GREEN NANOTECHNOLOGY – R & D AND INNOVATION STRATEGIES FOR LOW-COST AND AFFORDABLE SOLUTIONS:

THE PHILIPPINE INITIATIVES

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THE PHILIPPINE INITIATIVES

GREEN PUBLIC PROCUREMENT POLICY

Presidential Executive Order 301

"Establishing A Green Procurement Program for All Departments, Bureaus, Offices and Agencies of the Executive Branch of the Government"

GOALS

- Promote the culture of making an environmentally-informed decision in government, especially in the purchase and use of different products.
- Include environmental criteria in public tenders whenever possible and practicable.
- Establish the specifications and requirements for products and services to be considered environmentally advantageous.
- Develop incentive programs for suppliers of environmentally sound products and services.

Source: Alvarez, June M., Philippine Center for Environmental Protection and Sustainable Development, Inc., Philippines

NATIONAL ECOLABELLING PROGRAMME

GREEN CHOICE PHILIPPINES

Source: Alvarez, June M., Philippine Center for Environmental Protection and Sustainable Development, Inc., Philippines

AWARDED PRODUCTS

Cement

Water-based Paint

Fiber Cement Board

Induction Lamps

Organic Infill Material

TISSUE PAPER PRODUCTS

LED Lights

Multi-function Printing Device

Electronic Ballast

Detergent/cleaning agent

Ceramic Tiles

Plantex

Paper Board

Green Choice Philippines has been awarded to 42 products

Source: Alvarez, June M., Philippine Center for Environmental Protection and Sustainable Development, Inc., Philippines

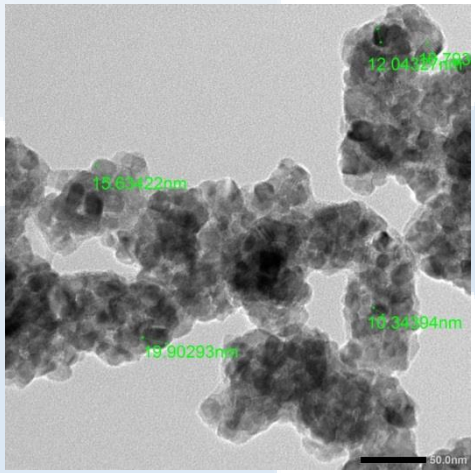
Boysen's KNOxOut Air Cleaning Paint

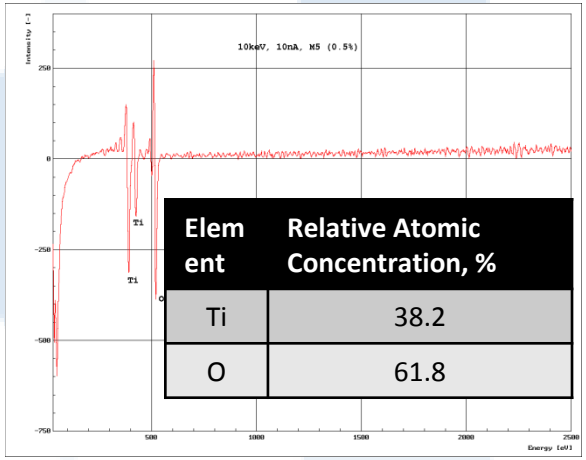
- Contains Crystal Active photocatalytic technology, Ultrafine (Nano) Titanium Dioxide (TiO2)
- Reduces pollutant such as Nitrogen Oxides (NOx)
- Gives also the paints its self-cleaning and anti-bacterial properties.

Source: www.knoxoutpaints.com

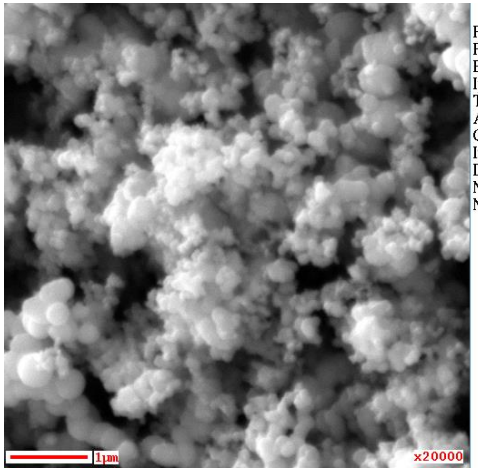
Transmission Electron Microscope
TEM Image of Nanotitania

Nano TiO_2 for self-cleaning applications

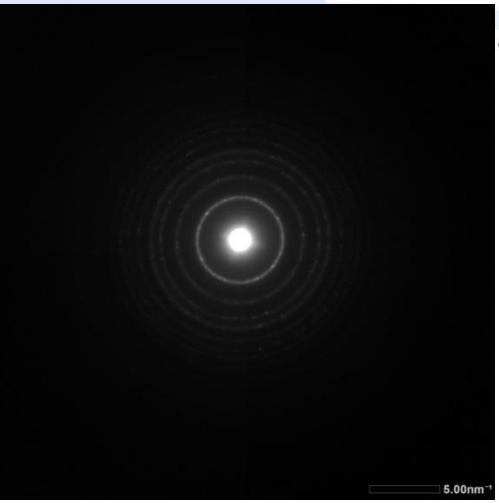




Element	Relative Atomic Concentration, %
Ti	38.2
O	61.8

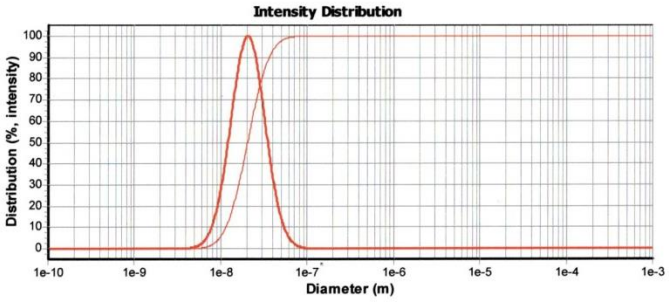


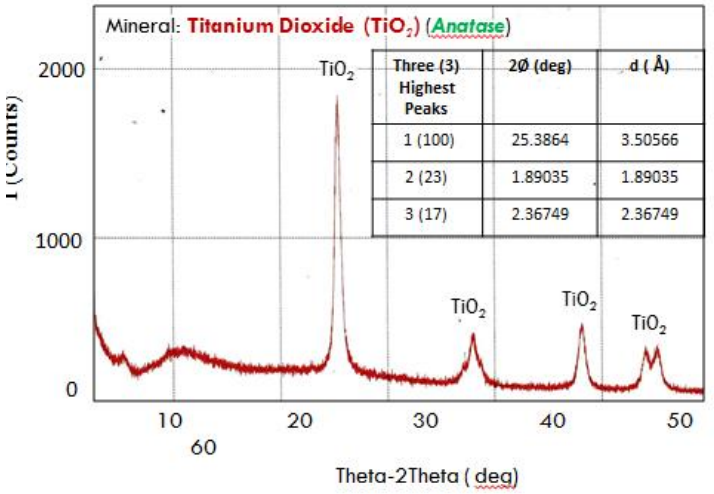
File Name : y012
PB Name :
Ep : 10.0 [keV]
Ip : 3.55 x10 -9 [A]
Tilting Angle : 0 [degree]
Analyzer Mode :
CEM :
Intensity Def. :
Dwell Time : [ms]
No. of Acc. : 10
No. of Pixels : 512 * 512



¶ Analysis Results

° d(0)	3.74 nm / 3.74 nm / 3.74 nm	° d(5)	9.86 nm / 9.86 nm / 9.86 nm	° # of Peaks	1
° d(10)	11.5 nm / 11.5 nm / 11.5 nm	° d(25)	15.3 nm / 15.3 nm / 15.3 nm		20.6 nm
° d(50)	20.5 nm / 20.5 nm / 20.5 nm	° d(75)	28.1 nm / 28.1 nm / 28.1 nm		
° d(90)	36.6 nm / 36.6 nm / 36.6 nm	° d(95)	43.5 nm / 43.5 nm / 43.5 nm		
° d(100)	113 nm / 113 nm / 113 nm				





Three (3) Highest Peaks	2Ø (deg)	d (Å)
1 (100)	25.3864	3.50566
2 (23)	1.89035	1.89035
3 (17)	2.36749	2.36749

GREEN NANOTECHNOLOGY SOLUTIONS:

R & D AND INNOVATION STRATEGIES

FOR MILITARY

Bullet proof vest

The unique properties of nanocellulose allow it to be used as an ultra-light and ultra-strong material for bullet-proof vests.

The Philippines is one of the major sources of bacterial nanocellulose and other cellulose sources such as abaca, and other natural fibers

FOR MILITARY

Bullet proof TRUCK

- The tough yet lightweight nanocomposite walls of the vehicle secure soldiers from bullets and blast fragments while the abaca fiber-reinforced composite roof protects them from intense heat.
- The use of lightweight nanocomposite materials also enables the vehicle to carry more troops, ammunitions, and other supplies.

FOR TRANSPORTATION

Tricycle

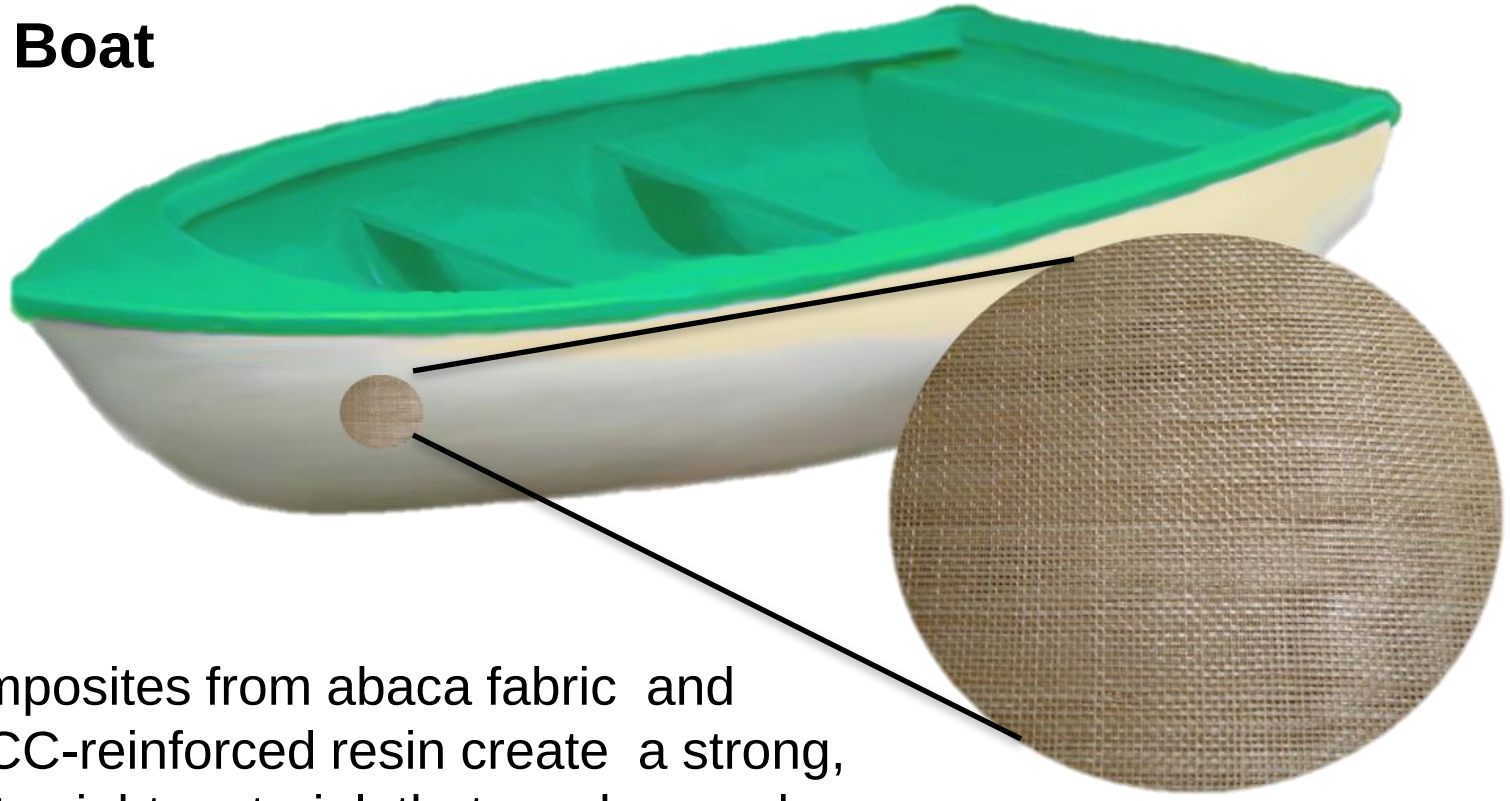
Abaca fiber-reinforced composite makes the iconic Filipino tricycle more environment-friendly. Abaca fiber is one of the strongest natural fibers and is known for its light weight and heat and corrosion resistance.

Nano-coating makes the tricycle body acid, alkali, and water resistant and protects the tricycle body from dust, heat and ultraviolet rays.

Hydrophobic nanocoating on glass surfaces improve visibility during rainy season

FOR TRANSPORTATION

Small Boat



Composites from abaca fabric and NPCC-reinforced resin create a strong, lightweight material that can be used for boat applications. Hydrophobic nanocoating further protects the natural fiber from harsh water conditions.

FOR DISASTER PREPAREDNESS

Innovative Utility Tent as Temporary Shelter for Disaster and Natural Calamity Victims

The utility tent will have the following functionalities and properties: (a) self – assembling, (b) water and moisture repellant, (c) fire retardant, (d) lightweight, (e) can generate and trap heat to provide warmth & protection during the cold weather, (f) has the endurance & resistance against ablation and puncture.

The study explores nanomaterials, develop methodologies or process that can be integrated in to the textile in order to enhance its properties and functionalities.

FOR DISASTER PREPAREDNESS

The floating baby capsule will be used to transport infants safely to dry location during floods. The capsule is used in case of flood, can be equipped with GPS and other accessories or gadgets necessary for survival and has the endurance & resistance against ablation and puncture.

FOR DISASTER PREPAREDNESS

- **MODIFIED CERAMIC WATER FILTER**

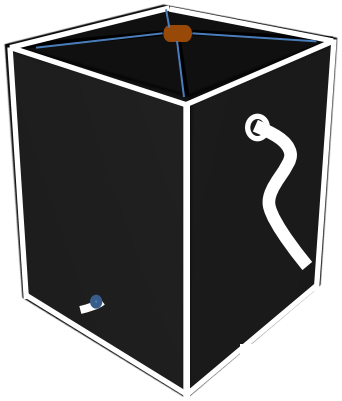
An alternative ceramic water filter system was developed to address the demand for simple, effective and inexpensive water filter for household use.

Provision for the removal of heavy metals is a new development with the addition of bottom catchment containing locally-produced nanozeolite.

The developed water filter will help address the need for a water purification system that can easily be fabricated and low cost.

FOR DISASTER PREPAREDNESS

- **Modular-type Rainwater Collection System**



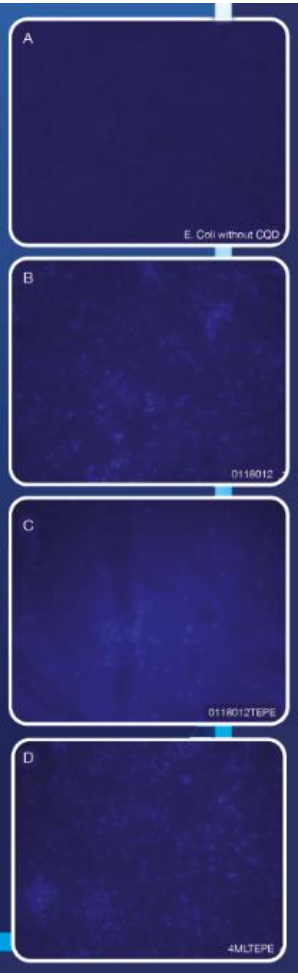
Description:
Composite liner made from HDPE plastic with nanoprecipitated calcium carbonate (NPCC). The composite liner is produced by compounding the HDPE with NPCC for better mechanical properties. It has improved water barrier properties, very good blend of physical properties like tensile-impact strength coupled with good weatherability and chemical resistance properties.

Product Features:
Can harvest and store rainwater up to one cubic meter for non-potable domestic use
Made from local raw materials
Inexpensive
Easy to install and deploy
Easy to store when not in use (foldable)
Can fit into individual homes

FOR BIOSENSING

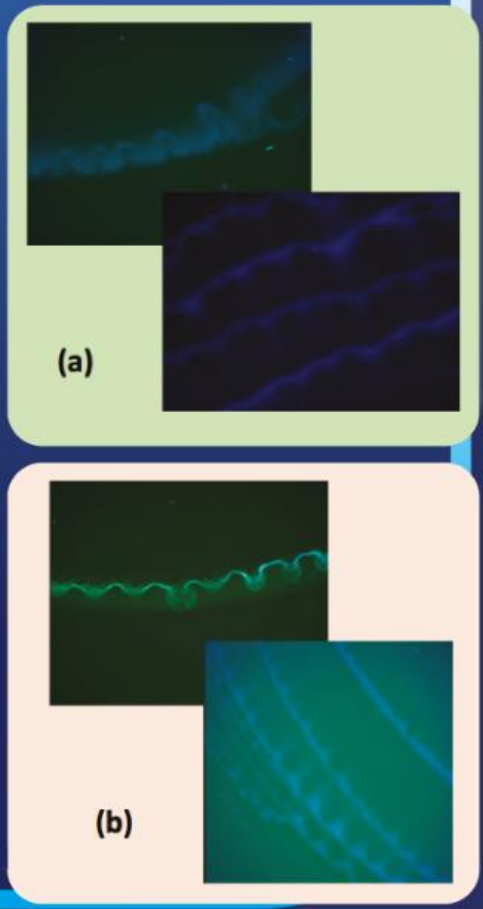
Carbon Quantum Dots

CQD due to their low toxicity, biocompatibility, low cost and chemical inertness in addition to having similar fluorescence properties as the existing metal quantum dots have promising applications in biomedicine, optronics, catalysis and optical sensors. In biomedicine, CQD can be used in bio imaging, biosensor and biomedicine delivery.



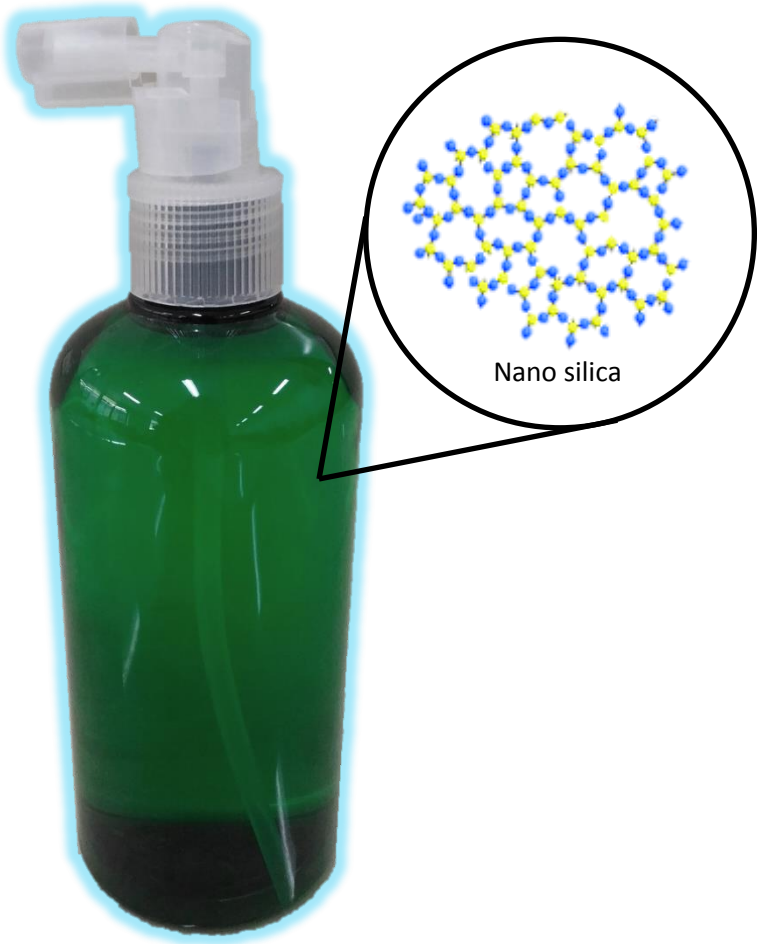
Semiconductor Carbon Quantum Dots

CdS quantum dots coated with iota-carrageenan is a biocomposite material suitable for applications such as biosensors, bioimaging & biolabelling since iota-carrageenan is a polysaccharide that interacts with a wide variety of proteins.

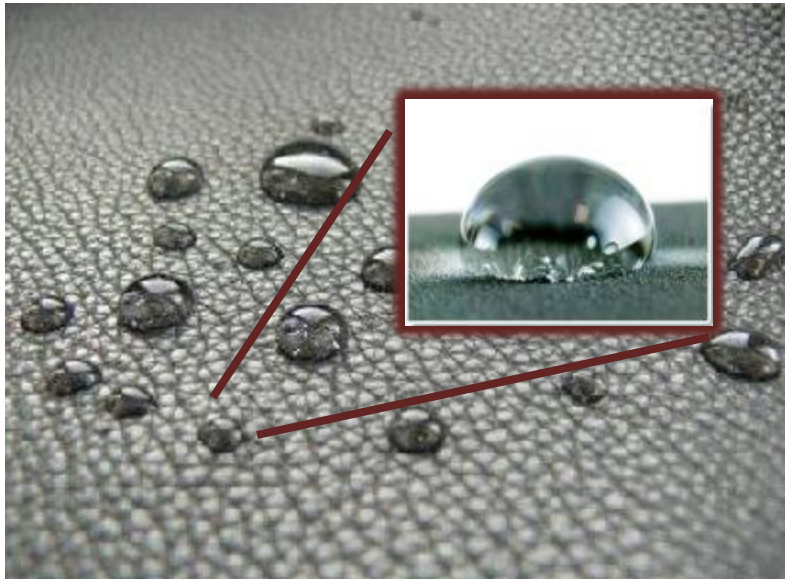


FOR MANUFACTURING

Super Hydrophobic Coating



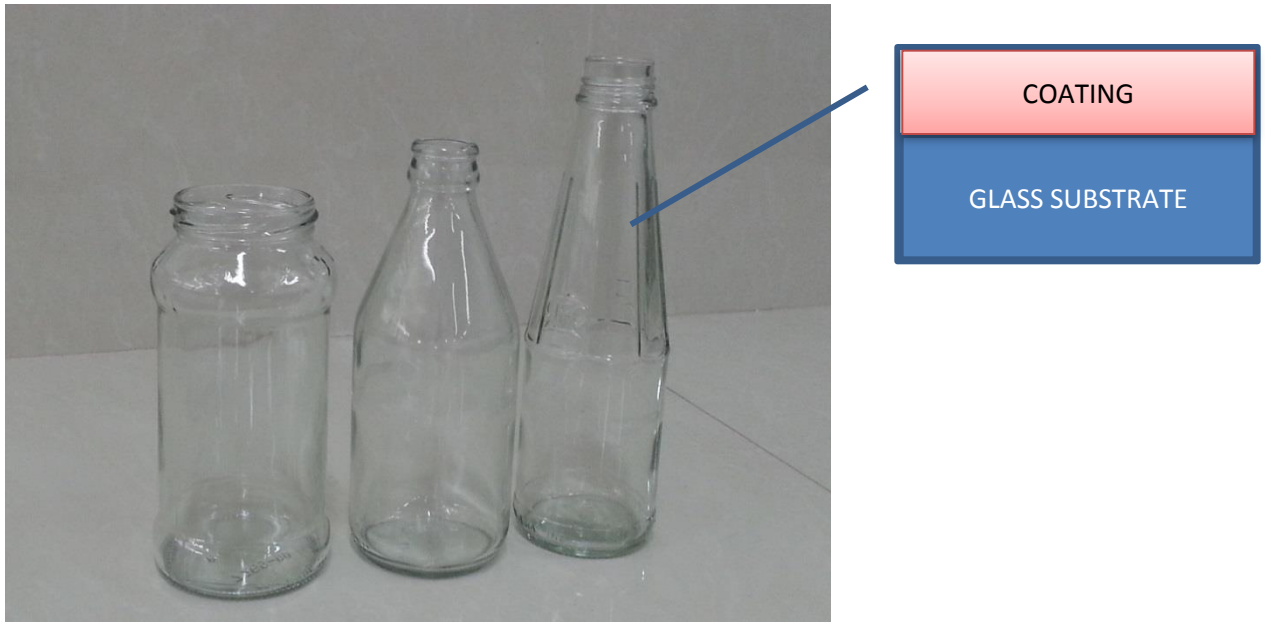
A solution enhanced with nano silica when applied to the surface it enhances the surface hydrophobicity making it water-repellent and self-cleaning.



Water contact angle greater than 150°
Sliding Angle less than 10°

FOR MANUFACTURING

- Integration of nanotechnology in glass technology by adding nanomaterials on the coating agent of glass containers to improve strength and prevents occurrence of defects by reducing the coefficient of friction and improves lubricity



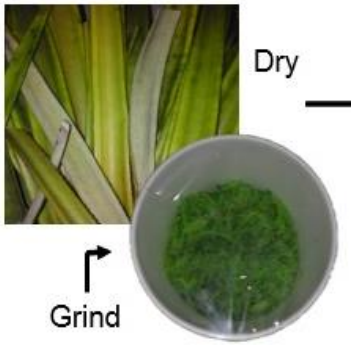
FOR MANUFACTURING

Green Synthesis of Gold Nanoparticles

FOR MANUFACTURING

CELLULOSE NANOCRYSTAL FROM PINEAPPLE LEAVES

Pineapple leaves



Centrifugation

Dialysis

Suspension of Cellulose nanoparticles

FUTURE PLANS

INNOVATION CENTER FOR GREEN TECHNOLOGIES

4-year project

Funding agency : National Research Foundation of Korea (NRF)

Collaborating agency : Korea Institute of Materials Science (KIMS)

THANK YOU!!!

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