



Recent trends on water and air disinfection using heterogeneous catalysis

Wilson F. Jardim

Instituto de Química – UN ICAMP
Universidade Estadual de Campinas
<http://lqa.iqm.unicamp.br>

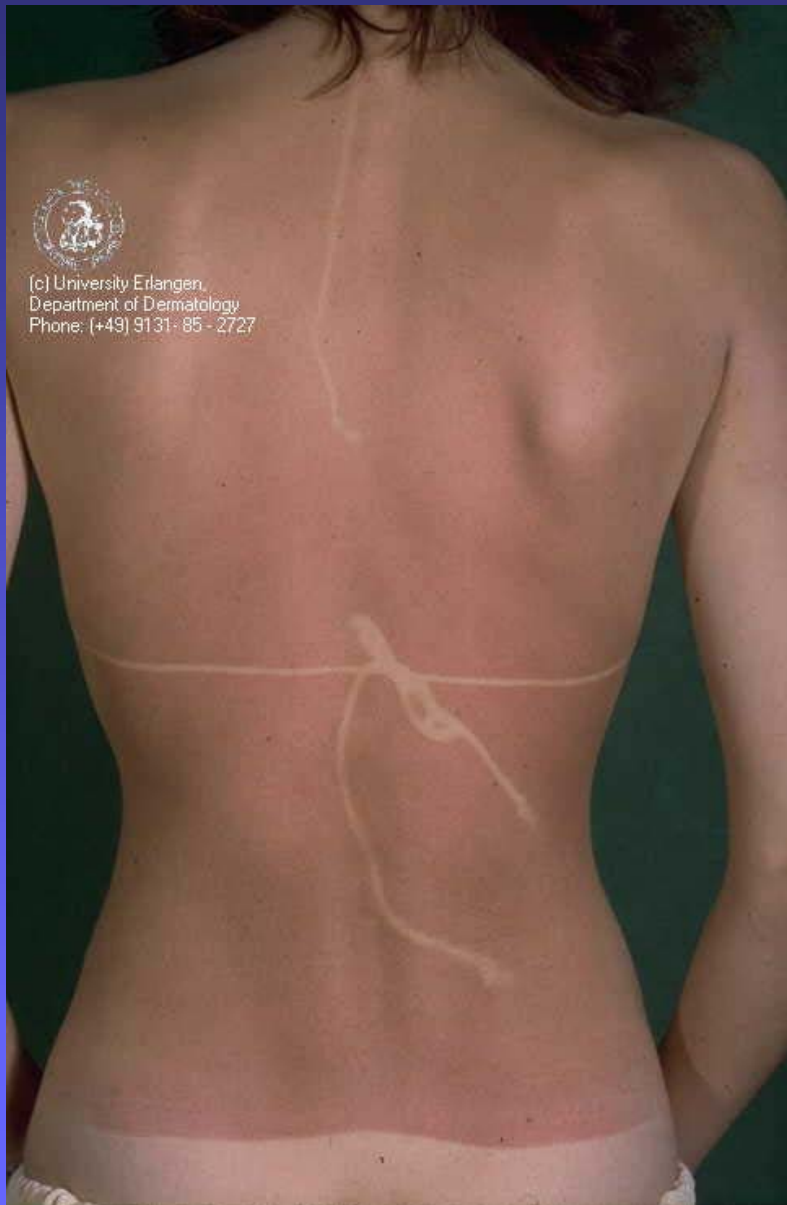
Briefly....

- Victims of the sun (many of them)
- Working with aqueous phase
- What is new in the air
- The age of clean atmosphere with nano
- How to clean a nano dirty?
- Conclusion

Victims of the sun (famous): Icarus



Victims of the sun (anonymous)



However, mankind is in a
constant quest for new
compounds...



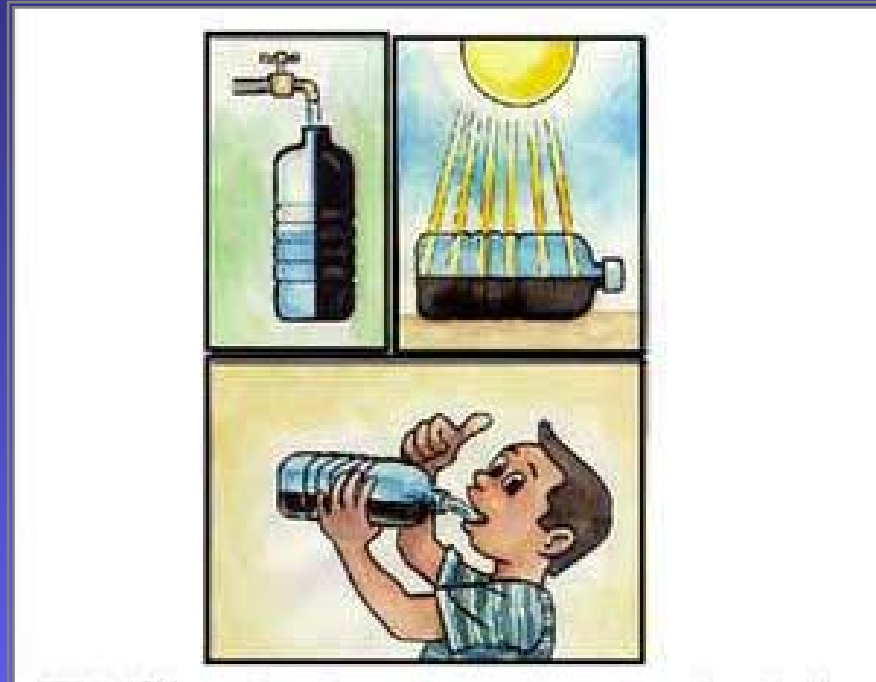
Aqueous phase

Other victims: bugs... very small bugs

- Early studies on solar disinfection in the early 80's carried out at the Universidade Federal da Paraíba (UFPb)
- Unpublished results using glass bottles
- Bugs got killed (heat, UV, alcohol residues?)

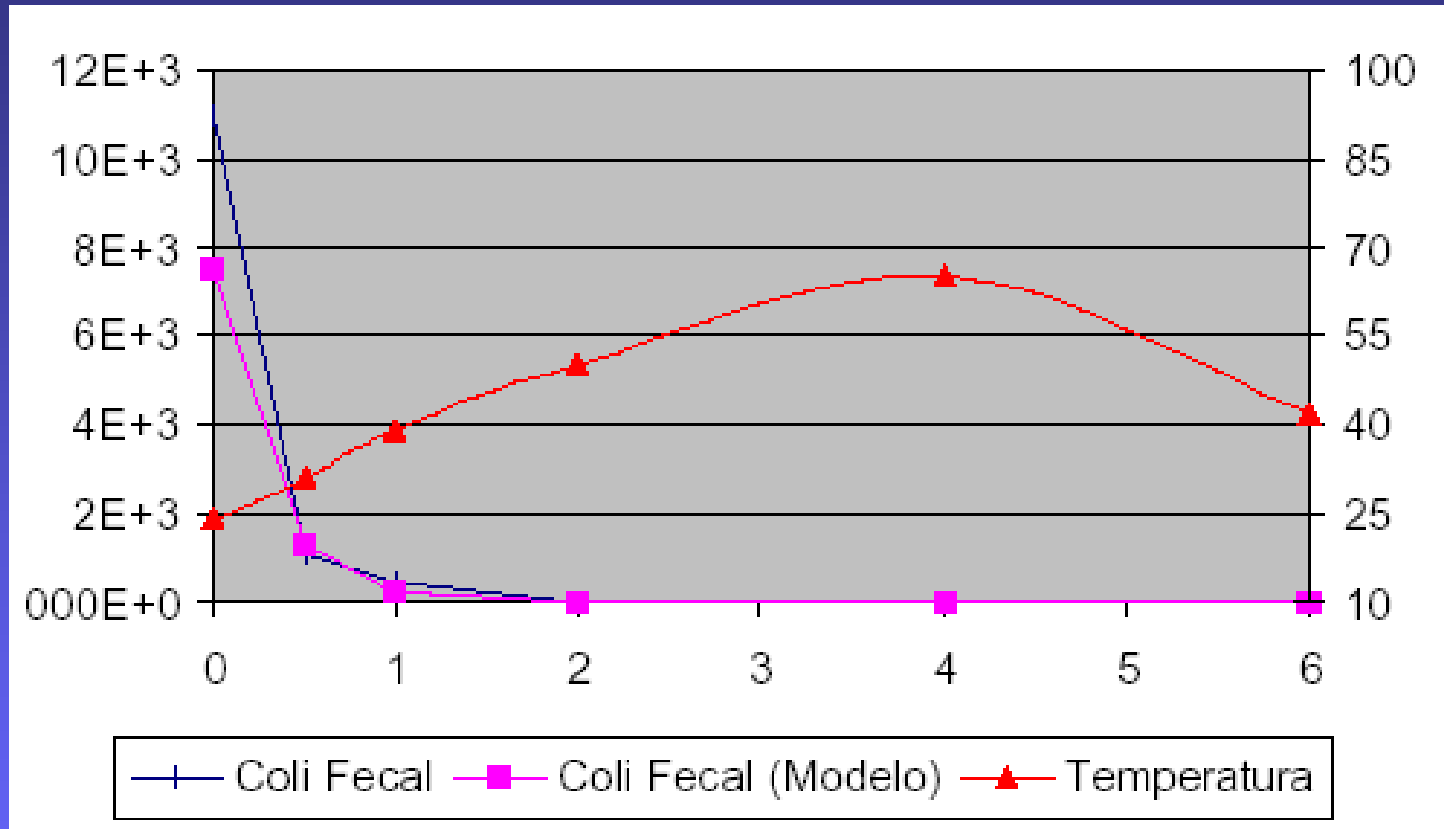


Solar Water Disinfection (SODIS)



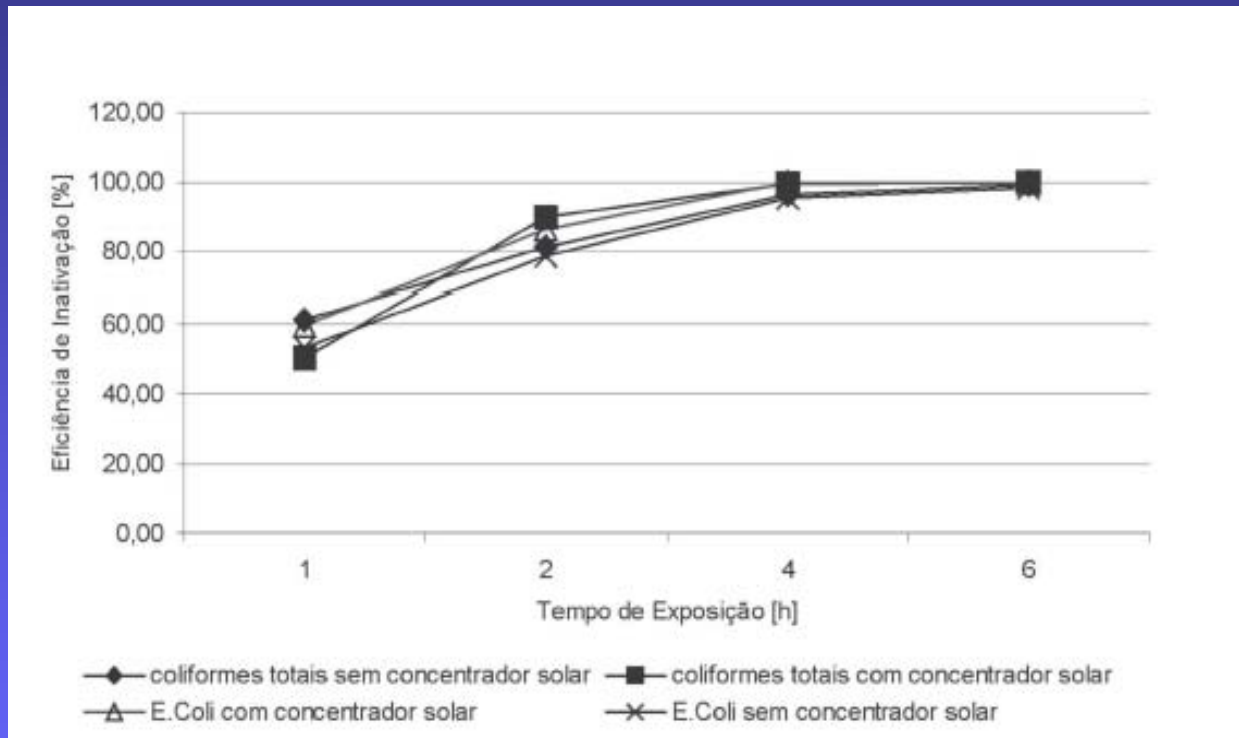
- Solar exposure (4–6 h) of plastic bottles containing unsafe water
 - Combination of UV light and heat (50–55°C)
 - Inactivation of bacteria and viruses (including *Vibrio cholerae*)

Solar disinfection in river water samples



Monteiro, P.C.G., Brandão, C.C.S. & Souza, M.A.A., UnB (Universidade de Brasília, PROSAB)

Sewage after tertiary treatment

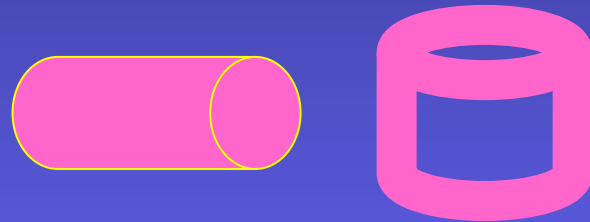


Paterniani, J.C.S & Silva, M.J.M. (2005). Eng. Sanit. Ambient., 10, 9–13

The help from nanotech: heterogeneous photocatalysis using TiO_2

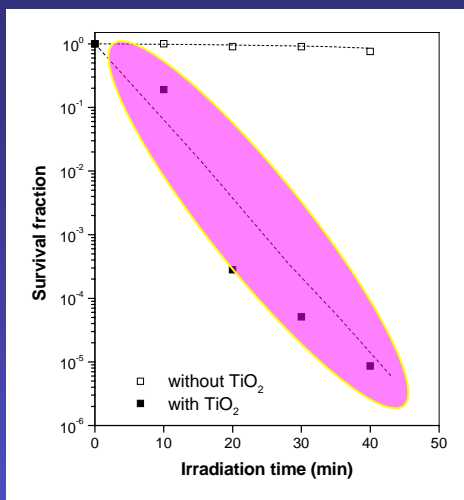


PORCELAIN SPHERES

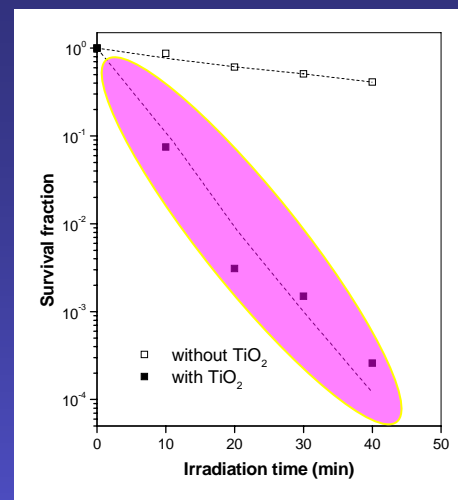


GLASS RODS AND RASCHIG RINGS

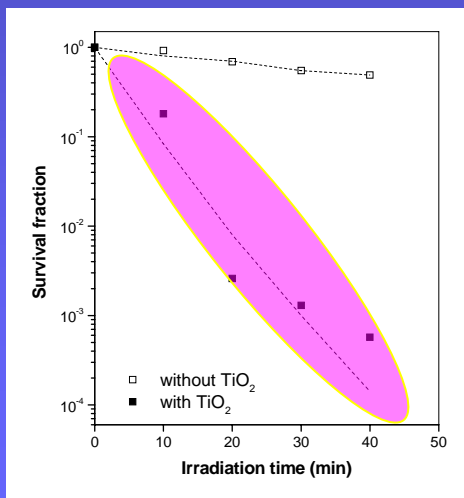
Bacterial inactivation



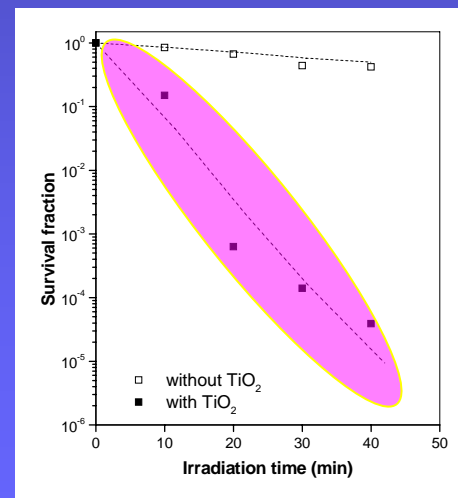
***Escherichia coli* K12K**



Enterobacter cloacae



Pseudomonas aeruginosa



Salmonella typhimurium

Fixation of TiO_2 to PET bottles

Commercial PET bottles, mineral water or soft drinks



1500 or 600 mL

- very cheap: TiO_2 -water suspension at pH 2.5 (HClO_4)
- Shaking to obtain a homogeneous film over the wall.
- Drain of the remaining suspension.
- Bottle left inverted
- Drying at room temperature for 24 h.

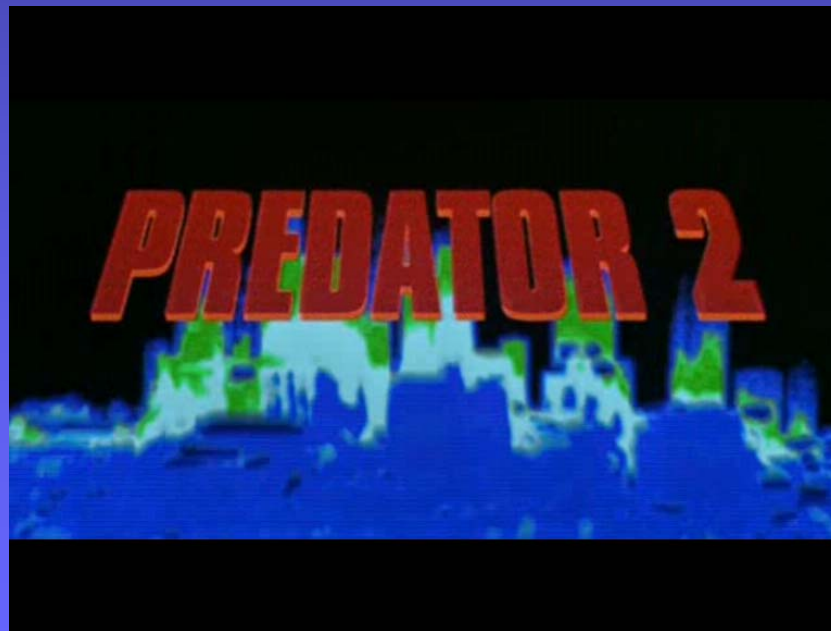
Very cheap, stable TiO_2 film, easy to be prepared

Some problems yet to be solved:

1– microbes regrowth

2– a reliable way of supporting the catalyst

3– make the whole system viable to poor communities



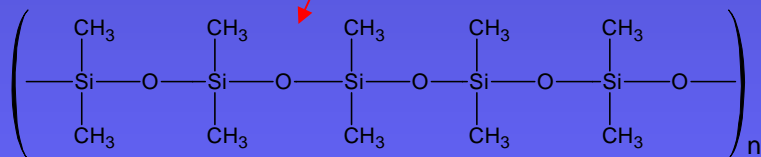
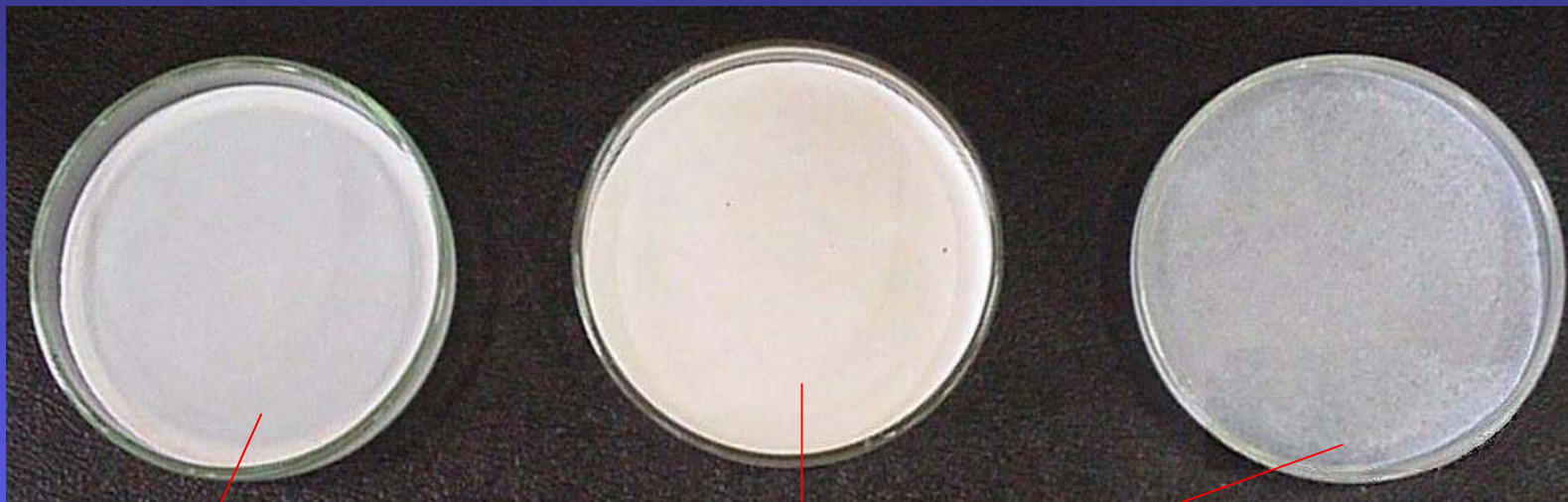
Gas phase

TiO₂ SUPPORTED ON POLYMERS FOR HETEROGENEOUS PHOTOCATALYSIS (HP)

**Polidimethylsiloxane
(PDMS)**

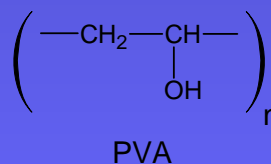
**Ortophtalic Poliester
(OP)**

**Polyvinyl Alcohol
(PVA)**



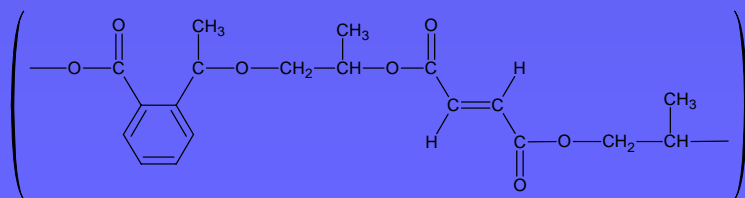
PDMS

- Loss of catalytic activity
- Low hydrophilicity



PVA

- Low mechanical resistance
- Low catalytic activity



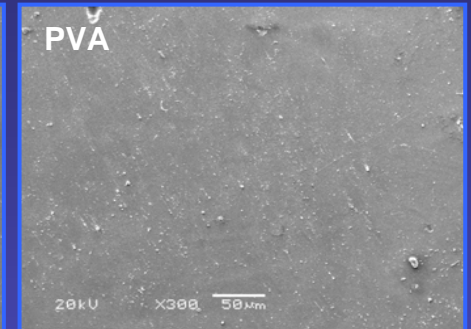
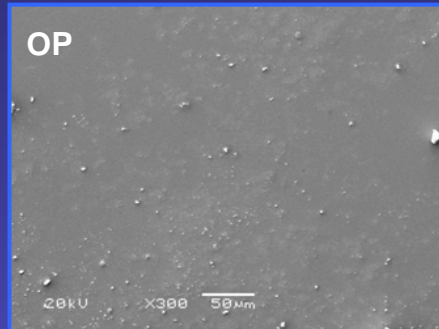
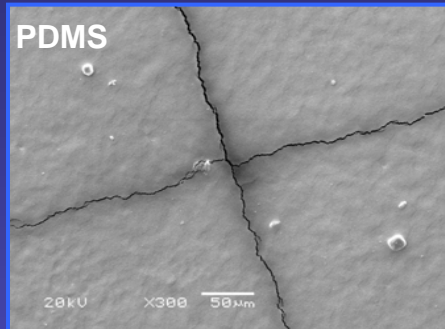
OP

Best results:

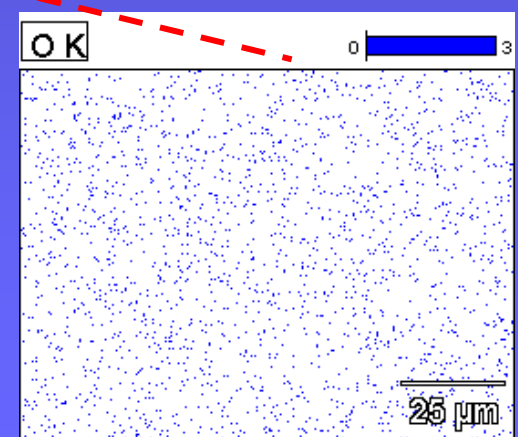
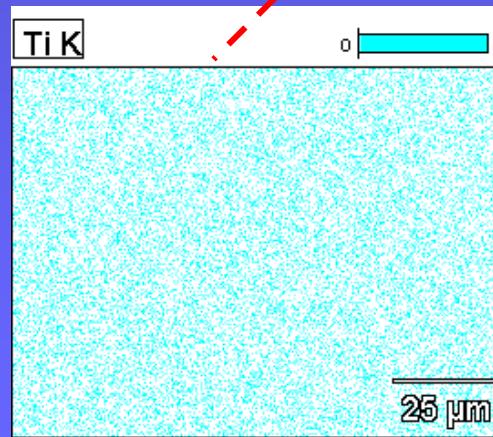
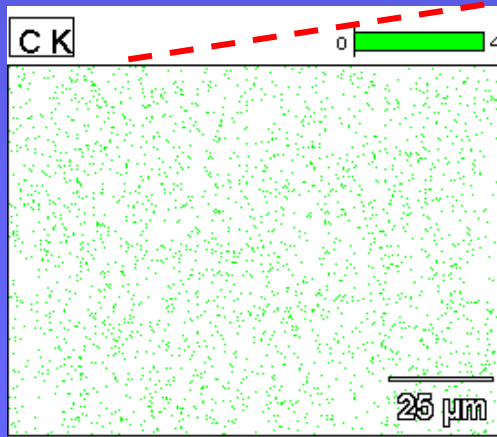
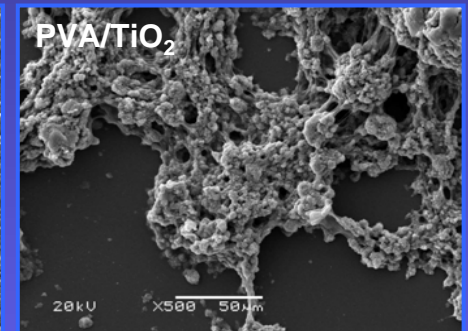
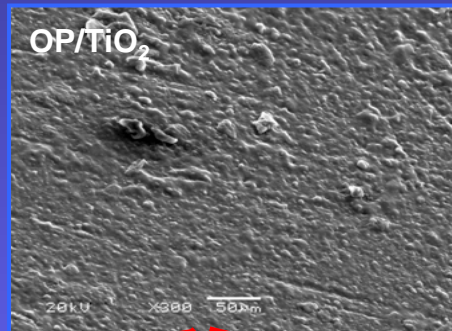
- Low cost
- Maintenance of catalytic activity

FILMS SURFACE CHARACTERIZATION (SEM – EDS)

Polymers

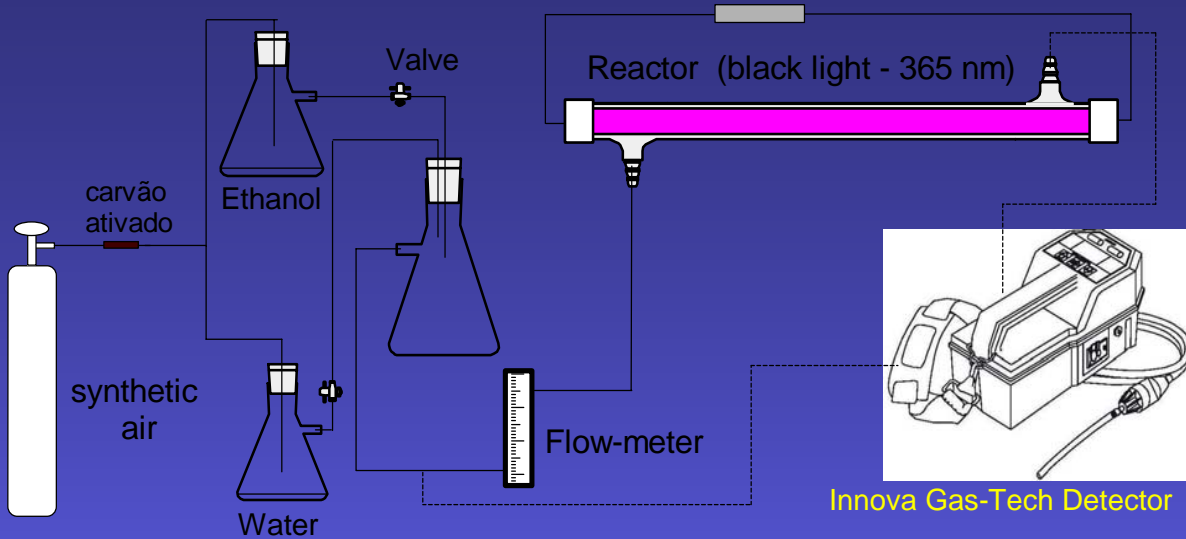


Polymers/TiO₂



32,6 % of Ti

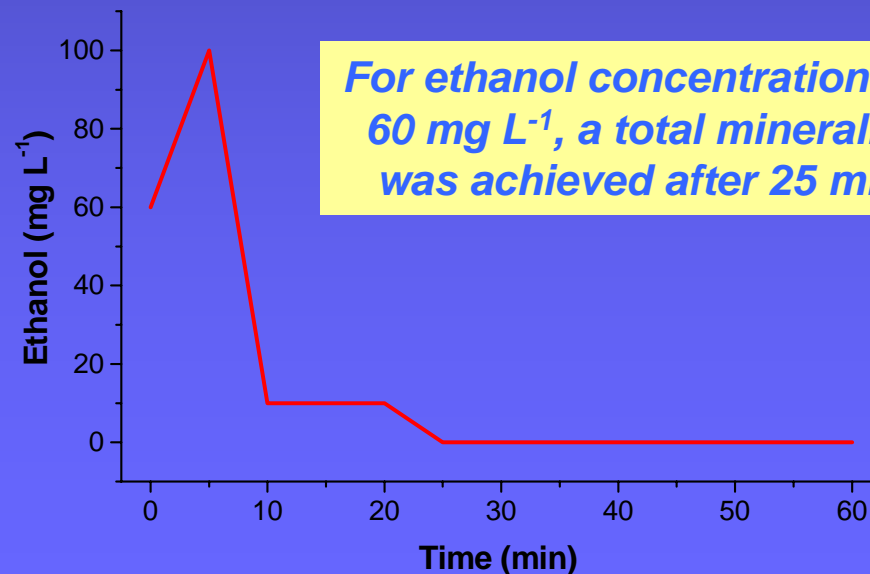
OP/TiO₂ 20 % (w/w) FILM: EVALUATING VOCs DESTRUCTION



- "plug-flow" reactor of 767 mL.
- reactive internal area: 900 cm².
- test-substance: ethanol vapor.
- 200 mL min⁻¹ flow of humid synthetic air.

photoreactors to treat confined atmospheres contaminated with VOCs

internal view



For ethanol concentrations below 60 mg L⁻¹, a total mineralization was achieved after 25 minutes

DEVELOPMENT OF AN AIR DISINFECTION REACTOR USING OP FILM



- PVC reactor
- designed to treat 200 L/min of contaminated air
- reactive internal area: 1312 cm².
- test-organism: air viable fungi

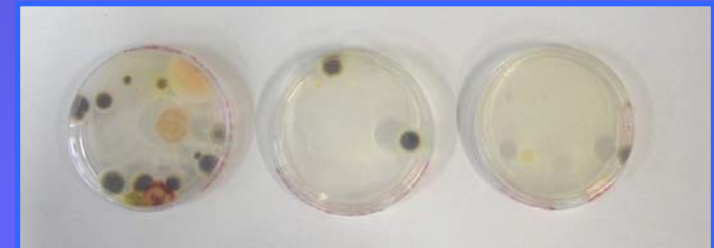
artificially contaminated atmosphere



Petri dish with culture media



C_0 Photolysis HP



Preliminar results:

- 60% of cfu elimination

Commercially available killing machines....



AiroCide Air

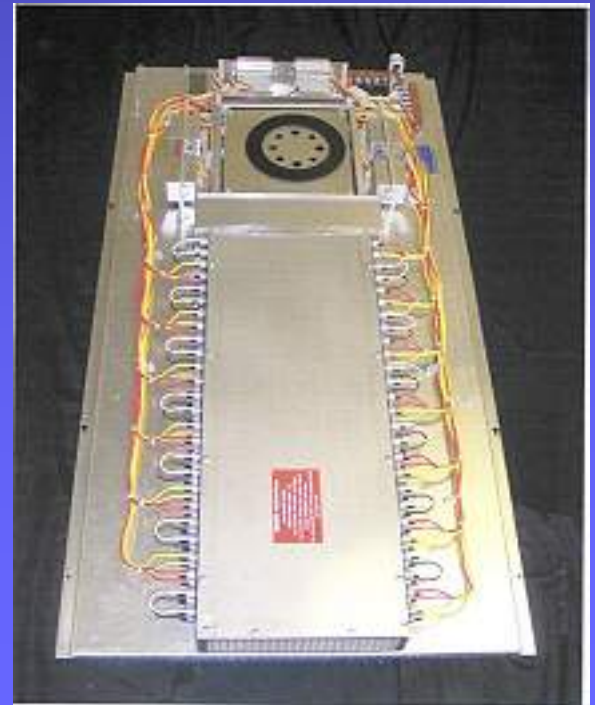
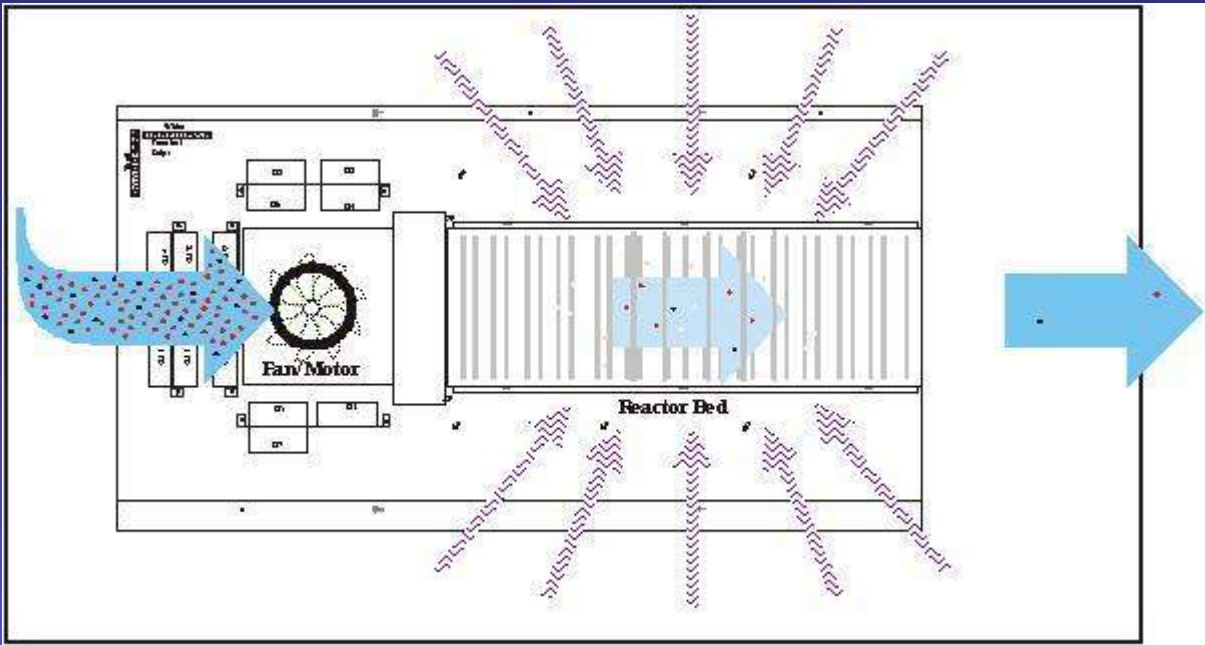


AiroCide™



**FROM OUTER SPACE
TO THE HUMAN RACE**





Sunpentown SF609 Portable Air Cooler w/ ionizer

12°F cooler than regular fan Ionizer to purify the air
(SF-609) With remote control Use regular tap
water 10L water tank capacity Photocatalysis filter
(washable) Antibacterial water tank Germ-free water
curtain circle system Thr

Brand: Sunpentown

Item # SF609

Our Price: **\$79.00**



Genesis Air™ 2000DT Lay-In Unit



Improves Health and Productivity:

Removes Smoke and Odors

Improves Operation of HVAC Equipment

Continuous Protection (24/7)

Kills Airborne Bacteria

Reduces Carbon Monoxide (CO)

Removes pollen, mold spore, mildew, ragweed, dust mites, pet dander, and many other irritants

Photocatalytic Oxidation eliminates the need for costly HEPA and Carbon filtration. Genesis Air™ units do not produce ozone.

Special Features:

115 VAC/60 Hz; 0.60 amps

Two 36 watt UVGI Lamps with Reflectors

Airflow capacity- up to 1,500 CFM

Weight: 26 lbs.

Dimensions:

Fits 24" x 24" ceiling grid openings

US \$ 1033.00



Arquivo Editar Exibir Favoritos Ferramentas Ajuda

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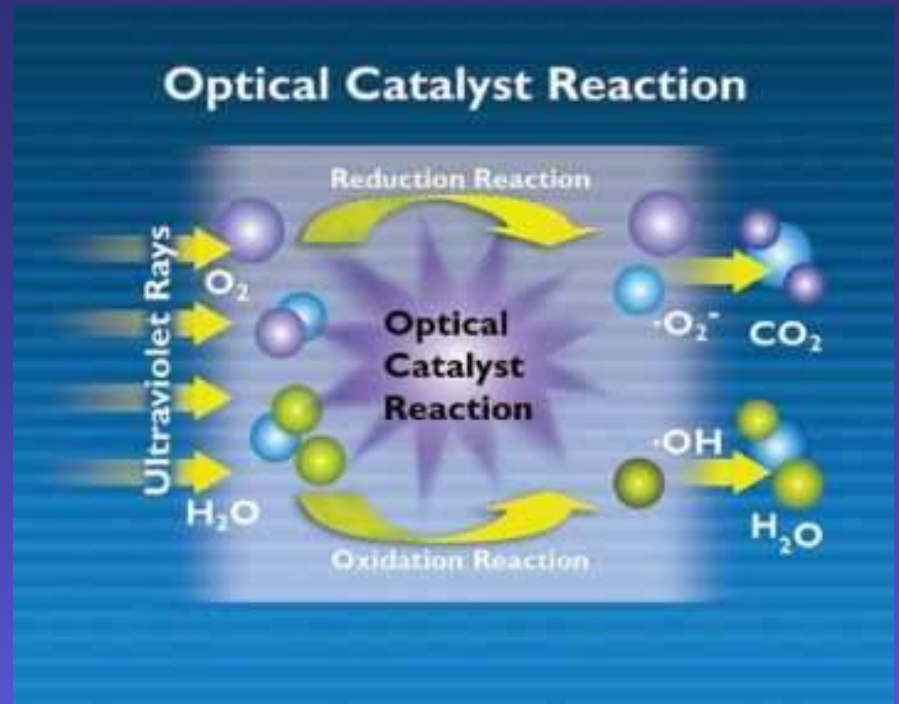
NanoBreeze™
1-877-4-Z-BREEZE

Products

How the Nanotechnology in Cleanses Indoor Air!

Nanotechnology is the design, molecules and atoms to perform

Nanotechnology involves the use



AIRLIFE Sevezh-45 Air Purifier

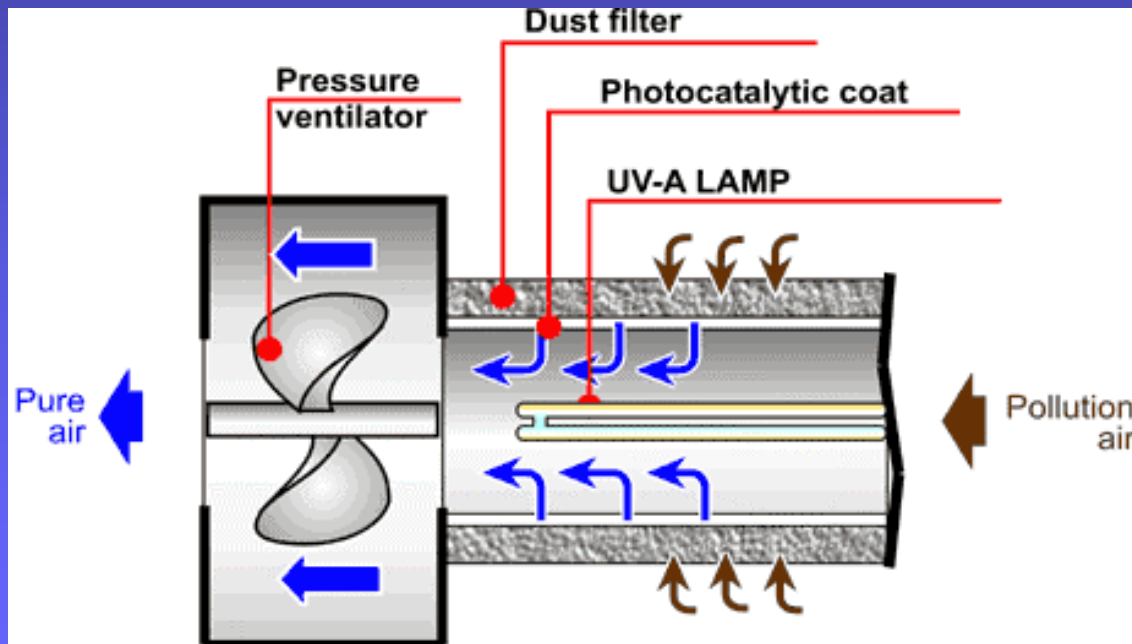
Sevezh-45



Price: **\$190.00 - 10% = \$171**

Price: **€174 - 10% = €156.6**

Price: **5301.00 rub.**



What is next?

Are we looking for a totally new machine able to perform things that we could imagine so far?

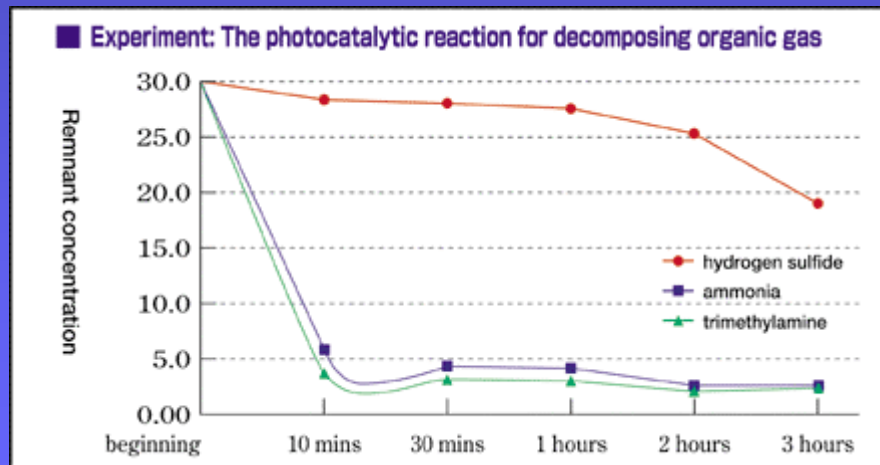


Medicine Man

Photocatalysis Sprayer System

Patent of Saga prefecture (No.2875993)
Nano-aqua-titania

Auto-sprayer for photocatalysis
Atom-titanium-jet



Type	Time
Small size	11 Mins
Middle-size	14 mins
Large-size	18 mins
Van	22 mins

The inside of the car should be cleaned at first. The dust and dirt will make half the result





Time for apartment (Height 2.7m)

Area	Time
10M2 (6tatami)	80 mins
13M2 (8tatami)	105 mins
20M2 (12tatami)	150 mins

Besides the time we show in the table, another 25 mins/10 M2 is needed in order to get a better result

To conclude:

Apparently it is much more fun to destroy flying animals than the ones that are good divers! Just check the number of patents!

Despite the help we got from nanotech, there has been a growing concern on how these material behave once they are disposed in the environment

According to the NSF, major uses expected for nanoparticles are:

(1) Energy storage, production & conversion

(2) Agricultural productivity enhancement

(3) Water Treatment & Remediation

Should we start looking for picofilters?

Muito Obrigado

Muchas Gracias

Thank You