DEVELOPMENT OF ANTIVIRAL, ANTIFUNGAL & ANTIBACTERIAL COATED FACE MASK TO PREVENT SPREAD OF SARS COV-2 AND OTHERS VIRUSES.

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Abstract - In recent decades, the rising prevalence of infectious diseases has posed a severe danger to public health. Different routes of transmission exist, but the respiratory droplet or airborne route has the most potential to impair social interactions while also being the most preventable with a simple face mask. The user is protected to varying degrees by various sorts of masks. The ongoing COVID-19 pandemic has resulted in a global shortage of face masks and the raw materials used to make them, forcing people to make their own masks out of common household objects. Simultaneously, research into increasing the quality and performance of face masks has advanced, for example, by including antiviral and antifungal characteristics. This presentation will cover mask-wearing from the public health perspective, and recent advances in mask engineering, disinfection, and materials and discuss the sustainability of mask-wearing and mask production into the future.

***Key Words*: Coated mask with Graphene oxide and silver nanoparticles.**

1.INTRODUCTION

This Masks are an easy barrier to assist save you your respiration droplets from achieving others. Studies display that mask lessen the spray of droplets while worn over the nostril and mouth. We have to put on a mask, despite the fact that we aren't feeling sick. This is due to the fact numerous researchers have discovered that human beings with COVID-19 who by no means broaden symptoms (asymptomatic) and people who aren't but displaying symptoms (pre-symptomatic) can nevertheless unfold the virus to different human beings. Wearing a mask facilitates defend the ones round us, in case we're inflamed however now no longer displaying symptoms. It is in particular essential to put on a mask while we're interior with human beings we do now no longer stay with and while we're not able to live as a minimum 6 ft aside when you consider that COVID-19 spreads specially amongst individuals who are in near touch with one another. COVID-19 spreads specially from character to character thru respiration droplets. Respiratory droplets journey into the air while you cough, sneeze, talk, shout, or sing. These droplets can then land withinside the mouths or noses of individuals who are close to you or they will breathe those droplets in.

2. LITERATURE REVIEW

I Face Mask

The utility of nano titania A systematic overview of observational research at the beta coronaviruses that reason intense acute breathing syndrome (SARS), Middle East breathing syndrome (MERS) and COVID-19 located that the usage of face protection (together with respirators and scientific mask) is related to decreased chance of contamination amongst fitness workers. This research counselled that N95 or comparable respirators is probably related to more discount in chance than scientific or 12– 16-layer cotton mask.[1]

Fig-1: Mask

II Graphene Oxide (GO)

By changing the ratio of graphite:KMnO4, GO was synthesized using an improved Hummers method. The best results in terms of oxidation degree were obtained at a mass ratio of 1:4. The decrease of GO and the effective production of ZnO-rGO nanocomposites can be seen in the XRD and Raman scattering spectra. This result has been confirmed by the appearance of peaks related to the hexagonal structure of ZnO wurtzite. The FTIR results tell us the presence of oxygen-containing functional groups corresponding to hydroxyl, carboxyl and epoxy molecules and the corresponding peak intensity changes after GO reduction. The best oxidized sample (GO1: 4) had the best reduction and decoration of zinc oxide, suggesting that the best oxidized graphene oxide resulted in a superior reduced and decorated graphene oxide.

In addition, the nanocomposite prepared has an important resistance to oxidation.[2]

Fig-2: Graphene Oxide

III Silver Nanoparticles (AgNP)

Nanotechnology offers a lot of potential for increasing the therapeutic potential of pharmaceutical compounds and other drugs. The chemical reduction approach was used to manufacture silver nanoparticles of various sizes in an ultrasonic field using sodium borohydride as a reducing agent. The antibacterial activity of silver nanoparticles was tested against Staphylococcus aureus (MTCC No. 96), Bacillus subtilis (MTCC No. 441), Streptococcus mutans (MTCC No. 497), Escherichia coli (MTCC No. 739) and Pseudomonas aeruginosa (MTCC No. 739) pathogens (MTCC No. 1934). B. subtilis and E. coli were found to be more sensitive to silver nanoparticles and their size. demonstrating silver nanoparticles' higher antibacterial activity.

Fig-3: Silver Nanoparticles

IV Graphene Oxide-Silver Nanoparticles (GO AgNP)

In this study, we created GO, AgNP and GO-Ag nanocomposites and investigated their thermoluminescence and photocatalytic capabilities in this study. GO-Ag nanocomposites are prepared by sono chemical methods. The SEM and TEM micrographs clearly show the AgNP deposition on the GO surface. The electrochemical activity of GO-Ag and GO nanocomposites was studied by CV. The results clearly demonstrate the inherent redox activity and chemical reversibility of GO-Ag nanocomposites, so it can be used as a promising material for biosensors or other electrochemical applications. The thermoluminescence of GO-Ag nanocomposites shows a maximum change at lower temperatures, indicating that the nanocomposites can be used for medical dosimetry and radiation dosimetry after some optimizations. The comparative study of GO and GO-Ag nanocomposites will provide a deep understanding of the doping of metallic nanoparticles on the graphene part to improve its practicality in many fields.

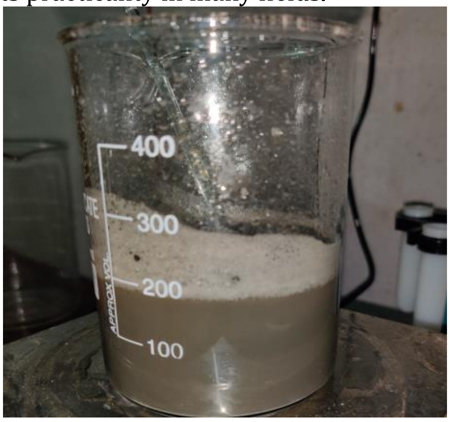

Fig-4: Graphene Oxide-Silver Nanoparticles

3. OBJECTIVES

- Aim of the project is to prevent the harmful viruses and toxic pollution gases, corona viruses such that.
- The graphene coating also repels dust and is effective against airborne particles of less than 2.5 microns in diameter.
- The coating on the mask has been shown to reduce levels of Staphylococcus aureus bacteria by 99.95% within a 24-hour period.
- Successfully produced laser-induced graphene masks with an anti-bacterial efficiency of 80 percent.
- It prevents the bacteria and polluted particles.
- Graphene oxide and silver nanoparticles have lot of antimicrobial properties.
- Coated face mask will be economically better than N95 mask and N99 mask.
- Graphene oxide doesn't harm our skin due to its softness in nature.

4. METHODOLOGY

- The case study of chemicals is done and literature survey for types of importance of masks, chemicals and different processes involved were studied.
- Components required for the model building such as solution and other materials for solvent preparations for the mask to be dipped has been selected.

- The process for of preparing the solutions is done using the main chemical powders such as Graphene oxide and sliver nano particles.
- Designs and diagrams for dip coating of masks has been done.
- 3D CAD Model for model for dip coating will be prepared based on rough dimensions.
- Tests will be carried out for the dip coated masks to ensure safety and efficiency of there working when wore.

5.1 COATING TECHNIQUE

Dip-coating technology has been used for coating a thin nano layer of Graphene oxide and silver nanoparticles on the face masks. Different types of masks available in the market have been used. Because the cause of Sars Cov-2 and other viruses is becoming more widespread, we decided to develop a more effective mask. The 3-D models below show the entire dip-coating procedure on masks.

5.2 3D CAITA MODEL

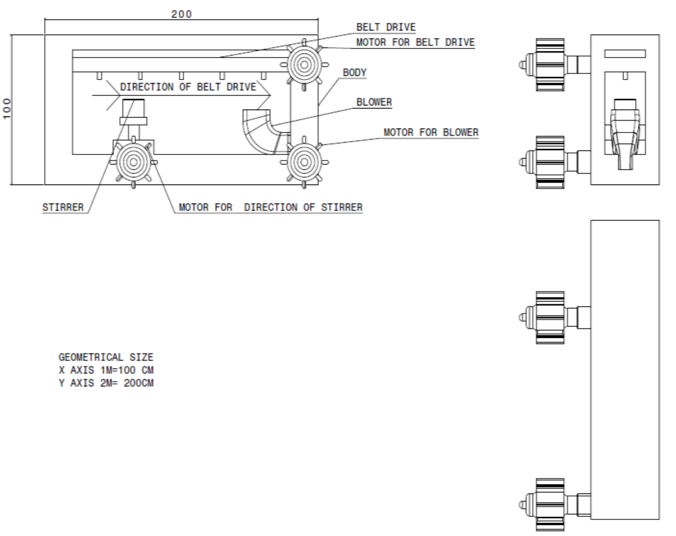

Fig -5: Drafting

- The solvent comprising of graphene oxide and 3 % of silver nanoparticles is prepared using Hummer's method and poured into a glass container.
- The conveyor carries the required number of masks towards the dipping tank and stops initially for a short period of time.
- And then the glass beaker is raised up towards the paused masks carried by the conveyor with the help of a mechanical system or a pneumatic system.

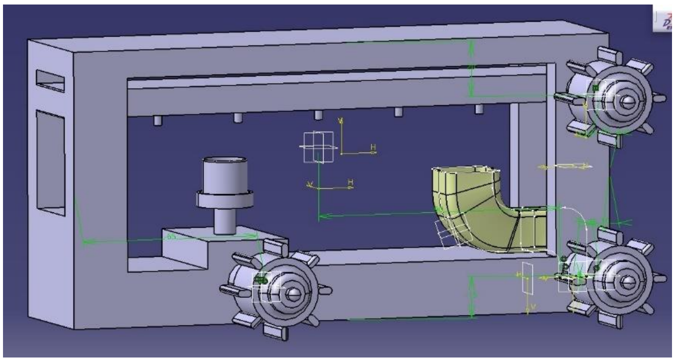

Fig-6: Isometric View

- The dip coating is done when the mask is dipped into the prepared solution.
- The masks are dipped for a predetermined amount of time till the coating applies evenly on the entire upper layer of the mask efficiently.
- Then the container is moved downwards and the coated masks moves forward to the drying zone with the conveyor.
- The dipped masks need to be dry as the wetness of the solvent must be drawn.

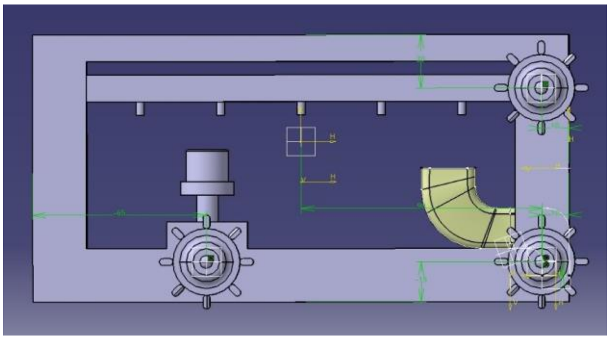

Fig-7: Front View

- The drying process can be done through the oven equipped with the blowing systems in them or they can be also dried in the sunlight as well.
- After the sufficient amount of drying of masks is completed, ANTI-BACTERIAL TEST is carried out.
- **Characterization tests such as XRD Test, Scanning Electron Microscopy (SEM), EDS and UV Spectroscopy have been done earlier to confirm the material properties.**
- After these trials the mask is fit to be worn.

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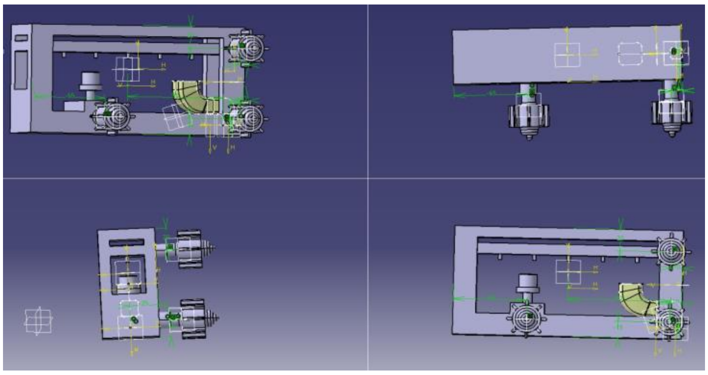


Fig-8: Different views of Dip coating model

6 .1 TEST -1 SCANNING ELETRON MICROSCOPY (SEM)

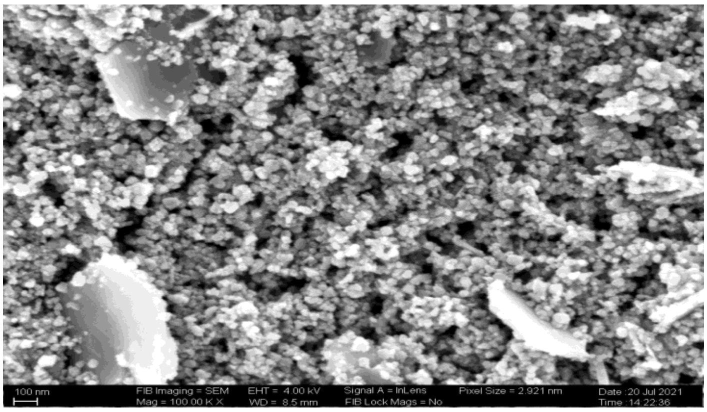


Fig-9: mag 100.00 KX

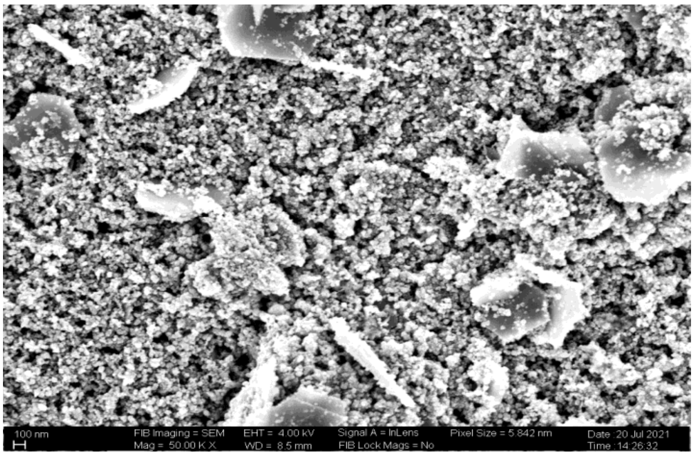


Fig-10: mag 50.00 KX

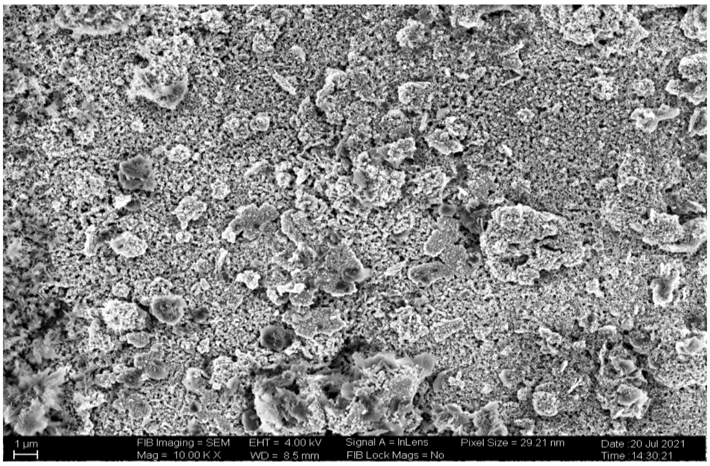


Fig-11: mag 10.00 KX

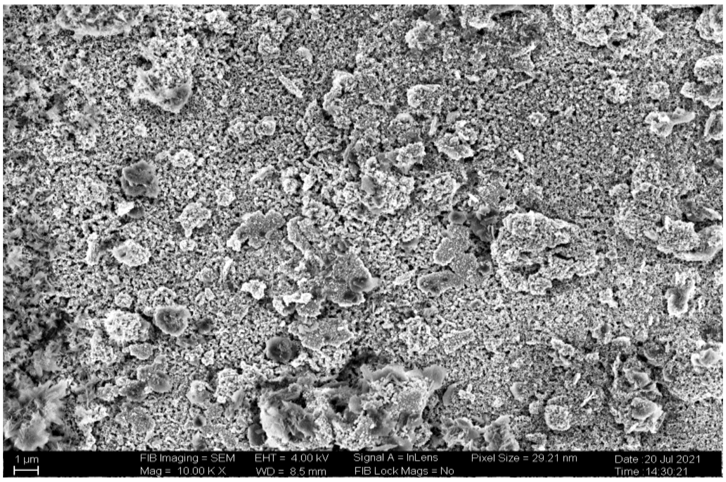
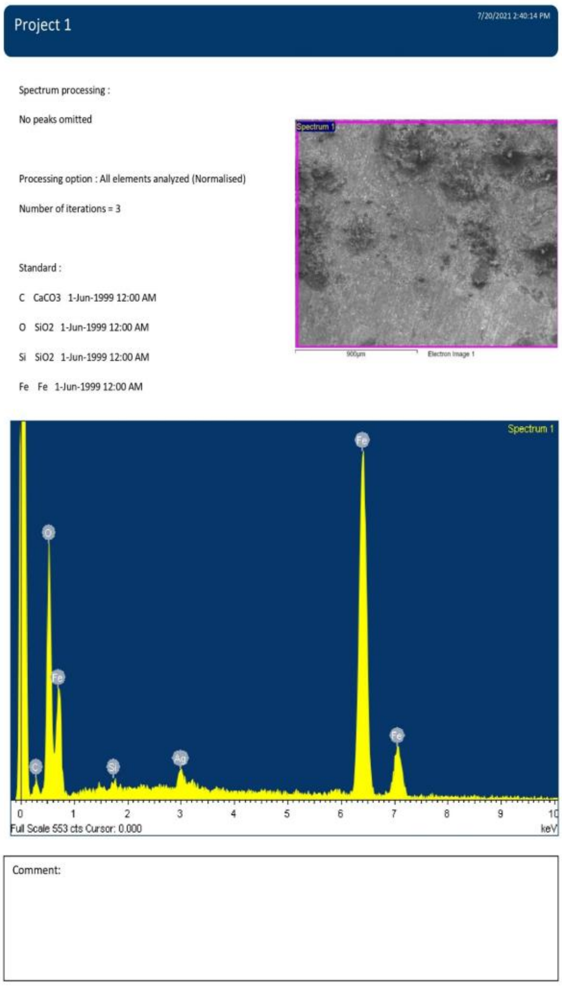


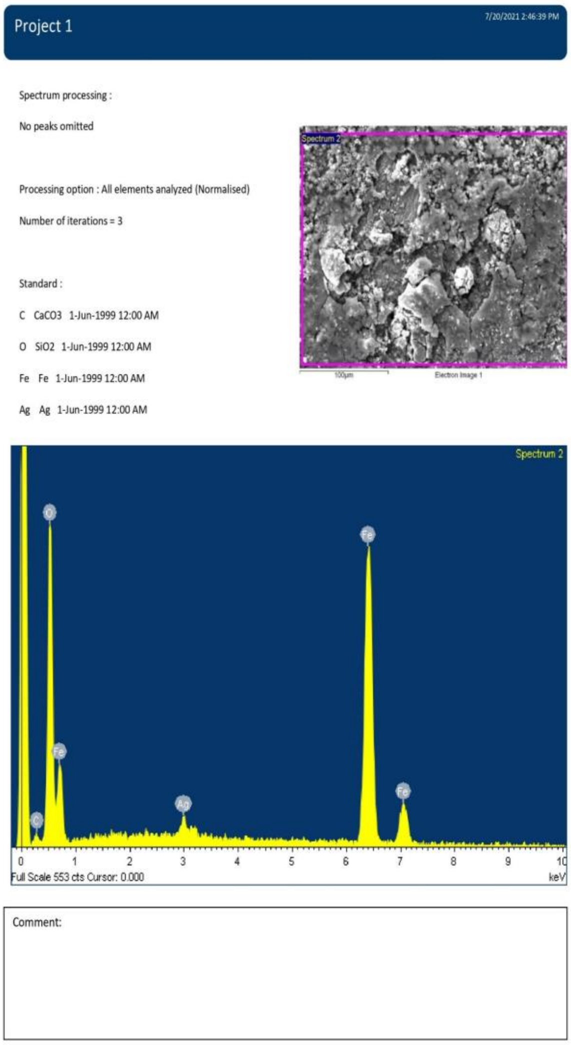
Fig-12: mag 25.00 KX

6.2 TEST-2 ENERGY DISPERSIVE X-RAY SPECTROSCOPY (EDS OR EDX)

Element	Weight%	Atomic%
C K	5.94	14.12
O K	30.02	53.60
Si K	0.39	0.40
Fe K	60.92	31.16
Ag L	2.73	0.72
Totals	100.00	



Element	Weight%	Atomic%
C K	4.82	10.41
O K	39.73	64.40
Fe K	53.01	24.61
Ag L	2.44	0.59
Totals	100.00	



Element	Weight%	Atomic%
C K	4.82	10.41
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Fe K	53.01	24.61
Ag L	2.44	0.59
Totals	100.00	

Project 1 7/20/2021 2:46:39 PM

Spectrum processing :

No peaks omitted

Processing option : All elements analyzed (Normalised)

Number of iterations = 3

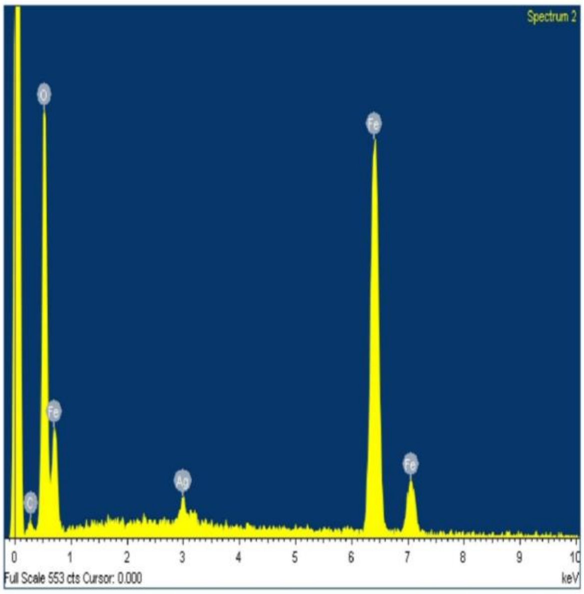
Standard :

C CaCO3 1-Jun-1999 12:00 AM

O SiO2 1-Jun-1999 12:00 AM

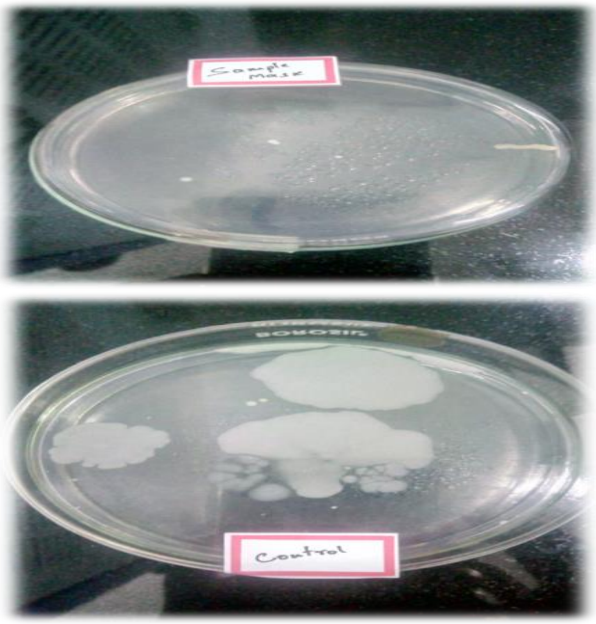
Fe Fe 1-Jun-1999 12:00 AM

Ag Ag 1-Jun-1999 12:00 AM



6.3 TEST 3 ANTIMICROBIAL TEST

Susceptibility trying out is used to decide which antimicrobials will inhibit the boom of the microorganism or fungi inflicting a selected infection. The effects from this check will assist a healthcare practitioner decide which pills are probable to be only in treating a person's infection.



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GSTIN : 29AXHPN0395B1ZG ISO 9001 : 2015

Ref. : Date : 23/07/2021

ANALYSIS REPORT of ANTIMICROBIAL TEST

1.	Name of the Customer	:	Rakesh C Ranajangi
2.	Sample Collected by	:	Brought by Customer.
3.	Date of Collection	:	19.07.2021
4.	Name of Sample	:	GoAgNPs Safety Mask
5.	Date of Sample Receipt	:	20.07.2021
6.	Analysis started on	:	20.07.2021
7.	Analysis Completed on	:	22.07.2021
8.	Report to be Sent	:	23.07.2021
9.	Page No.	:	1 of 1

Sl. No	Parameter Name	Test Method	Result
1.	Total Plate Count	Lab SOP	Partial Growth of Microorganisms

Inference	After the Experiment mask confirms Partial Antimicrobial activity.

End of the Report

Authorised Signature

7. CONCLUSIONS

With the ever-increasing threat to human life from various viruses like Sars-19, influenza and Zika, it has become mandatory to use masks in our day-to-day life. Various masks are already available in the market. But certain issues have to be addressed like, comfort, anti-fogging, self-cleaning and anti-viral, anti-bacterial and anti-fungal attributes, besides low cost and economy.

These issues have been addressed in our product. The masks available in the market have been coated with graphene oxide and silver nanoparticles, which have excellent anti-viral, anti-bacterial and anti-fungal properties, using a novel coating technique. The coating material has been characterized for chemical composition, phases present and microstructure and UV properties using XRD, SEM-EDS and UV-spectroscopy. The coated mask has been tested as per standards for the anti-viral property.

8. SCOPE OF FUTURE

Trials have been conducted with 3% of Silver nanoparticles. More trials are to be conducted with a higher percentage of the nanoparticles. Moreover, initial studies yielded a reasonably good result as to the attainment of graphene oxide and silver nanoparticles as evident form the SEM/EDS results and the anti-viral behavior of the coated masks. More trials are to be conducted to establish the process parameters like composition of the material at each stage of solution preparation, temperature, processing time, post coating curing time and temperature. Also the entire coating system can be improvised for establishing the process on a larger scale. The coating thickness and adhesion are important properties to be studied in detail. Moreover, the anti-bacterial, anti-viral tests have to be conducted for more number of samples. In any case, this initial study has succeeded in bringing good results.

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10. BIOGRAPHIES

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