex More-expensive option
- Vinyl– Polyvinyl:- Use in case of low biological risk (low protection against pathogens), for patient Cleaning activities (low heat) Average resistance to chemicals (alcohols), low tensile strength Less-expensive option
- Polyethylene Only maneuvers where one-handed and short-lasting sterility is required Loose fit, ideal for frequent glove change, but low protection against hazardous Materials Very economical
- Synthetic Gloves :- Latex- and polyvinyl-free surgical or diagnostic gloves Very loose, no protection against pathogens

PPE kit: PPE is only one part of system to prevent contamination of those working near patients with COVID-19 which might then reduce the risk to those staff and patients. For Droplet precaution PPE is appropriate, when caring for a patient or being within two because of airborne virus protection of PPE is recommended only when aerosol generating procedures are being undertaken and after this until air exchanges have reduced virus sufficiently. It should be worn by those in the room during this period.

Crises generated from improper disposal of biomedical Waste:-

- The entire amount of waste generated by health-care activities is about 85% in General, which is non hazardous waste.
- The remaining 15% is taken into account to be hazardous material which will be Infectious, toxic and radioactive.
- Measures to make sure the safe and environmentally sound management of health Care wastes can prevent adverse health and environmental effects such as unintended release of chemical or biological hazards, including drug-resistant microorganisms, into the environment thus protecting the health of patients, doctors, and therefore the general public. -The medical equipment or biomedical products like PPE kits ,gloves, masks ,face Shields ,CPB(cardiopulmonary bypass), SUP (single use plastics) etc. wont to protect And restore health and save lives of frontline workers, waste management workers, But What about the waste and by-products they generate? And what if it's not properly Disposed
- Open burning and incineration of health care wastes can undergo some Circumstances, end in the emission of dioxins, furans, chloride and Particulate matter.
- An individual who experiences one needle stick injury from a needle used on an infected source patient has risks of becoming infected with HBV, HCV and HIV. So it's vital to handle the medical waste to proper disposal.

There are several adverse crises are generated from improper disposal of biomedical Waste during this covid-19 pandemic these are as follows:-

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As there are various disposal methods for bio medical waste management Process and if they didn't perform in well manner it'll cause hazardous to health of workers, public health also. However, variety of poisons are Produced during its operation like products of incomplete combustion (PIC) and dioxins. During incineration when post combustion cools the waste recombine forming new particles called PIC, Which are toxic in nature. Infectious waste is not produce by hospitals but also from the person which is asymptomatic by their mask. Since the virus can continue cardboard, plastic, and metals for hours to Days. Throwing such waste improperly can endanger the lives of many people's and workers involved in waste management. The situation may become even more critical in developing nations where waste management workers aren't equipped with proper personal protective equipment (PPE). The rag Pickers and informal waste collectors are in the high-risk zone of getting infected from the virus-laden waste. These can affect the environment and Health if improperly handled. The rapid increase in medical wastes during The COVID-19 pandemic may disrupt medical waste treatments since they're designed for normal conditions. Some cases arise in Delhi due to Masks, gloves and PPEs are found Dumped outside the hospitals or even on the roads. There are no Separations happening at the household level. Waste collectors have to Sort it, and in doing so are directly exposed to the doubtless infected Material. And therefore the collectors reside in congested and densely populated Places. Just in case they're asymptomatic or infected, they're going to pass the virus onto others.

Crises which affect the environmental conditions, thanks to improper Disposal of biomedical waste: - The mask wastes are increased across the planet because the people aren't following the acceptable disposal methods for the used mask. Thus, it creates a replacement environmental challenge. Further, there is not any appropriate Mask or plastic waste collecting method laid out in our country. This is creating a huge amount of plastic and plastic particle waste within the Environment, which can find you within the streets and landfills. Besides, it gets into the waterways and reaches the water and marine water. The health and Environmental effects of plastic and plastic particles thanks to the inappropriate disposal of facemasks were also highlighted by number of Literature. Moreover, the assembly of the face masks also contributes the emission of CO2, which can potentially contribute to the worldwide warming.

The processes of propylene, small aluminium strips and polypropylene in the production of N95 and surgical mask contributes the many amounts Of CO2 emission to the environments. However the production of cloth, Sewing and weaving process of fabric mask fabrication also contributes the CO2 emission to the environments. The N95 mask production release 50 g CO2 per single mask, excluding the transportation process. Surgical Mask produce with 59 g CO2 per single and therefore the highest share is from the transportation process. Whilst, the material mask production Contributes about 60 g CO2-eq greenhouse emission per single mask. However, this is able to create a huge impact to the atmosphere because, Millions of face masks are produced everywhere the planet to regulate the Pandemic situation. The face masks employed by doctors in Hospitals are carefully collected as its hazardous waste. A study was Conducted within the UK and analyzed that if each individual uses one Disposable surgical mask a day for a year, this is able to create over 124,000 plenty of unrecyclable plastic waste 66,000 plenty of contaminated Waste and 57,000 plenty of plastic packaging .However, There is currently no specific waste stream for these products if it employed by the public. Mostly, it is thrown carelessly on the streets or collected as a mixed waste

- **Water Pollution** :- General, terrestrial environments area unit the vital sources for marine Plastic rubbish, that area unit in the main originated from the Anthropogenetic Emissions. After years the Ocean's seas are found with ton of plastic waste created by human. Plastics in our oceans will come back from each land-based or marine Sources, and area unit largely classified into nanoplastics (particulate size vary Between 1-100 nm), microplastics (MPs) (particulate size vary between 1- 5 mm), microplastics (particulate size vary between a pair of.5 cm–5 mm), and Macroplastics (particulate size vary >2.5 cm) . Land-based anthropogenetic activities like unregulated disposal of medical specialty wastes are considered Potential sources of nephrotoxic, infectious and hot pollutants (WHO, 2018). Typically, attention wastes embrace cytotoxic, chemical, Pathological, pharmaceutical, sharp, hot, and general wastes. Most of those wastes area unit created

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victimization plastic materials, particularly for Like syringes, and scalpels, gloves Surgical masks, surgical and isolation gowns, face shields, shoe Covers, sanitizer containers, and waterproof aprons .The COVID-19 Pandemic has created more biomedical waste within the type of waste Plastics. In step with the WHO, on the common, about 0.2 to 0.5 kg/day of hazardous biomedical wastes are generated by low-income and high-income countries, respectively (WHO, 2018). China the was first reported, the Emergency Management Office of the Ministry of Ecology and Environment documented an about 23% Increase within the amount of medical waste generated and treated. China has an accumulated 142,000 tones of medical wastes with the national medical waste treatment capacity increasing from 4902.8 tones/day before the SARS-CoV-2 outbreak to the present 6022 tones/day.

- **Air pollution**:- The reaction of health care wastes with chemical disinfectants can result in the discharge of chemical substances into the environment if Those substances handle properly, stored and disposed in an environmentally sound manner. Incineration of waste has been widely practiced, but insufficient incineration or the incineration of unsuitable materials leads to the discharge of pollutants into the air and within the generation of ash residue. Incinerated materials treated with chlorine can generate dioxins and furans which are carcinogens which shows variety of adverse health effects. Incineration of heavy metals in particular lead, mercury and cadmium can result in the spread of toxic metals within the environment. Only modern incinerators work on 850-1100 °C and fitted with special gas Cleaning equipment are able to adjust to the international emission Standards for dioxins and furans. Alternatives to incineration like autoclaving, microwaving, steam treatment integrated with internal mixing, which minimize the formation and release of chemicals or hazardous emissions should incline consideration in settings where There are sufficient resources to control and maintain such systems and eliminate the treated waste.

Classification of health care waste- Health care facilities are primarily responsible for management of the healthcare waste generated within the facilities including activities undertaken by them in community. Waste generated from HCF is classifieds as 1.Biomedical waste 2. General waste 3.Other waste

1. **Biomedical waste**: Biomedical waste means any waste which is generated during the treatment, immunization of human being or animal research or in production or testing of biological. Biomedical waste stated from HCF which shows adverse effects on the health of peoples or environment. These waste has to managed as per BMWM rules 2016 It categories into 4 types based on segregation pathway and colour code
   - Yellow categories
   - Red categories
   - White category
   - Blue category
2. **General waste: It** consists of all the waste other than biomedical waste which does not contact with any hazardous chemical and includes any waste Sharps. It mainly consist of the following: Packing materials ,Aluminium cans of soft drinks dry waste ,Food containers after emptying residual food ,Organics / biodegradable waste etc.
3. **Other waste :** Others waste is the waste which consists used electronic wastes , radioactive wastes ,used batteries which does not comes under biomedical waste but proper disposal must be done as per provision provided by E waste management rules 2016, and guidelines under atomic energy act ,1962

Steps involves in bio medical waste management it mainly consist of 5 steps:

1. Segregation
2. Collections
3. Pretreatment Intramural
4. Transportation and
5. Storage

The treatment and disposal is responsibility of common bio medical waste treatment facility while the waste from lab and highly infectious waste need to be pretreated by the health care facility.

Guidelines: - Features of biomedical waste management rules are following:-

- The boundary of the rules has been expanded to include vaccination camps, blood donation Camps, surgical camps etc.
- Pre-treatment of the hospital waste, microbiological waste, blood samples and blood bags Through decontamination or

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sterilization on-site in the manner as prescribed by WHO or NACO;

- Provide instructions to all its health care workers and immunize all health workers regularly;
- Begin to demonstrate a Bar-Code System for bags or containers containing bio-medical waste For disposal;
- Report major accidents as well as minor issues.
- There are new rules for incinerator to reduce the emission of pollutants in environment;
- Rules for incinerator to achieve the standards for retention time and dioxin and furan.
- Bio-medical waste has been categorized into 4 parts to improve the segregation of waste at Source.
- Procedure to get authorization simplified. Automatic authorization for bedded hospitals. The Time period of authorization accompanied with validity of consent orders for Bedded HCFs. One Time Authorization for Non-bedded HCFs;
- No occupier shall accompany on-site treatment and disposal facility, if a service of `common Bio-medical waste treatment facility is available at distance of seventy-five kilometer's.
- It is the responsibility of operator of a common bio-medical waste treatment and disposal Facility to ensure the timely collection of bio-medical waste from the HCFs and assist the HCFs in Conduct of training.

Tables showing Disposal techniques:

Category of waste	Color code	Final disposal at CBWTF
Personal protective material like gown, caps, mask made of fibers materials.	Yellow	Incineration (Pretreatment is not required)
Solid waste like items contaminated with blood i.e blood bags etc.	Yellow	Incineration (Pretreatment is not required)
Gloves which is contaminated with blood and blood fluids or bottles, urine bags.	Red	Autoclave, and shredding (Pretreatment is not required)
Laboratory waste, microbial waste, specimen, vaccine etc.	Yellow	Pretreatment with non chlorinated chemical or autoclave, microwave is done After pretreatment incineration is done.
Metallic waste such as blades, needles, syringes etc.	White	Shredding followed by Disposal in iron foundries.
Medical vials, ampules, glassware's intact or broken.	Blue	Disinfection then recycling.

Disinfection or disposal techniques:-

1. **Low heat technology**

- **Microwave disinfection process:** Microwave disinfection process works on electromagnetic waves that have wavelength of range from 1 – 1000mm or sometime frequency among 1000-3000MHz. It is characterized by fast action; low energy consumption shows less negative effect on environment, higher heat yield and without toxic residue or waste after disinfection. This disinfection techniques is very useful foe on site COVID 19 waste .This method can be used instead of incineration, which can be designed under a specially controlled process that can help to inactive SARS-CoV-2
- **Autoclave:** The autoclave is machine used carried out the commercial sterilization method

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by elevating temperature and pressure. It absolutely was fictional by Charles Chamberland in 1879.The autoclave name comes from Greek word auto means that self and in Latin calvi means that key so it's self lockup device. . The autoclave is taken into account a heat-based method during which water steam temperature is exceeding 100 °C is applied for sterilization. The steam can release heat of transformation that would destroy the microorganisms due to protein denaturation and coagulation on sanitary landfills, which are used for removing the treated waste. This method has its own drawbacks such as this method is not suitable for all types of plastic such as HDPE, PVC, and LDPE.

2. **High Heat Technology**

- **Incineration:** This method is efficient waste-to-energy treatment Processes, especially for recycling the plastic-based and inorganic proportion of waste, is incineration. The combustion range of incineration relies on approximately 800 to 1200 °C temperature, which may entirely kill all viruses and bacteria. It seems that the majority portion of The COVID wastes is transported to incinerate at almost above1100 °C temperature. By considering the declined volume of COVID waste, the residual mass are often incinerated again among Fresh charges. Additionally incineration can play the Main role in pollution due to producing toxic substances such as dibenzofurans, dibenzodioxins, and chlorines. Thus, the fluorine gas treatment facility is needed in order to reduce negative effect on air pollution which increases the costs of this facility for operating system.
- **Pyrolysis:** works at approximately between 540 -830 °C temperature including laser based pyrolysis, induction Based pyrolysis, and pyrolysis oxidation. In pyrolysis oxidation Liquid waste and organic solid inside the pyrolysis chamber vaporize at a temperature of 594 °C leaving behind metal fragment, glass, and ash. In the second step, the vapors combustion takes place in the chamber at 982–1093 °C temperature; later on clean exit steam is released. As this coronavirus is spreading rapidly so Disposal of waste can be done by plasma energy than laser combustion, gaseous.

3. **Chemical disinfection** is often used only the dimensions volume of contaminated wastes is little. Chemical disinfection is usually utilized to pre-treat waste of COVID-19 and combined with earlier mechanical crushing. The Crushed wastes are mixed with chemical disinfectants hypochlorite, dioxide, hypochlorite, etc. On sufficient time under negative pressure so as to deactivate infectious microorganisms. Chemical disinfectants are Defined by stable performance, immediate effect, and broad Sterilization spectrum for like viruses, bacteria, and spores Chemical disinfection are often applied for COVID waste and may be divided into two main sub-groups, namely **chlorine- and no chlorine-based systems.** Chlorine Based disinfection systems commonly contains ClO2or NaOCl, where the chlorine electronegativity assists in peptide Link oxidation and denaturing proteins that follow cell layers Penetration even at neutral ph. Hypochlorite is one among the first antiseptics releasing dioxins, chlorinated aromatic Compounds, and halo ethanoic acid . The quantity of obtainable Chlorine in NaClO is around 5–20%.After that, ClO2 extended, which may be a potent biocide, is used On-site thanks to its unstable nature. H2O2 is employed as a nonchlorine-based Disinfection system because the disinfectant substance. It can denature and oxidize lipids and proteins, and it can also disorganize the Membrane by swelling the H+-ions. A chlorinated system is more convenient to use thanks to its non-toxicity and high reactivity. Moreover, some chemical solutions like ethyl alcohol(>75%), isopropanol (>70%), povidone-iodine (>0.23%), and Formaldehyde (>0.7%) can effectively inactivate coronavirus

PPE Disposal techniques: Reusing of the PPE may be a promising temporary solution during the Corona virus outbreaks so techniques for disinfection including dry heat, Hydrogen peroxide vapor, ozone, and UV light at 2000 mJ/cm2 during which most of the effective methods are the utilization of Hydrogen peroxide vapor H_2O_2 .These mentioned disinfection methods and viral inactivation are Related to the transformation of structural factors, which include an outer envelope, RNA genome, and a protein capsid . The other important points for effective PPE Disinfection are conserving PPE integrity, especially fit and filtering ability, non-toxicity, and safety.

- **Using Hydrogen Peroxide Vapor:** The Food and Dry Administration (FDA) had permitted

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the V H2O2 method, under Emergency Use Authorization (EUA), to reprocess N95 Face masks in the USA during the COVID-19 pandemic, which was based on the studies of the Columbus-based Battelle. The applying Vapour H2O2 and its advantages, which is taken account a considered a reprocessing operator and sterilizing manner for medical device usages, have been precisely studied by Rowan and Mcevoy in 2019. The Centers for Disease Control and Prevention (CDC) investigated all related publications on Vapour H2O2 decontamination of filtering face piece respirators to prepare the proof of minimum filtration effects with high efficiency of 99.99% in destroying bacterial spores Moreover, Maimuna Jatta et al. illustrated the N95 respiratory decontamination by VH2O2 (59%) could be safely applied to disinfect single-use N95 respirators without notable effects on quantitative fit testing or efficiency of the filtration .However, Bergman et al. reported that filtration efficiency adversely had been affected by three periods of gas plasma treatment, mainly applying the STERRAD 100S H2O2 gas plasma decontaminant

- **Using Ozone for Reprocessing of PPE:** Ozone can breakup Proteins and lipids within the virus envelope by exposing crucial Genetic material hence, it causes oxidative inactivation. Potential by performing an easy system of the disinfection Box for FFRs. They suggested concentrations of the ozone at 10 to twenty mg/L combined with a minimum of 10-min exposure for Effective viral inactivation. This method is fast viricidal action as compare to others which is useful for fibrous thing. However, it has also some negative effect such as lung irritants, and it can be risky to humans and other
- **Using Ultraviolet Light:** Ultraviolet Irradiation (UV) causes the inactivation of viruses by destroying their nucleic acids (RNA) with a photograph dimerization procedure. Maximum irreversible damage of molecules happens in range of the 254-nm Wavelength in the UVC area 200-280nm Moreover, the central disease control indicated that UV germicidal irradiation (UVGI) is a proper way For PPE reusing. However, it reported that not all ultraviolet Lamps could present of equal intensity. Besides, UVGI is improbable to destroy all different sorts of bacteria and viruses
- **Using Dry Heat for Reprocessing of PPE:** Several sorts of Research have focused on the appliance of varied heating Regimes for PPE reprocessing, which is causing irreversible Structural damage in virus proteins that prevents binding from Hosting cells. Generally, heat procedure for ≥30 min at 60 °C leads to 4.6 to 7 log10 reduction in Coronavirus. Increasing the exposure period for 60 min at 60 °C could be wiser, due to the variability in heat inactivation the heating of the facemasks in the oven at 56 °C for about 30 min with hot air without examining the efficacy within the capacity of filtering to inactive the Influenza virus. A short-term UV irradiation and oven-dry mainly conserved the filtration efficiency. However, the disadvantage of those methods is that the incomplete sterilization efficiency during a Severe microbial environment.

How to dispose the medical waste in covid-19 pandemic: - some rules to be Follow to reduce the infection of virus from different departments from which the medical waste is generated.

1. From containment zones / hotspots and sealed regions: - the region like red zone and Orange zones, from this areas the used masks Other medical products (gloves, face shield, Used CPB) should be disposed and collected separately by the waste collectors and have to be incinerated or Buried at a depth of at least 10 feet from the Earth's surface in order to prevent infection. Also, should Keep the sanitation of staff have to be advised not to mix waste from these hotspots / containment and Sealed zones with the other localities.

2. COVID-19 Isolation Wards / Test Centre and Laboratories: Used masks (any type Masks) have to be discarded and collected in separate 'yellow colour coded plastic bags' (as per the Guidelines it is collected in yellow bag). They have to be handed over to the waste collector engaged by Common biomedical waste treatment facility (CBWTF) operator at the doorstep and should be Incinerated or deep burial. Used masks from patient, visitors etc are kept for 72 hours in separated bin before Disposal Local bodies.

3. Quarantined homes or other households: Used masks should be kept in a paper bag for a Minimum of 72 hours prior to their disposal as general waste. This must be done in accordance with the SWM rule 2016. It is also advised to cut the masks prior to disposal to prevent their reuse

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and also make sure the manner in which the mask is cut as it should be cut in such a way that it couldn't use by any other person. The union ministry of health and family welfare has advised non-Quarantined homes and residents to dispose used masks by disinfecting them with ordinary bleach Solution (five per cent) or sodium hypo-chlorite solution (one per cent). It should cover in a closed bin before handing the mask over to the sanitary worker. This waste must be treated as domestic Hazardous waste and should be incinerated. There are other rules which are for the masks used by Patients / care givers / close contacts during home care should be disinfected using ordinary bleach Solution (five per cent) or sodium hypochlorite solution (one per cent) and then disposed of either by Burning or deep burial.

Public awareness:

- Cleaning and disposal of mask is essential as it makes the mask more effective.
- Don't use masks which have valves.
- Whenever you took off a mask ,store it in a clean plastic bag
- If the mask material is fabric, you can either wash it or dispose it in a trash bin.
- We should think about safety of ourselves as well as others also, so use reusable masks, as it will degrade the generation of waste from it.
- We should don't put disposable masks in the recycling .As they can get caught in specialist Recycling equipment and can be a potential biohazard to ,so many workers who are working in The management of the waste.
- Don't dispose the mask in toilet flush.
- One should follow the each and every guideline given by the corporation, government as the Citizen of country it is our responsibility to conserve us from this disaster.
- We should also motivate scientific research to achieve this target and we should support as Much as we can.

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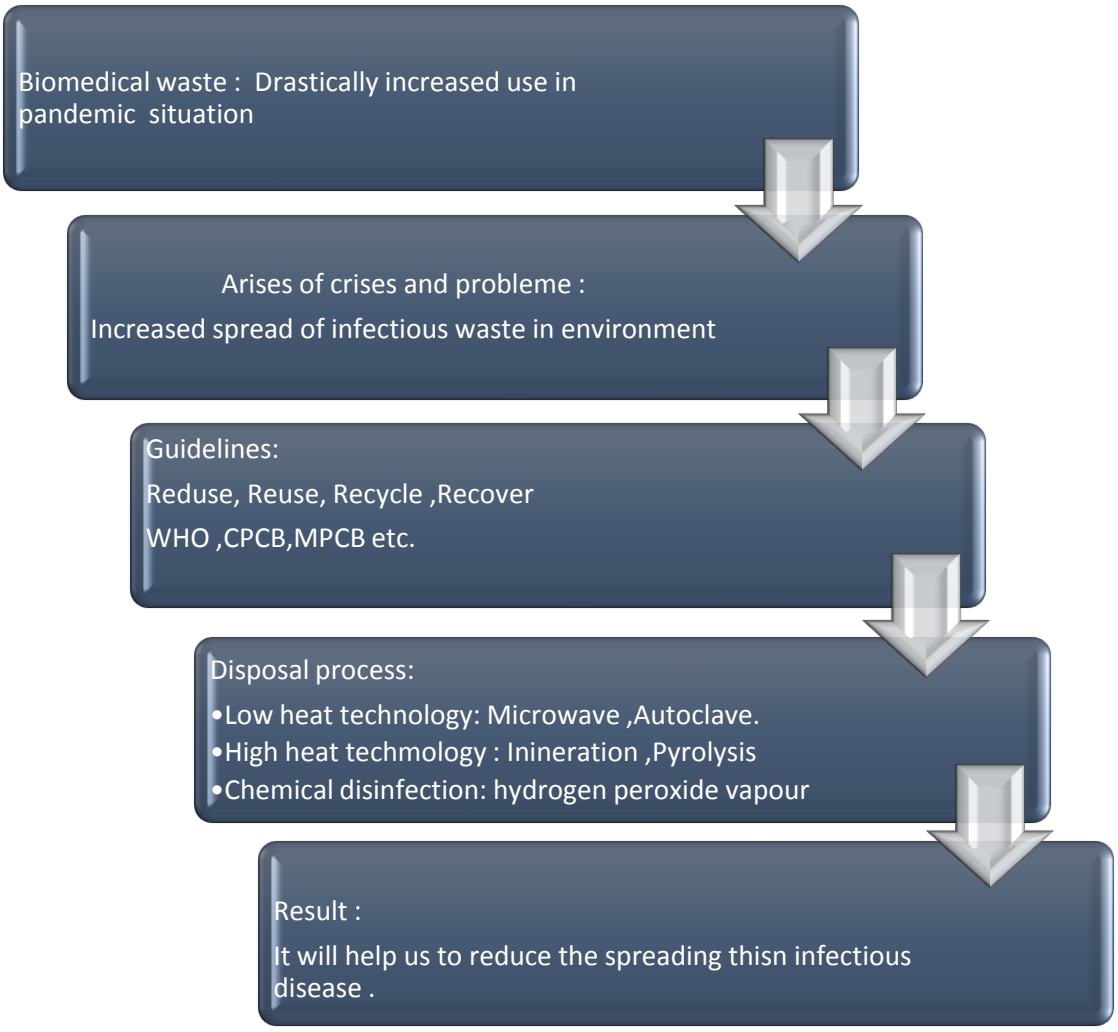

Diagramatical representation of strategies,recommendation during COVID-19

II. CONCLUSION:

The COVID-19 virus is a newly discovered, highly pathogenic, and infectious virus, all aspects of prevention and control shall be highly value. Disinfection and strict administration of the management of COVID-19 related medical waste should be with careful consideration to minimize the risk of infection within hospitals and other medical organization. The potential spread of COVID-19 through fomites of COVID-waste is not ruled out. In fact, the novel coronavirus can survive for long periods outside of its host organism like 72 hr on the surface of a surgical mask. Hence, COVID-19 waste may cause to the community spread if not handled in proper way. The chemical disinfection using a sodium Hypochlorite solution is one of the best in-situ practices which are also easy to spray and not limited to COVID-waste but it is also effective to sanitize the larger space, shopping malls, hospital premises/wards, and isolation centers. Microwave disinfection technique is useful to disinfect PPE and cloths material that can be recycled and reused; whereas, incineration is useful to tackle a larger volume of COVID-waste which is an Energy-intensive process but we'll founded process due to a high operating temperature (800–1200 °C). The strategy like "Identify, isolate, Disinfect, and safe treatment practices/disposed" has been found to be effective and safer management of COVID-19 waste. The practices States herein will greatly help the strategy development for preventing/controlling the pandemic of similar episodes in the future. The Perfusion community has a responsibility to investigate good methods for PVC disposal. The harmful by-products of incineration, dioxins, and Furans cause cancer and cardiovascular disease. Burying sanitized waste is expensive and

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unsustainable. Although the recent opportunities for Recycling of the contaminated perfusion circuit and other medical waste are minimum, research is currently being conducted to create Recycling possibilities for the future. By following the lead of other industries, the medical management system /laboratories/quarantine Centers significantly lower its growing environmental impact in the coming years. Still, those chances have notable obstructions to overcome to be physically and monetarily efficient.

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