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Development of Bio Mask for Sanitization

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ABSTRACT
The global manufacture of facemasks has significantly increased in the days leading prior and after the COVID-19 epidemic. The principle raw materials used to make the facemasks are artificial polymers that are non-biodegradable generated from petrochemicals. When artificial polymers that are disposed to the environment waste burden increases, seriously harming the flora and fauna resulted in significant greenhouse gas emissions. As a result, it has necessitated to develop facemask which are bio degradable. Facemasks with many layers are developed using traditional textile fabrics composed of natural fibres like cotton, flax, hemp, etc. are utilised to develop facemasks that have numerous layers for all-around protection. By adding various herbal and anti-microbial extracts like turmeric and salt. The filter for the masks have micro meter porosity which is the unique feature to prevent microscopic viruses. The biomasks are also helpful for skin healing, skincare and auto-fragrance.
Keywords—Non bio degradable Facemask, Biomask, Covid-19, Anti-microbial

1. Introduction
The necessity for efficient and widely accessible medical facilities have increased due to the diseases' of global spread. Additionally, it shown that during a pandemic, typical production lines are unable to meet demand. COVID-19 is spread through human fluids, contaminated surfaces, and cough or respiratory droplets Chan *et* al. 2020. Medical staff must remain virus-free in order to continue treating patients and to prevent the virus from spreading to other patients both while they are ill and after they have recovered. The current coronavirus, for instance, spread very little among Chinese healthcare workers because they have access to Personal Protective Equipment (PPEs). The absence of PPEs led to the infection of more than 25% of Swedish healthcare professionals (Website 2, 2020: https://time.com/5785223/medical-masks-coronavirus-covid-19/). In order to stop the pandemic, it is equally essential that healthy people stay disease-free. To protect medical staff, patients, and healthy people during this pandemic as well as from future virus outbreaks, robust protection measures like facemasks are therefore necessary. Facemasks are also effective in limiting the spread of the infection among affected people.

2. Literature Survey
Filters are one of the most crucial components for facemasks. Particulate Matter (PM) filters are typically made from fibrous materials and tailored to a certain PM size., PM is categorised as ultrafine (0.1 m), fine (0.1–2.5 m), and course (2.5–10 m). These designations are denoted as PM 0.1, PM 2.5, and PM 10, respectively Kadam *et* al. 2018. The target particles interact with each other, with the surface of the filter medium, through interception, inertial impaction, diffusion, and intermolecular/electrostatic/gravitational interactions. The primary filtration mechanism for tiny (between 20 and 400 nm) virion particles is Brownian diffusion (Mao,2017).
Aerosols that are pathogenic are released by an infected person when they breathe, speak, sneeze, or cough. Due to the media's ability to filter out aerosol particles, facemasks consequently offer respiratory protection from the diseased patient.

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Coronaviruses are between 160 and 200 nm in size (Pellett *et al*., 2014), hence non-woven filter media would be far more effective than their woven counterparts (Chellamani *et al*., 2013). Contrary to what some modern woven filters and petroleum-based polymers like polyester and non-woven filters have greater barrier characteristics. The target to PM and specific filter medium fibres interact to cause the non-woven filter takes effect (Chellamani *et al*., 2013).
These non-woven filter media is produced using the electro spinning technique. An effective way of such technique to produce fibrous membranes with a range of fibre diameter and porosity is simple and affordable.(Purwar *et al*., 2016).
Through regulated manufacture that enables customised material structure for specified applications, electro spun filter membranes have demonstrated tremendous potential for filtration applications (Lv *et al*., 2018; Neisiany *et al*., 2020). By electro spinning a variety of basic materials, versatile fibres with diameters ranging from tens of nanometres to micrometres can be created (Zhu *et al*., 2017).
Electro spun membranes offer high filtration efficiency owing to large porosity (ca. 80%) contributed by concurrently open and interconnected pore structures and a high specific surface area (Zhu *et al*., 2019).
Despite electro spun fibrous membranes possessing highly porous non-woven structure that aids in filtration application, their mechanical strength remains inferior. This issue is considered somewhat alleviated by a partial alignment of the electro spun fibres (Andersson *et al*., 2014; Strain *et al*., 2015).

3.Types of Face Masks
Masks may generally guard the wearer against breathing in dangerous gases, tiny particles such as pollens, allergies, and airborne germs such as bacteria, viruses. The working environment, any disease or other medical condition criteria determine the kind of masks that would be appropriate. For instance, breathing apparatus-equipped selective masks are required for fire fighters and mining employees. Masks allow their wearers breathe better in challenging settings and stop the spread of viral illness. Wearing masks during the outbreak lessened the likelihood of contracting an infection and spreading it. (MacIntyre and Chughtai, 2020).
Surgical masks and other protective masks are the two main categories. Medical professionals should use surgical masks because they shield patients from bacterial liquid spills and aerosols from the wearer's mouth and nose. Respirators are masks made specifically to shield the user from airborne bacteria, viruses, toxic gases, and other microscopic particles. In accordance with filtration/penetration capability and kind of filter cartridge, several types of respirators are sold.
Surgical masks: After 1960, most nations started using surgical masks. These masks are made using the melt blowing technique using non-woven textiles. The outer layer of surgical masks, which have three layers, is comprised of non-woven cloth. The outside layer is a soft non-woven fabric serves as a water barrier, with medical-grade filter paper in the middle and paper in the inner layer. The surgical masks construction differed depending on the nation's laws. The purpose of surgical masks is to shield patients from inhaling bacterial liquid droplets or aerosol from the mouth or nose of their carriers. Typically, surgical masks do not permit the passage of droplets or aerosols with a 3.0 m diameter (i.e., splashes, sprays, and respiratory salves), big diameter particles.
In terms of penetration effectiveness, droplets, germs, and other aerosols, >95% were encountered. However, the smaller size bacteria and minute particles present in the air are not filtered by surgical masks. The possibilities of infection are considered very high because this form of mask did not fit the face effectively.
Respiratory masks: In order to breathe in toxic or dangerous atmospheres such as those with biological pollutants or bacteria, dust, mists, vapours, fumes, or an oxygen-deficient atmosphere, respirators are typically utilised. Depending on usage in various contexts and types of filters or cartridges, these sorts of masks have a variety of ratings and names. The two primary categories of respirators are air-purifying and air-supplying models. The fundamental benefit of respirators is that

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they are completely face-mounted, which prevents the passage of dangerous particulates from the sides. In general, respirators can filter particles between 0.01 mm and 0.3 mm with 95-99% effectiveness. Therefore, respirators are most useful in a variety of industries, such as public safety, oil and gas, mining, construction, healthcare, pharmaceutical, defence, and healthcare.

Air-Purifying Respirators (APRs): There are two different kinds of APRs: reusable and disposable APRs. Half-face masks are the only type of APR available for disposable devices, whereas full-face and half-face masks are available for reusable devices. Usability, filtering effectiveness and capacity are three factors that both masks have in their favour and against them. Both types of masks and their categories are described below.

Disposable Air-Purifying Respirators (DAPRs). Disposable APRs give the wearer filtered air while blocking the passage of small particles (0.3 m). According to the National Institute of Occupational Safety and Health (NIOSH), these masks fall into various categories, which signify the use of the masks in various situations, as well as their types and filtration effectiveness. There are three different types of disposable APRs that are frequently used: N, R, and P series. The masks in question are reasonably priced, lightweight, and comfy.

Reusable Air-Purifying Respirators (RAPRs). Replaceable cartridges or filters are included with reusable APRs. There are two different types of reusable APRs: HFRAPRs (half-face) and FFRAPRs (full-face) reusable air-purifying respirators. The usability of both APRs in particular working settings, types of cartridges, or types of filters is determined by the type of cartridges. Both RAPRs included the identical components, including two sets of rubber straps, a mouthpiece, and two NIOSH-approved cartridges/filters. Both RAPRs are positioned on the wearer's face in such a way as to form a facial seal and filter incoming and outgoing air.

Powered air Purifying Respirators (PAPR). Additionally to filters, this kind of respirator has a battery-operated portable fan. The air may be drawn via chemical filters and then blown into the helmet facepiece by the fan. There are two varieties of PAPRs: half-face pieces and full-face pieces. These masks are useful in environments with concentrated dangerous gases, mists, or fumes. Because of the fan, the air pressure inside the helmet is sufficient, allowing the wearer to breathe easily even under challenging conditions. Such a mask is pricey, has a limited battery and fan life, and is particularly heavy because of the batteries. The battery had to be brought along every time, which restricted the use of the respirators. It is impossible to use in oxygen-deficient environments.

4. Necessity and Effectiveness of Wearing of a Mask to Prevent Covid-19 Transmission

In order to stop the coronavirus from spreading through the air, which may include minute droplets full of the virus, face masks must first be worn. Talking, breathing, coughing, and contacting the body regions where the viruses are already present are all ways it might spread. All of these fundamental human behaviours interact with the unseen airflow system. Since air is the main viral carrier in an epidemic, the mask's main function is to reduce or halt airflow. It is crucial to comprehend that viruses do not wander the world on their own. They leave in the form of water droplets.

The mask's use is primarily necessary to stop these moisture droplets. If some people haven't worn masks, some of those droplets may evaporate into infectious nanoparticles that can be inhaled by a person through their mouth or nose. Any form of mask finds it incredibly challenging to screen out viruses. Stopping moisture droplets from entering the occupants' breathing space is essential. Since most face masks can catch the virus, the droplets cannot dissipate in the moist area between the mouth and the mask. Right now, there isn't much difference between effective face mask and a respiratory.

As a result, it is essential to apply nanotechnology to create biodegradable, effective, and skin- and eco-friendly face masks. The ability of a mask to reduce the droplet's motion is another significant advantage. The mask needs to properly fitted to the face. To block the infection from spreading, the mask must fit snugly over the mouth and nose. A multi-layered face mask is typically advised since each layer has a particular purpose that offers functional protection while breathing. For optimal

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comfort and protection, the skin-contacting layer should be manufactured, in particular, of a soft-skin friendly biodegradable substance.

5. Method of Facemask Development

Sea salt is used as a foundation material and added other salts, such as potassium and calcium, in varying amounts. The increment of pH is measured using a pH digital metre. The pH of the salt solution increased, and a pH metre was used to quantify it. The pH was determined to be 9.5.Since the covid virus thrives at a pH range of 5.8 to 8.5. Since a rise in pH is shown to be incompatible with viruses, the pH solution utilised in the current investigation was chosen as the medium to prevent any germs from entering through oral and, in particular, nasal channel.

Since it was difficult to become infected through organic means when the work was initiated experimentally, it was advised in the proposal to utilise turmeric, an antibacterial substance. The turmeric material, which has antimicrobial properties and, in particular, the bio component curcumin, which has important anti-initiating, pro-inflammatory, antibiotic, anti-rheumatic, and anti-cancer properties as well as micronutrients zinc, selenium, and magnesium, plays a crucial role in health. While blending this organic material, these characteristics have been confirmed. These properties have been confirmed while blending this organic material with that of inorganic salt prepared for the purpose of spraying.

To determine the actual necessity for spraying turmeric liquid over the fabric mask, inorganic salt with a pH of 9.5 was taken and mixed with the substance in various ratios. Spraying was done repeatedly to ensure a proper coating of the solution over the mask, now known as a bio mask, while it was being done in the shade. While processing, the temperature and humidity were also noted, and the amount of time needed for the liquid to dry over the mask was also calculated. It was determined that the mask is safe for use at room temperature and when the humidity is between 65 and 70 percent using a blended solution with organic turmeric antibacterial solutions. It is found that whether humidity increases at low room temperature 30 degree c .The time taken was much higher when compared to low humidity high temperature.

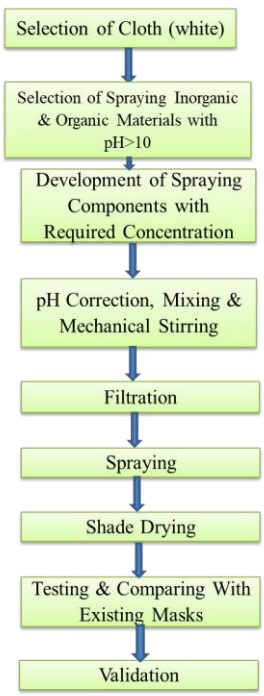

Fig.1 Flow Graph

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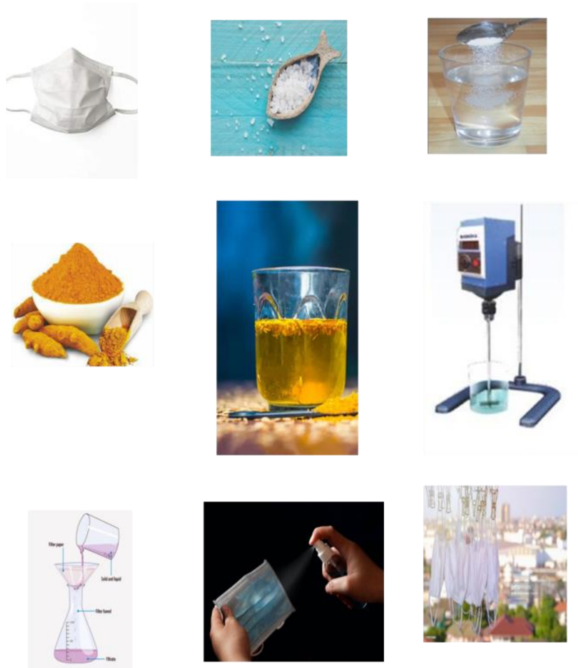

Fig.2 Bio Mask Process

6. Results

S.NO.	Name of the cloth material	Blending time of inorganic and organic material	Time taken for dryness spraying	Humidity	Name of the cloth material	Blending time of inorganic and organic material
1	N95 MASK	65-80	35-45	55-60	20-25	4
2	SURGICAL MASK	75-90	30-35	60-65	25-27	5
3	CLOTH MASK	55-60	25-30	65-70	27-30	2

Table.1 Results

Because the pore size of the cloth was chosen and kept to a minimum, repeated spraying over the cloth results in salt obstructing the pores, causing the input and exit of breathing gases. Therefore, for the aforementioned experimental objective, the currently available commercial mask goods were purchased.

This mask has been evaluated and found to meet an international standard for

- Particle and bacterial filtration
- Breathability
- Fluid resistance
- Flammability of materials

Disposable Bio masks were also thought of as non-pharmaceutical solutions to stop the spread of Covid-19.Emerging cold conditions, religious and cultural differences, and markets for fish and vegetables that challenge non-pharmaceutical solutions are risk factors.

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7. Advantages

The Comparison between the various existing mask and the one we have developed out of the project has been validated. However, it is assured from the experimentally work, the present mask developed is for more medically biologically suitable and economically acceptable to meet the standard operation norms such as the particle and bacterial filtration, breathability, fluid resistance and flammability of materials.

CONCLUSION

One of the Personal Protective Equipments (PPEs) used to reduce exposure to various hazards, such as COVID-19, is a face mask. At least 88% of the world's population is advised to wear a face mask in public as of early July 2020, and more than 75 nations have made mask wearing obligatory. Therefore, while we work to protect ourselves and others from COVID-19, wearing a face mask every day has rightfully become the new norm. These traditional masks are rapidly being replaced by biomasks composed of biodegradable and biobased materials, which are safe for the environment, long-lasting, light in weight, and comfortable, and reasonably priced. These biomasks serve a variety of purposes, including skin healing, skincare, moisturizing, etc., as one of the component layers of the facemask. Multilayer masks for common usage are created utilizing conventional natural fiber textile materials as an additional economical and biodegradable option. The anti-microbial efficiency of such masks is increased by the use of various herbal extracts, including turmeric, salt, and other substances. These masks have a lot of fragrances, are antibacterial, antifungal, UV protective, insect repellent, and kind to the skin. The masks also have a natural color from various plant elements, which raises their aesthetic value. The development, use, and functioning of these biodegradable masks have been sufficiently covered in the literature to show that they are successful at preventing and getting rid of infections like the coronavirus. It is crucial to apply these techniques in order to prevent the ecology and ecosystem from being affected by the entrance of another unidentified pandemic.

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