

# **Building a Virus-Free Society**

## C-Polar Technology

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April 25, 2021

## AGENDA

The problem

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Our solution: C-Polar

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Evidence of effectiveness

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Our path forward

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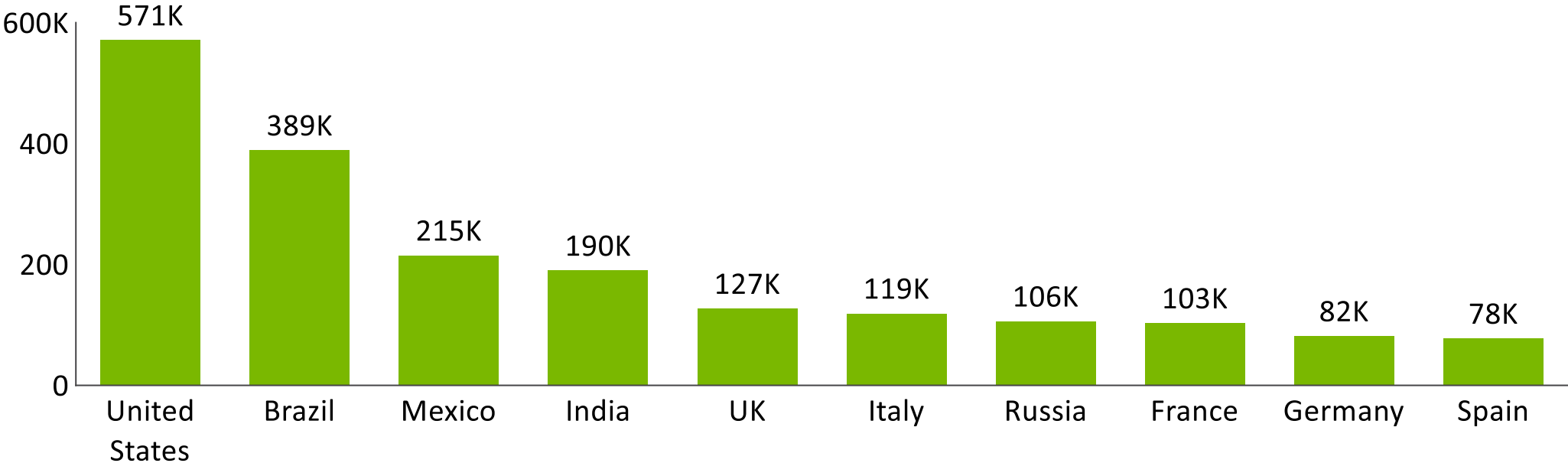
# The COVID-19 virus has devastated the world and caused the deaths of more than 3 million people globally

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## Top 10 countries with largest death toll from COVID-19

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Number of deaths, by country



Note: Data as of April 25, 2021  
Source: Gov't health ministries

# Masks serve as the 1st line of defense against COVID-19; however, their effectiveness is often lacking

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## Masks only have a 25%-75% protection rate against the COVID-19 virus...

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- A study conducted by the University of Hong Kong showed that hamsters who were protected by a surgical mask partition still had a **25% chance of being infected by the COVID-19 virus\***
- A study conducted by Boston University showed that **masks can only contribute 15%-25% efficiency** on stopping transmission of COVID-19 mutation\*\*

## ... Consequently, frontline healthcare workers have suffered disproportionately, despite their PPE

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- Frontline healthcare workers, who are typically equipped with the highest grade of masks and PPE, continue to experience high levels of infection.
- In November 2020, *The International Journal of Infectious Diseases* found that approximately 300,000 healthcare workers from 37 countries had been infected with COVID-19.
- The CDC estimates that more than 415,000 healthcare personnel in the United States had been infected, with close to 1,400 dying from the disease



**There is a critical need for an effective and affordable solution that can arrest and destroy the COVID-19 virus**

\*Surgical mask partition reduces the risk of non-contact transmission in a golden Syrian hamster model for Coronavirus Disease 2019 (COVID-19)

Source: The University of Hong Kong

\*\*Mask-wearing and control of SARS-CoV-2 transmission in the USA: a cross-sectional study

Source: The Lancet

## AGENDA

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# To address this critical need, our company has developed C-Polar, a technology that can arrest and destroy COVID-19

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- C-Polar is a polymer that can **arrest and destroy** coronavirus and enterovirus with a 99.9% ratio, within a **short incubation time** (5 minutes)
  - Given that coronavirus and enterovirus are structurally quite different, there is a high likelihood of seeing similar results with other viruses as well
- C-Polar can also **destroy bacteria** (*Staphylococcus Aureus*) with a 99.9% ratio, within a **short incubation time** (within 1 minute)
- The polymer has **no cytotoxicity to human lung cells**
- The polymer can be **applied to a wide range of surfaces** – including fabric, paper, plastic – lending itself to a **wide range of use cases**
  - Potential use cases include – but are not limited to – face masks, air filters, medical garments, and military gear

# Our founders, Aldrin and Raymond, developed the C-Polar polymer while conducting research on 3D tissue printing

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- Prior to the COVID pandemic, Aldrin and Raymond were using a 3D printing method called Continuous Liquid Interface Production to **develop nano scaffolding for human tissue**
- The two of them developed the C-Polar polymer as a way to **treat the nano scaffolding structure**, so that human cells can stick to the structure
- When COVID hit, Aldrin and Raymond hypothesized that the strong positive polarity of the C-Polar polymer **may work to arrest the negatively-charged COVID virus**
- Through experimentation on bacteria, they found that C-Polar was able to **significantly arrest bacteria – to a much greater degree than meltblown fabric (the commonly used material in conventional face masks)**

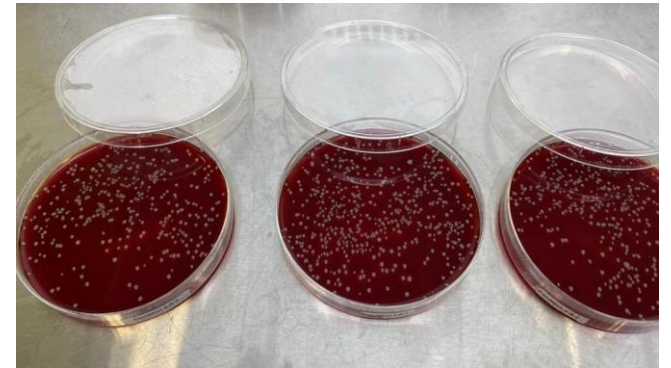


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**These promising results gave our founders confidence to pivot and focus on tackling COVID**

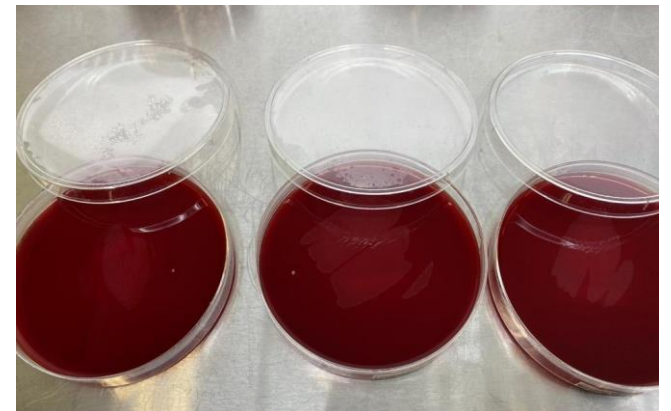
Meltblown treated with bacteria

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C-Polar treated with bacteria

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# C-Polar works to arrest and destroy COVID-19 by using a strongly charged polymer to tear off the virus' negative cell envelope

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① Strong positive charged polymer attract negative charged protein based biohazard like COVID-19

② Polymer arrest biohazard like COVID-19

③ Polymer tear off envelope of biohazard like COVID-19





## AGENDA

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Our solution: C-Polar

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**Evidence of effectiveness**

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Our path forward

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# Third party laboratory testing confirms that C-Polar is highly effective at destroying viruses and bacteria, and also safe for human usage



## Effective against viruses

Study conducted by **Finland Tampere University** concluded that C-Polar arrests and destroys coronavirus and enterovirus with **99.9% effectiveness, within 5 minutes**



## Effective against bacteria

Study conducted by **The Open University of Hong Kong** concluded that C-Polar destroyed *Staphylococcus Aureus* with **99.9% effectiveness, within 1 minute**




























## Safe for human usage

Study conducted by **Finland Tampere University** concluded that C-Polar **does not cause any human harm at 0.5%**

[See Appendix for more detailed information on these studies](#)

# Additionally, C-Polar compares favorably to competitor products across several key dimensions

	Our product	Potential competitors			
	C-Polar	Disinfectant on meltblown mask	I3 Biomedical	Zen Graphene	Pharm2Farm
How does it work?	Uses a strong positively charged polymer to arrest and destroy negatively charged COVID virus	Destroys virus on a normal mask's outer surface by applying a disinfectant spray	Destroys virus using the cytotoxicity of iodine	Destroys virus using the cytotoxicity of graphene	Destroys virus using the cytotoxicity of copper
Does it arrest the virus in fast air flow?	 Research showed that C-Polar was able to arrest more than 99.9% of the virus and bacteria in fast air flow	 Applying disinfectant on a mask does not result in the mask arresting the virus	 Iodine does not generate extra attractive force towards the virus	 Graphene does not generate extra attractive force towards the virus	 Copper does not generate extra attractive force towards the virus
Does it destroy 99.9% of the virus in a short time frame?	 Research showed that C-Polar was able to destroy 99.9% of the virus and bacteria in a short time frame	 Water in disinfectant discharges electrostatic force, reducing filtration efficiency of the mask. Disinfectant disappears after 5 minutes due to volatility	 Deactivates 99% -- but not 99.9% -- of the virus within minutes	 Research showed it was able to destroy 99% of the virus in 35 days	 Research showed that it was able to destroy 90% of the virus in 7 hours
Is it non-toxic?	 Safer than natural food additives	 Continual and frequent exposure to disinfectant damages the user's lung tissue	 No toxic effects on humans	 Graphene has toxic effects on humans, Health Canada ban it	 Copper contains nanoparticles that have heavy toxicity against the human body
Is it non-metallic?	 C-Polar does not contain metals (e.g. toxic metals like zinc, copper, or titanium)	 Disinfectant is made of isopropyl alcohol. It does not contain metals	 Does not contain metals	 Graphene is not a metal	 Copper is a heavy metal
Is it bio-degradable?	 The C-Polar polymer is 100% biodegradable and causes no environmental damage	 Applying disinfectant on a meltblown mask does not result in biodegradability	 I3 Biomedical masks are not biodegradable and take centuries to degrade in landfills	 Zen Graphene masks are not biodegradable, and take centuries to degrade in landfills	 Copper is not biodegradable and results in soil pollution

## AGENDA

The problem

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**Our path forward**

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# We have made the following progress since 2020...

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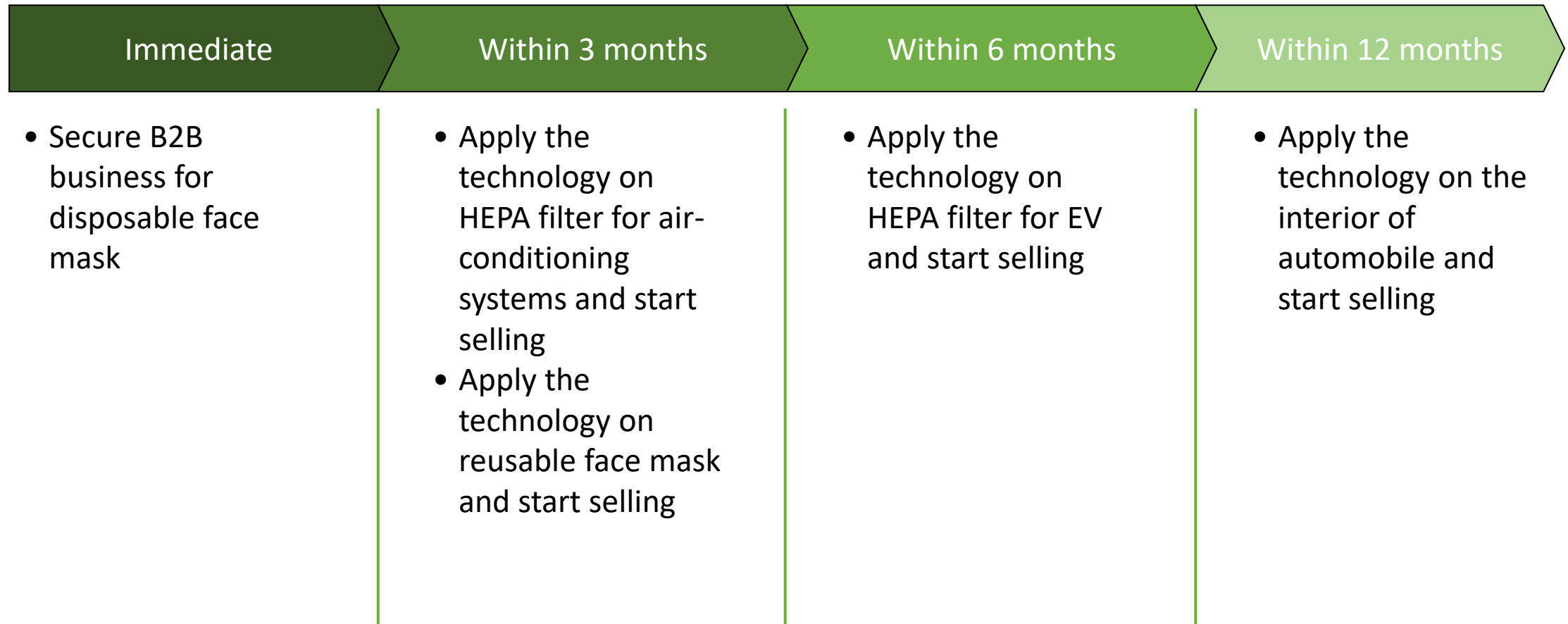
# ... And secured a wide range of certifications and patents

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<b>Safety</b>	<b>Patents</b>	<b>Flat mask / Respirator</b>	<b>Antiviral / Anti-bacterial activity &amp; filtration efficiency</b>
<ul style="list-style-type: none"><li>• Cytotoxicity on Human Lung Cells</li><li>• Cytotoxicity on Green Monkey Kidney Cells</li><li>• ISO10993</li><li>• EN ISO 21084:2019</li><li>• EN ISO 18254:2016</li><li>• EN ISO 14184:2011</li><li>• JIS L 1041</li><li>• DIN EN ISO 17070:2015</li><li>• 64 LFBG B 82.02-08</li><li>• EN ISO 14389:2014</li><li>• US CSPC-CH-C1001-09.4</li></ul>	<ul style="list-style-type: none"><li>• U.S. provisional patent</li><li>• HK short term patent</li><li>• Patent Cooperation Treaty</li></ul>	<p><b>Flat mask</b></p> <ul style="list-style-type: none"><li>• ASTM F2100 / F2101 Level 3</li><li>• CE EN14683 Type IIR</li><li>• Intertek Tick Mark</li><li>• Australia ARTG</li></ul> <p><b>Respirator</b></p> <ul style="list-style-type: none"><li>• CE EN149 FFP2 (N95 Standard)</li><li>• CE EN149 FFP3 (N99 Standard)</li></ul>	<p><b>Antiviral / Anti-bacterial activity</b></p> <ul style="list-style-type: none"><li>• Destroy SARS-229E (5 mins / 60 mins)</li><li>• Destroy Coxsackievirus B6 (5 mins / 60 mins)</li><li>• Destroy SARS-CoV-2 (2 hrs)</li><li>• Destroy H3N2 (2 hrs)</li><li>• Destroy Staphylococcus Aureus (1 min)</li></ul> <p><b>Filtration efficiency</b></p> <ul style="list-style-type: none"><li>• Viral Filtration Efficiency (VFE)</li><li>• Bacterial Filtration Efficiency (BFE)</li></ul>

# In the next 12 months, we hope to achieve the following high-level milestones

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# Appendix

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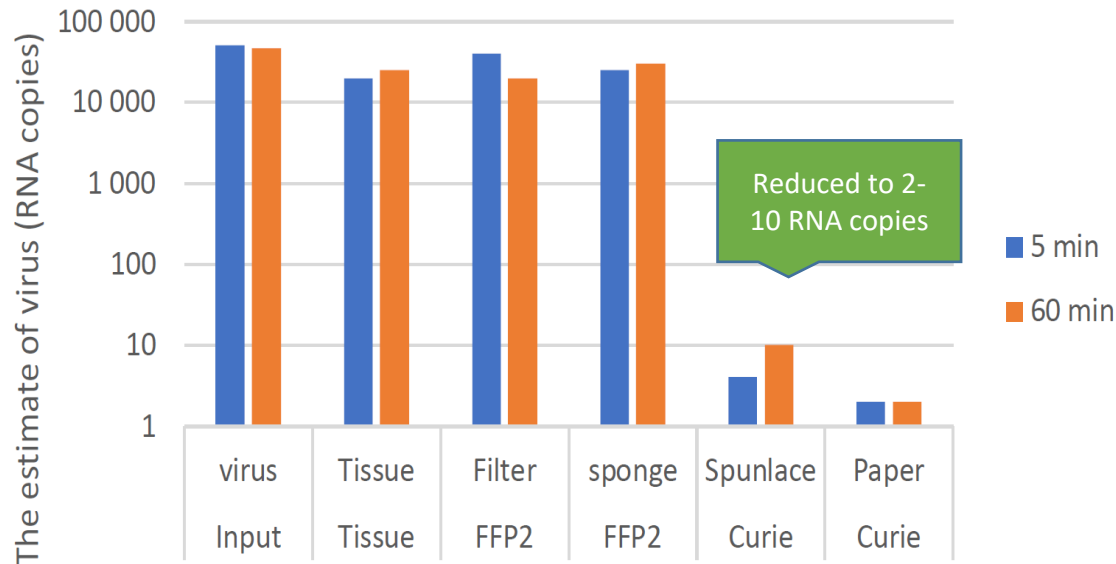
- ① Test results
- ② Air filtration
- ③ Use case



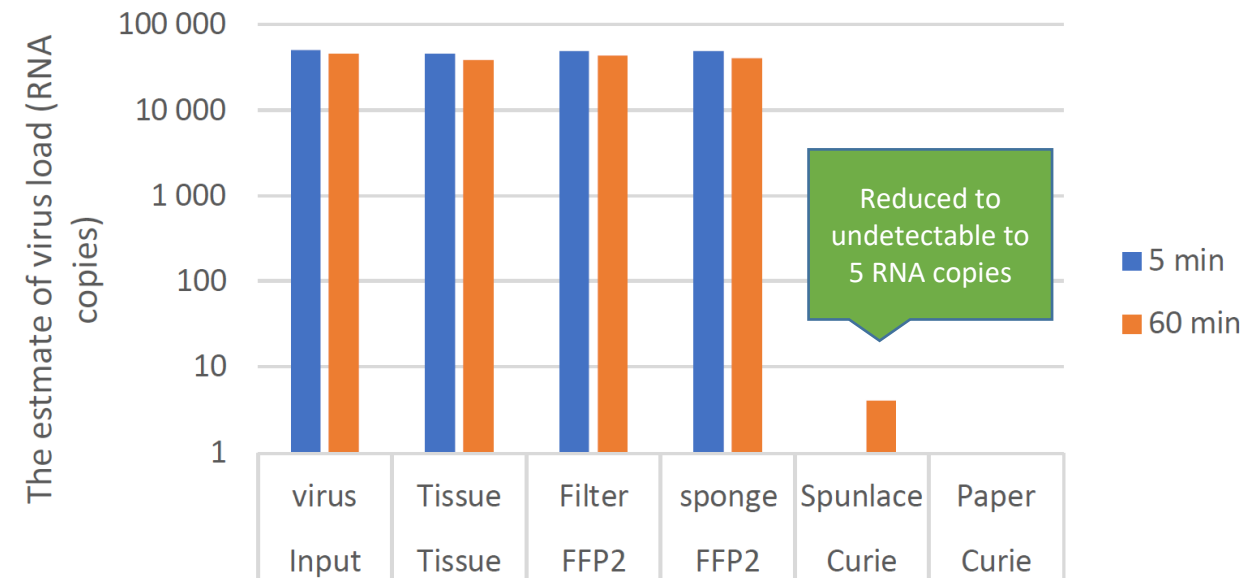
# 1 A study conducted by Finland Tampere University confirmed that C-Polar significantly reduced COVID-19 virus substitutes\*

## EFFECTIVE AGAINST VIRUSES

**C-Polar biotech significantly reduced SARS-229E RNA copies compared to controls (tissue, FFP2 filter, FFP2 sponge)**



**C-Polar biotech significantly reduced Coxsackievirus-B6 RNA copies compared to controls (tissue, FFP2 filter, FFP2 sponge)**

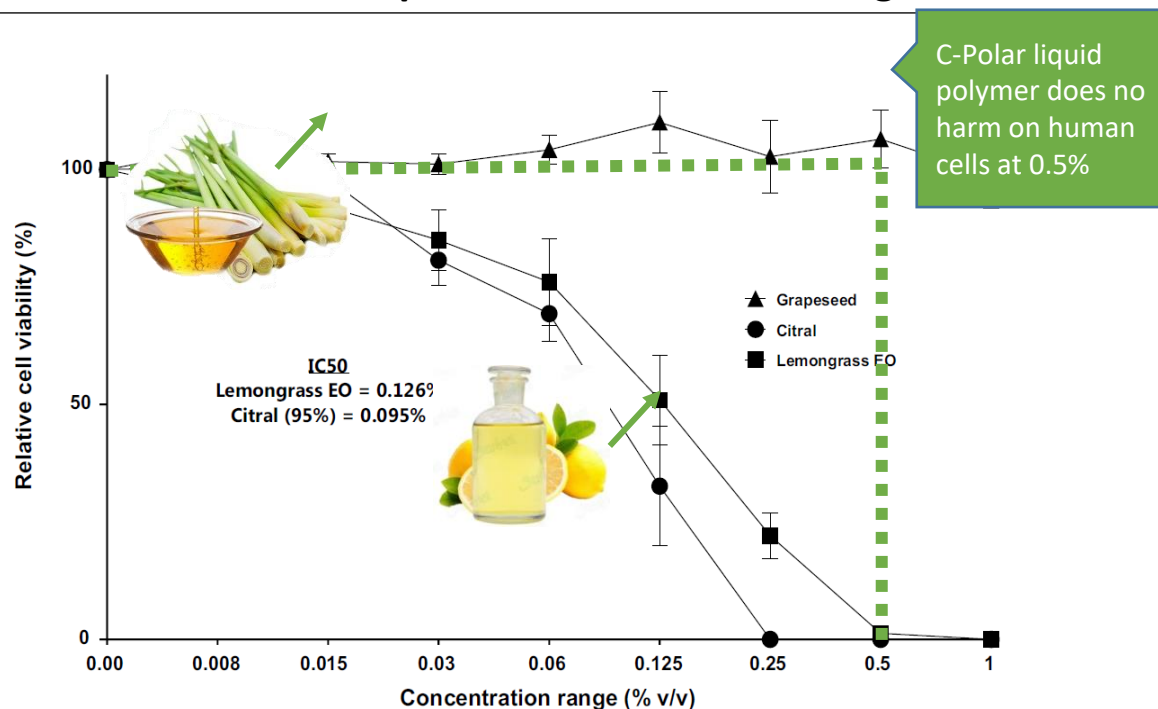


\* Both SARS-229E and Coxsackievirus-B6 are accepted substitutes for the SARS-CoV-2 virus; FFP2 is the filter in a conventional mask  
Source: Finland Tampere University, 2021

# 1 A study conducted by Finland Tampere University and Czech Academy of Science proved that cytotoxicity of C-Polar are better than some natural food additives

## EFFECTIVE AGAINST VIRUSES

### C-Polar liquid polymer is safer than natural food additives such as Grapeseed, Citral and Lemongrass\*



- Finland Tampere University:
  - Liquid polymer was directly applied on human lung cell
  - To simulate polymer of the filter fabric is peeling off under stress test
  - 0.5% of liquid polymer (12.5% of total polymer) does no harm on human lung cells
- Czech Academy of Science:
  - Filter fabric is vortexed 5-times for 5 seconds to wash out polymers on the filter fabric
  - 4% solid polymer on filter fabric does no harm on cells\*\*
- C-Polar biotech does not have toxic effect on mask or similar application

\* Cytotoxicity of Grapeseed, Citral and Lemongrass

Source: Antimicrobial activity, cytotoxicity and chemical analysis of lemongrass essential oil (*Cymbopogon flexuosus*) and pure citral, from the University of the West of England, Bristol

\*\* Complete report shall be ready within April 2021

Source: Virology Research-Service Group, Institute of Organic Chemistry and Biochemistry of the Czech Academy of Science

# ① A study conducted by Hong Kong Open University proved that C-Polar biotech destroyed 99.9% bacteria within 1 mins

## EFFECTIVE AGAINST BACTERIA

Results:

Specimen	Conditions	Number of bacteria <sup>a</sup> (CFU per specimen)
#1	Shake-out before incubation	0
#2	Shake-out after incubation	0

<sup>a</sup>1 millilitre of an inoculum of *Staphylococcus aureus* with concentration of  $1 \times 10^6$  CFU/ml to  $3 \times 10^6$  CFU/ml was applied onto an agar plate in the transfer method, where each specimen was set on the agar surface and weigh down with a 200 g stainless-steel cylinder for  $60 \text{ s} \pm 5$  s to transfer the microbial content. Incubation Measurement of the number of bacteria colonies was conducted in accordance with the plate count method specified in Annex C of BS EN ISO 20743:2013.



*Staphylococcus Aureus*

- C-Polar has a clear ability to
  - **Destroy** high dosage of Staphylococcus Aureus with a **99.9%** ratio
  - 99.9% reduction after short incubation time (**1 mins**)

## ② Air filters serve as the 2nd line of defense against COVID-19; however, their effectiveness is often lacking

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**UVC requires high dose and long duration to inactivate virus, while contact time of air with UVC treatment is extremely short**

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- A study conducted by Columbia University Center for Radiological Research discovered UVC long exposure to inactivate coronavirus\*
  - 90%: 8 Mins
  - 95%: 11 Mins
  - 99%: 16 Mins
  - 99.9%: 25 Mins
- Ineffective to inactivate coronavirus even with direct irradiation by UVC, from FDA recommendation\*\*
- More difficult to inactivate pathogens embedded in dust, soil, or other particulates with porous surface

**Other risks and drawback of using UVC**

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- Accelerates the aging of filter bag and causes degradation of the certain materials in the air conditioning system
- Generates irritating ozone gas
- Release of toxic mercuric fume when the UVC tube is broken
- Consumes electricity



**There is a need for an effective and affordable solution that can arrest and destroy the COVID-19 virus**

\* Far-UVC light (222nm) efficiently and safely inactivates airborne human coronaviruses

Source: Columbia University

\*\* UV Lights and Lamps: Ultraviolet-C Radiation, Disinfection, and Coronavirus

Source: US Food & Drug Administration

## ② FDA underscores the risk of UVC in the air conditioning system

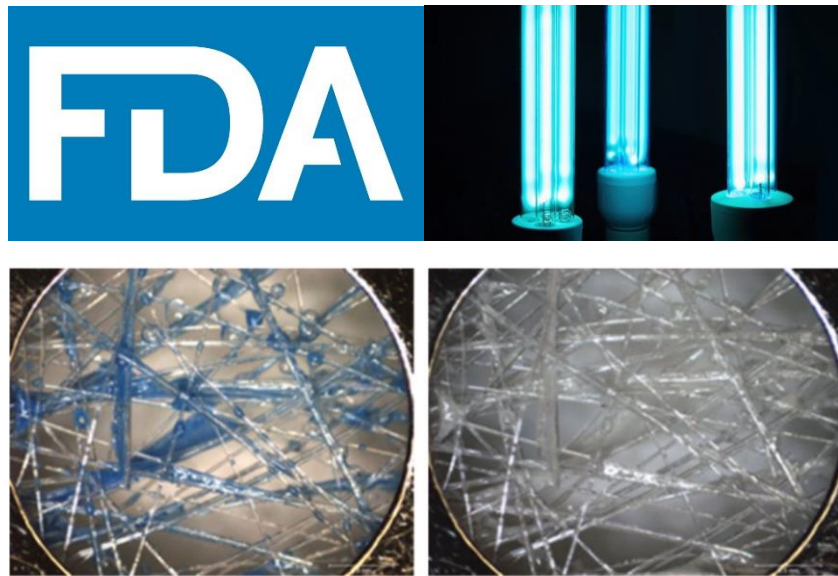


Fig. 8. Lofted fiberglass air filters before (left) and after (right) exposure to  $1130 \mu\text{W}/\text{cm}^2$  ( $7300 \mu\text{W}/\text{in.}^2$ ) UVC for 3 months viewed

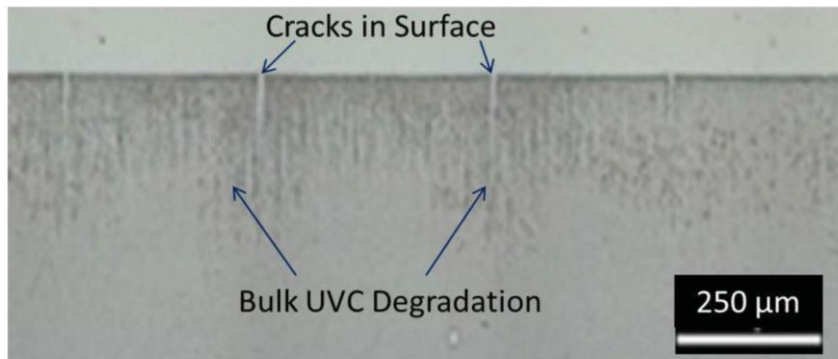


Fig. 4. Magnified cross-sectioned HDPE crater bottom formed by  $1130 \mu\text{W}/\text{cm}^2$  ( $7300 \mu\text{W}/\text{in.}^2$ ) UVC for 3 months.

UV Lights and Lamps: Ultraviolet-C Radiation, Disinfection, and Coronavirus  
Source: US Food & Drug Administration

**Q: Is it safe to use a UVC lamp for disinfection purposes at home?**

**A:** Consider both the risks of UVC lamps to people and objects and the risk of incomplete inactivation of virus.

**Risks:** UVC lamps used for disinfection purposes may pose potential health and safety risks depending on the UVC wavelength, dose, and duration of radiation exposure. The risk may increase if the unit is not installed properly or used by untrained individuals.

- Direct exposure of skin and eyes to UVC radiation from some UVC lamps may cause painful eye injury and burn-like skin reactions. Never look directly at a UVC lamp source, even briefly. If you have experienced an injury associated with using a UVC lamp, we encourage you to [report it to the FDA](#).
- Some UVC lamps generate ozone. Ozone inhalation can be irritating to the airway.
- UVC can degrade certain materials, such as plastic, polymers, and dyed textile.
- Some UVC lamps contain mercury. Because mercury is toxic even in small amounts, extreme caution is needed in cleaning a lamp that has broken and in disposing of the lamp.

**Effectiveness:** The effectiveness of UVC lamps in inactivating the SARS-CoV-2 virus is unknown because there is limited published data about the wavelength, dose, and duration of UVC radiation required to inactivate the SARS-CoV-2 virus. It is important to recognize that, generally, UVC cannot inactivate a virus or bacterium if it is not directly exposed to UVC. In other words, the virus or bacterium will not be inactivated if it is covered by dust or soil, embedded in porous surface or on the underside of a surface.

- ② Degraded filter bag by UVC exposure results in leakage of dust, including pathogens, to the outlets and ducting
- 



(Exposed to UVC for 1 month)

## ② Testing results after 1 week of on-site operation in Hong Kong shopping mall, conducted by the Open University of Hong Kong

- Antibacterial activity of the outer layer of filter bag after the trial run
  - In accordance with BS EN ISO 20743: 2013 Clause 8.2
  - Transfer *Staphylococcus Aureus* onto the outer layer of filter bag
  - Compare the number of colonies results before and after 24 hours incubation of the contaminated outer layer

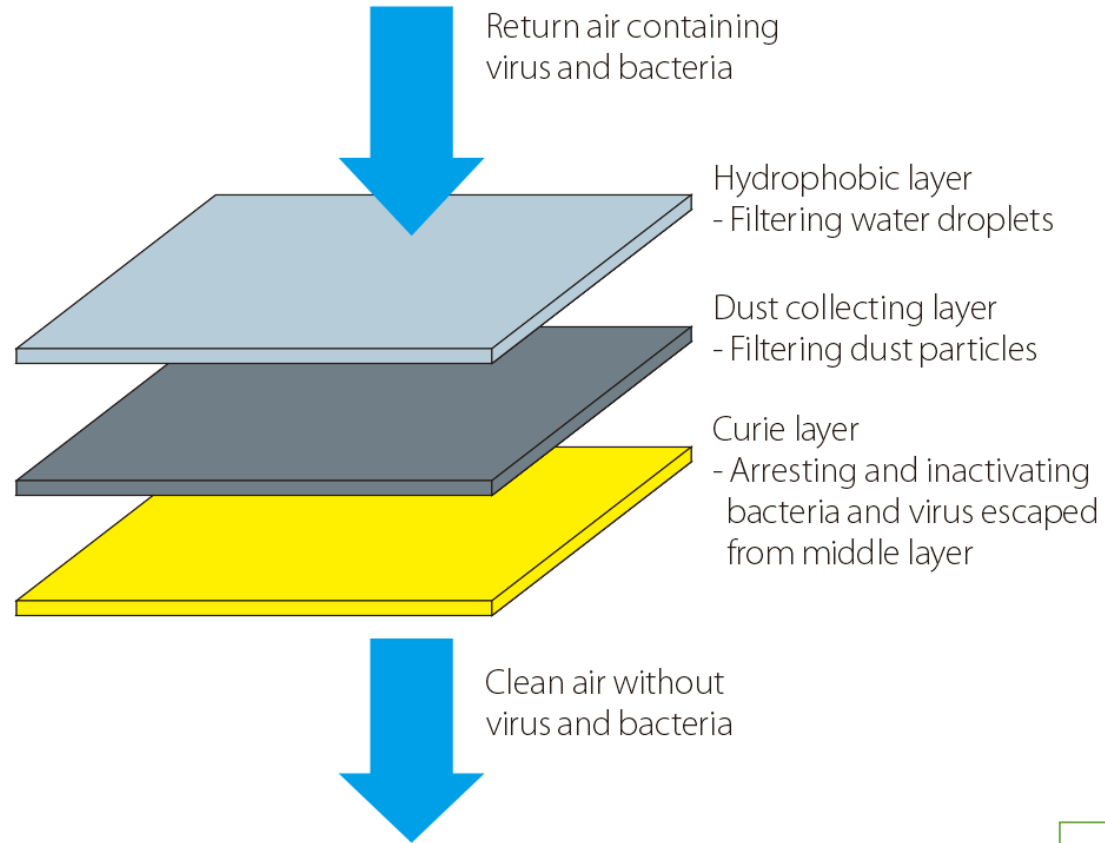
	Colonies found before incubation	Colonies found after incubation	Antibacterial Activity Value	Antibacterial Activity (%)	Remark
Sample A	6	0	6.54	> 99.99%	C-Polar Treated
Sample B	5	0	6.54	> 99.99%	C-Polar Treated
Sample C	10	25,600,000	0.13	-	Untreated
Sample D	13	28,800,000	0.20	-	Untreated

Reduction of more than **1,000,000 fold of Staphylococcus Aureus growth** by C-Polar filter

- 2.56M - 2.88M folds on Staphylococcus Aureus growth on untreated filter

**No efficiency lost** on antiviral / antibacterial performance **under strong air flow and harsh condition**

## ② C-Polar can be used to arrest and destroy COVID-19 and other virus in air-conditioning system




























### To apply C-Polar material at the outer lay of filter bag

- As the gate keeper to destroy bacteria and virus leaking from filter bag
- Demonstrated strong efficiency on arresting and inactivating wide ranges of viruses and bacteria
- Non-cytotoxic to human lung cells and safe to use
- No negative effect on the performance of air conditioning system
- Easy to apply to existing filter bag units
- Saves electricity and maintenance costs when comparing with UVC modules

An easy, effective, affordable and well proven solution that can arrest and destroy the COVID-19 virus



## 2 C-Polar biotech compares favorably against potential competitor products across several key dimensions on filter application

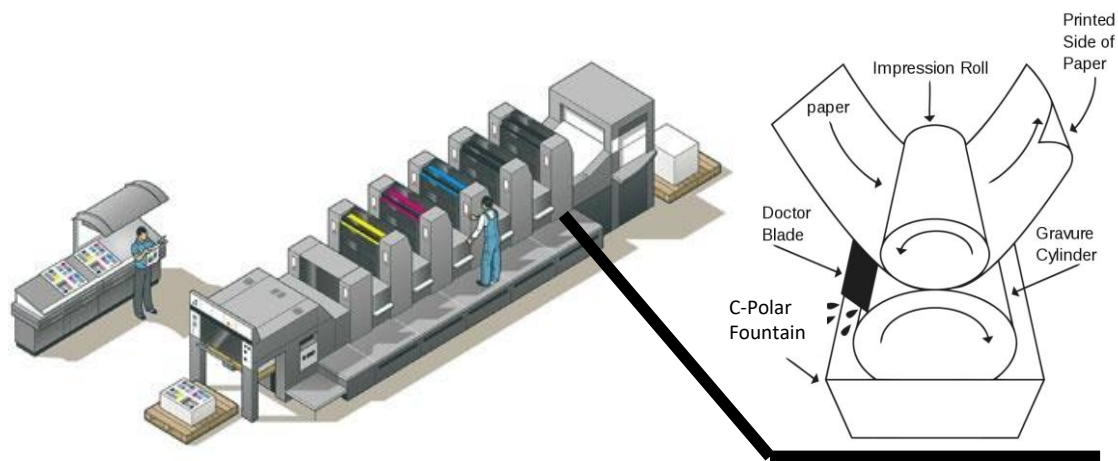
	Our product		Potential competitors			
	C-Polar Biotech	HEPA Filter	UVC	Silver / Copper / Zinc / Titanium	Nanofiber	
How does it work?	Uses a strong positively charged polymer to arrest and destroy negatively charged COVID virus	Uses multiple layers of meltblown to arrest COVID virus	Destroys virus by electromagnetic radiation	Destroys virus using the cytotoxicity of heavy metal	Uses high density fabric to arrest COVID virus	
Does it arrest the virus in fast air flow?	 <p>Research showed that C-Polar was able to arrest more than 99.9% of the virus and bacteria in fast air flow</p>	 <p>Arrests virus in fast air flow by high density of fabric</p>	 <p>Does not arrest any virus in fast air flow</p>	 <p>Does not arrest any virus in fast air flow</p>	 <p>Arrests virus in fast air flow by high density of fabric</p>	
Does it destroy 99.9% of the virus in a short time frame?	 <p>Research showed that C-Polar was able to destroy 99.9% of the virus and bacteria in a short time frame</p>	 <p>Does not destroy any virus, virus can survive in HEPA filter for 7 days</p>	 <p>Deactivates 99.9% of the virus in 25 mins</p>	 <p>Deactivates 99.9% of the virus in long time frame</p>	 <p>Does not destroy any virus, virus can survive in nanofiber for 7 days</p>	
Is it non-toxic?	 <p>Safer than natural food additives</p>	 <p>No toxic effects on humans</p>	 <p>Emit ozone to cause skin irritation</p>	 <p>Toxic effects on humans, FDA and Health Canada ban it</p>	 <p>No toxic effects on humans</p>	
Is it easy to deploy?	 <p>Easy to fix on air conditioning system, by adding 1 layer only</p>	 <p>Limit to air conditioning system with strong air flow only</p>	 <p>Needs extra electricity and installation</p>	 <p>Easy to fix on air conditioning system, by adding 1 layer only</p>	 <p>Limit to air conditioning system with strong air flow only</p>	
Does it have low pressure drop?	 <p>Low pressure drop, without significant lost in efficiency</p>	 <p>High pressure drop, resulting significant lost in efficiency</p>	 <p>No pressure drop, without significant lost in efficiency</p>	 <p>Low pressure drop, without significant lost in efficiency</p>	 <p>High pressure drop, resulting significant lost in efficiency</p>	

### 3 Using C-Polar material to arrest and destroy COVID-19 and other virus on banknote (1<sup>st</sup> banknote to destroy virus)

C-Polar Killing Virus Layer

Moroccan Dirham

C-Polar Killing Virus Layer



#### To apply C-Polar at the outer surface of banknote

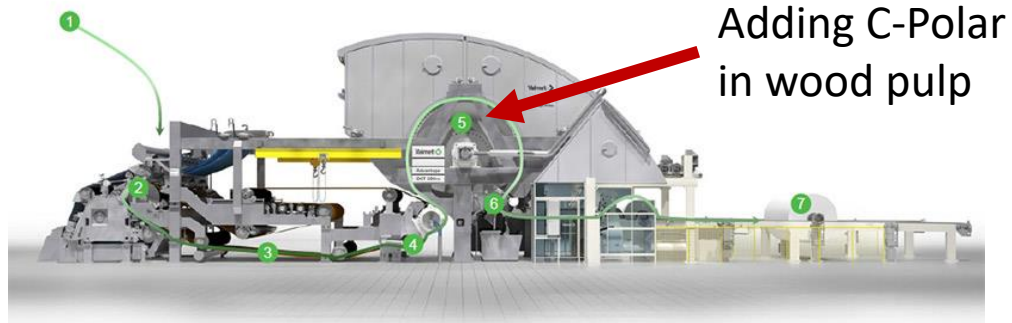
- COVID-19 can survive on banknotes longer than 28 days\*
- Banknotes become one of the vehicle for COVID-19 transmission via surface contact
- Adding C-Polar at the final stage of the printing process of banknote
- C-Polar polymer act as an additional ink which destroys virus
- Report from Finland proved C-Polar can be effectively deployed on cotton and polyester
- Cotton is the core material of Moroccan Dirham
- The world 1st banknote to destroy the virus

**An easy, effective, affordable and well proven solution that can arrest and destroy the COVID-19 virus**

\*The effect of temperature on persistence of SARS-CoV-2 on common surfaces

Source: Commonwealth Scientific and Industrial Research Organization (CSIRO), Australian Centre for Disease Preparedness, Geelong, VIC, Australia

### ③ Using C-Polar material to arrest and destroy COVID-19 and other virus on dry paper



Adding C-Polar  
in wood pulp



#### To apply C-Polar on paper manufacturing process

- International parcels can carry mutations to spread other countries
- By applying C-Polar on the paper, paper can destroy virus without using alcohol
- Destroying the virus without alcohol fits the requirement of Halal
- Packaging with destroying virus function can cut the transmission of mutations across countries via international freight
- Food packaging with destroying virus function can extend the storing duration for food industry
- This would be the world's 1<sup>st</sup> dry paper tissue with a destroying virus function



**An easy, effective, affordable and well proven solution that can arrest and destroy the COVID-19 virus**

### ③ Using C-Polar material to arrest and destroy COVID-19 and other virus on interior of public transports and sharing vehicles

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Public Bus



Train



Air Flight



Taxi

- COVID-19 Free Transport
- 1st in the World

#### Immediate Applications

- Seat Cover
- Carpet
- Ceiling
- Air Filter
- Uniform for Driver

### ③ Using C-Polar material to arrest and destroy COVID-19 and other virus on interior of restaurants, hotels and public area



Restaurants



Hotel



Gym



Apartment

- COVID-19 Free Indoors
- Rebuild confidence of tourists

#### Immediate Applications

- Seat Cover
- Carpet
- Tablecloth
- Wall Covering
- Ceiling
- Beddings
- Curtains
- Air Filter
- Uniform for Staff

### ③ Using C-Polar material to arrest and destroy COVID-19 and other virus in a medical environment

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- Stop virus and bacteria from penetrating from outer environment into wound
- Keep virus / bacteria free environment for wound to recover
- Safe for human contact
- Boosts speed of recovery

#### Immediate Applications

- Bandage
- Medical Cotton
- Gunshot Syringe
- Nitrile Glove
- Burn Treatment
- Invasive Plastic Parts

### ③ Using C-Polar material to arrest and destroy COVID-19 and other virus on sanitary supply

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Sanitary Pad



Diaper



Wipe



Toilet Seat Cover

- Arrest and destroy virus and bacteria from outside environment, preventing them from human contact
- Enhance the cleanliness of sensitive areas from virus or bacteria infection

#### Immediate Applications

- Sanitary Pad
- Diaper
- Wipe
- Toilet Seat Cover
- Toilet Paper

### ③ Using C-Polar material to arrest and destroy COVID-19 and other virus on military



Gas Mask



CBRN Suit



CBRN Vehicle



CBRN Filter

- Existing Chemical, Biological, Radiological and Nuclear (CBRN) equipment cannot destroy virus in fast air flow
- Stop virus and bacteria from penetrating from outer environment into soliders
- Effective counter against viral or bacterial weapons
- Easy to deploy on current equipment system

#### Immediate Applications

- Gas Mask
- CBRN Suits
- CBRN Filter
- CBRN Vehicle