OxyCat

A Green Chemistry Solution
For Indoor Air Environmental Quality

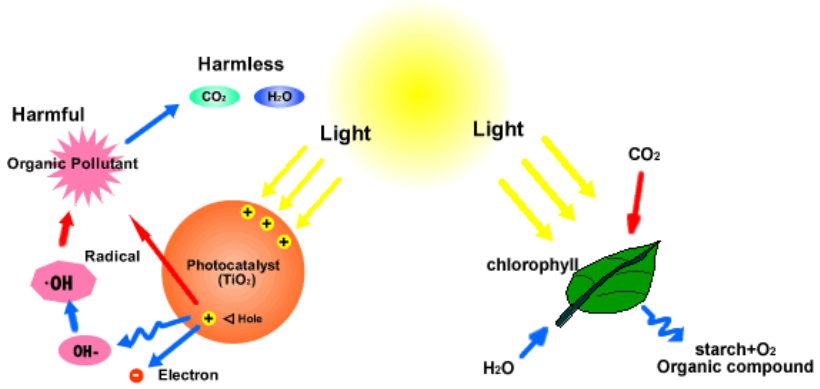
TECHNICAL OVERVIEW

THE FUNDAMENTAL CONCEPTS OF PHOTOCATALYSIS

The word photocatalysis is a composite word which is composed of two parts, “photo” and “catalysis”. Catalysis is the process where a substance participates in modifying the rate of a chemical transformation of the reactants without being altered or consumed in the end. This substance is known as the catalyst which increases the rate of a reaction by reducing the activation energy.

Generally speaking, photocatalysis is a reaction which uses light to activate a substance which modifies the rate of a chemical reaction without being involved itself. And the photocatalyst is the substance which can modify the rate of chemical reaction using light irradiation.

Chlorophyll of plants is a typical natural photocatalyst. Let’s look at the difference between chlorophyll photocatalyst to our nano OxyCat photocatalyst. Usually chlorophyll captures sunlight to turn water and carbon dioxide into oxygen and glucose, but on the contrary, our OxyCat photocatalyst creates a strong oxidation agent and electronic holes to breakdown the organic matter to carbon dioxide and water:

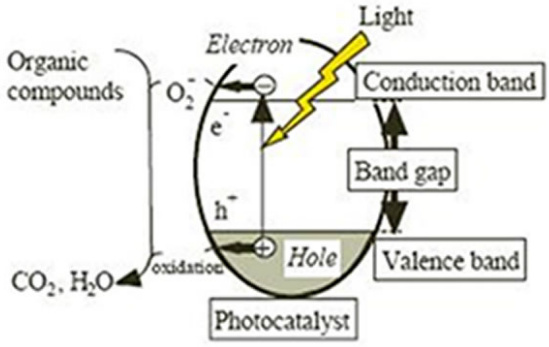


AIR STERILIZATION WITH OXYCAT NANOTECHNOLOGY

Nanotechnology refers to a field of applied science and technology; the control of matter on the molecular level in scales smaller than 1 micrometer, normally 1 to 100 nanometers, and the fabrication of devices within that size range. One nanometer (nm) is one billionth of a meter. For comparison, typical carbon-carbon bond lengths, or the spacing between these atoms in a molecule, are in the range .12-.15 nm, and a DNA double-helix has a diameter around 2 nm. On the other hand, the smallest cellular life forms, the bacteria of the genus Mycoplasma, are around 200 nm. To put that scale in context, the comparative size of a nanometer to a meter is the same as that of a marble to the size of the earth. One nanometer is quite small.

Nanotechnology is a highly multidisciplinary field, drawing from fields such as applied physics, materials science, colloidal science, device physics, supra molecular chemistry, and even mechanical and electrical engineering. Nanotechnology can be seen as an extension of existing sciences into the nano scale, or as a recasting of existing sciences using a newer, more modern term. Examples of nanotechnology in modern use are suntan lotion, cosmetics, functional coatings, food color, air purification and stain resistant clothing.

THE OXYCAT PHOTOCATALYSIS MECHANISM



When the OxyCat photocatalyst absorbs Ultraviolet (UV) radiation from our UV light source it will produce pairs of electrons and holes. The electron of the valence band of OxyCat's Titania formula becomes excited when illuminated by the UV light. The excess energy of this excited electron promotes the electron to the conduction band of titanium dioxide therefore creating the negative-electron (e-) and positive-hole (h+) pair. This stage is referred as the semiconductor's photo-excitation state. The positive-hole of titanium dioxide breaks apart the water molecule to form hydrogen gas and hydroxyl radical. The negative-electron reacts with oxygen molecules to form a compound containing oxygen atoms.

TECHNICAL BACKGROUND – ANTI - BACTERIAL

The formula of OxyCat is internationally recognized as one of the new sterilization materials, which can kill almost all kinds of bacteria including avian flu and SARS. It can be widely used in places with high sterilization demanding hospitals, institutions, schools etc. The OxyCat Photocatalyst has strong destructive effect on almost all kinds of bacteria under the irradiation of light, which can be maintained for a very long time to decompose bacteria, its body and the exdo toxin. In addition, this photocatalyst can wipe out the indoor allergen to reduce the incidence of respiratory diseases.

THE STERILIZATION MECHANISM OF OXYCAT

OxyCat's Titania has no toxicity to a microbe or cell. In other words, it is a non-toxic substance. Ever wonder how they made chocolate the color white? Titania is a main ingredient. You probably already ate Titania. It's also the main ingredient in suntan lotion.
It processes the air sterilization function only after being irradiated by UV light. In the presence of the UV light, the very strong oxidizing power of OxyCat can destroy a bacteria cell wall and membrane, and react with this cell component, which inhibits the bacteria's activity and ultimately results in the death and decomposition of bacteria.

The sterilization process of the OxyCat photocatalyst presents biochemical mechanisms:

1. OxyCat irradiated by light directly reacts with cells

The electron-hole can directly react with the cell wall, cell membrane and cell component. In the sterilizing process of microzyme and bacilli the respiration of the cell is caused to stop and finally results in its death.

2. Indirect sterilization reaction

The electron hole dissolves in water which will generate active oxygen such as hydroxyl radical. The electronic structure of titanium dioxide is characterized by filled valence band (VB) and empty conduction band (CB). The band gap energy is excited and an electron is promoted from the valence band (VB) to the conduction band (CB). Then an electron-hole pair is generated (electron e- and hole h+).

COMPARISON OF ANTI – BACTERIAL ANTICEPTICS

The traditional antiseptics and OxyCat, the new antiseptic:

- Inorganic antiseptic
- Organic antiseptic
- Natural antiseptic

INORGANIC: There are two kinds of inorganic antiseptics, one uses strong oxidant ability to kill bacteria and fungus; the other is by means of metal ion that can effectively kill germs. However the antiseptics themselves, like chlorine and chlorine oxide, are bad for human health. The metal ion antiseptics can't continue to decompose the germ body after killing them. Thus the germ body coats the metal ion, which greatly affects its anti-bacterial efficiency.

ORGANIC: The organic antiseptics compounded by scientific chemical methods usually kill germs quickly, but the germ can adapt itself to organic antiseptics easily. Meanwhile the sterilization brings toxic substances.

OXYCAT: The OxyCat photocatalyst, when exposed to UV light, offers a wide range of sterilization, a high and everlasting effect, decomposition of germ bodies and endotoxins, it's safe, reverses pollution, and harmless to human beings.

Notes: Coming in 2008-2009, a combination of OxyCat's formula with a new formulation of nanotechnology, allowing an OxyCat air purifier which can work without any UV light.

OXYCAT FOR ENVIRONMENTAL PURIFICATION

Environmental air pollution has become a global problem. More and more air is being polluted. Finding the way to purify our environment efficiently has become a hot topic in scientific research.

The OxyCat technology is considered to be a potential high efficient environmental purification technology. In 1976, scientist found that the pollutant biphenyl and biphenyl oxide can be easily decomposed by a photocatalyst. This discovery has lead to a new environmental purification research trend. The advantage of OxyCat technology is its deep purification reaction ability.
Even under room temperature, OxyCat technology can decompose pollutants into harmless chemicals, completely and rapidly. This green technology consumes light as power, and does not require any other energy to work.

Since Photocatalytic purification does not have re-pollution risk, it has become a very promising, next generation environmental purification technology. Various researchers show that this technology can purify and destroy organic pollutants.

HIGHLIGHTS – ODOR ELIMINATION

There are two traditional odor control methods. One is to use some pleasant smell to cover the odor, such as spray deodorizers. The other is to use physical method to absorb the odor and remove it temporarily. However, OxyCat can effectively decompose the materials causing the odors and gases. OxyCat itself is a safe substance with no extra pollution. It reacts as a catalyst in the reaction so that its results remain for a long time. OxyCat is effective on most odors and it can be widely used from daily life to industry to eliminate all kinds of odor.

HIGHLIGHTS –AIR PURIFICATION

OxyCat is the next generation of air purification technology, which can treat air pollution caused by more than 85% of harmful gases such as car exhaust, NOx, formaldehyde, benzene and VOCs.
In the presence of UV light the OxyCat produces hydroxyl radicals and holes (h), which react with organic materials and harmful gases to produce water and carbon dioxide. There is no extra pollution in the whole purification process. The nano photocatalyst reacts as a catalyst in the chemical reaction so that its performance will never be consumed.

Features:

- Purify air pollutants including NOx and VOCs
- Completely (100%) mineralize harmful gases to H2O and CO2
- Environmentally friendly, non-toxic
- Organic pollutant decomposition
- Catalytic action mode, longtime performance
- Odor control and elimination
- Anti-bacterial

On the next page we show a comparison based on factual, scientific evidence, of air purification methods including the photocatalyst method and UV light without a photocatalyst. Note the difference between UV light as air purification and the photocatalyst method which uses UV light as energy. The improvement of the method of air purification is extraordinary when OxyCat is added.

Air purification technologies comparison:

	HEPA[1]	ES Filter[2]	Ozone	UV[3]	Minus-Ion	Photocatalyst
Mold	***Good***	***Normal***	***Good***	***Good***	***Normal***	***Excellent***
Germs	***Excellent***	***Normal***	***Good***	***Good***	***Normal***	***Excellent***
Virus	***Normal***	***Normal***	***Normal***	***Normal***	***Normal***	***Excellent***
Dust Mite	***Excellent***	***Good***	***Normal***	***Normal***	***Normal***	***Normal***
Toxicant	***Normal***	***Normal***	***Good***	***Good***	***Normal***	***Excellent***
Odor	***Normal***	***Normal***	***Good***	***Normal***	***Good***	***Excellent***
Smoke	***Good***	***Good***	***Good***	***Normal***	***Excellent***	***Good***
VOCs	***Normal***	***Normal***	***Good***	***Good***	***Normal***	***Excellent***
Allergen	***Good***	***Good***	***Good***	***Normal***	***Excellent***	***Excellent***

Notes: [1] *High Efficiency Particulate Air Filters*
[2] *Electrostatic Filters*
[3] *Ultraviolet*

THE ADVANCED STERILIZATION SOLUTION

The advanced formula used in OxyCat has strong effect on killing almost all kinds of bacteria and virus including SARS, H5N1 etc. The OxyCat process continues for a very long time. The OxyCat coating can thoroughly decompose bacteria & virus, their body and the endotoxins, and has a stable effect on killing new variations of the bacteria. OxyCat's photocatalyst can also eliminate cigarette smoke and pet odor, and even wipe out indoor allergen agents to reduce the incidence of respiratory disease.

Features:

- Broad-spectrum sterilization
- High performance with an everlasting effect
- Decompose germ bodies and endotoxins
- Safety, no pollution made when doing its job
- Environmentally friendly and harmless to humans

Benefits:

- Destroys nearly any bacteria and virus; meets a variety of anti-bacterial needs
- Provides deodorization and an anti-allergen feature
- Long time efficiency, no need for frequent replacement
- Control and restrain the outspread of molds, mildew and fungus
- Efficiently defend against epidemic disease in public places, such as hospitals, schools, hotels etc.
- For home, office and soon the car
- Excellent performance & no odor release like Chlorine oxide antiseptics / spray deodorizers

LABORATORY TEST RESULTS

Test 1

The test was done to determine the anti-bacterial effect of the photocatalyst formula with the lamp.
Tested by Guandong Detection Center of Microbiology (China) under GB15979-2002.

Test Organism	Irradiation using 40 watt lamp to activate the photocatalyst formula		
	The Inoculums Count of "0" hour (cfu/piece)	The Inoculums Count after "24" hour (cfu/piece)	Bactericidal rate (%)
Escherichia coli (ATCC 25922)	$3.9X10^4$	$9.0X10^2$	97.69
Staphylococcus aureus (ATCC 6538)	$6.8X10^3$	$1.1X10^2$	98.38
Pseudomonas aerugimosa (ATCC 9027)	$2.8X10^5$	84	99.97
Klesiella pneumoniae (ATCC 10031)	$2.7X10^5$	$1.5X10^3$	99.44

Test 2

This example tests the environmental anti-bacterial performance of the lamp treated by the formula.

The test is performed in a house, where lamps are set inside and the air was tested for bacteria count.

Tested by Chemical Laboratory (Malaysia) SDN BHD.

This test was based on The United States Pharmacopoeia 28. The United States Pharmacopeia is a non-profit organization based in Rockville, MD. The stated purpose of the USP is to "...promote the public health by establishing state-of-the-art standards to ensure the quality of medicines and other health care technologies." USP publishes the USP-NF (United States Pharmacopeia and National Formulary) and creates reference standards for use in testing to determine if a substance meets USP requirements. If you are interested in learning more about USP you can visit their Website at www.usp.org

Stage Marking	Results: Total Mould Count, ctu/plate [Sabouraud Dextrose Agar (25 ° C, 5 days)]
STAGE 1: TEST TAKEN WITH 4 18W LAMPS 9.30 A.M.	***19***
STAGE 2: TEST TAKEN 90 MINUTES AFTER REMOVING 2 OF THE 4 18W LAMPS 1.00 A.M.	***4***
STAGE 3: TEST TAKEN UNDER THE SAME CONDITIONS 90 MINUTES AFTER STAGE 2 TEST ENDS 12:30 A.M.	***0***

Test 3

Test Condition: According to GB15981-1995, tested by SGS, the whole process is under a no-light condition a sister to the other formula which we'll be offering in 2008/2009

Test Organism	Bacteria concentration (cfu/ml)	Sample concentration	Test times	Contact time	Survival bacteria from sample (cfu/ml)	Survival bacteria from control sample (cfu/ml)	Killing Rate %
Escherichia coli (ATCC 25922)	$1.2X10^6$	*Original*	*1*	*24h*	*<1*	$1.2X10^8$	>99.9
		Original	*2*	*24h*	*<1*	$1.1X10^8$	>99.9
		Original	*3*	*24h*	*<1*	$1.1X10^8$	>99.9
		Original	*4*	*24h*	*<1*	$1.4X10^8$	>99.9
		Original	*5*	*24h*	*<1*	$1.0X10^8$	>99.9

HIGHLIGHTS - EMPLOYER BENEFITS

Every employer has the problem of lost production. Lost production can and does cost millions of dollars annually and the main reason for lost production from employees in worker sickness. Canadian scientists published, in the Lancet Medical Journal, a study where they discovered that using UV germicidal light alone in office buildings reduced worker sickness and lost productivity by up to 20%. Here's an overview of what employers lose when a worker gets sick:

Potential Costs Associated with Employee Productivity Loss Due to Poor Air Quality

A study by the National Energy Management Institute (NEMI) estimates that the building environment can reduce productivity by 2 - 6%. Officials at an American insurance company estimate that the potential decrease in productivity could be as high as 6 - 8%. Other professionals estimate that the employee productivity loss attributable to indoor air pollutants is close to 3% and microbial contamination among employees 6%. See the next page for an example of loss.

The correlation between employee productivity loss and poor air quality can be significant:

Costs Associated with Employee Productivity Loss

Consider an office space	10,000 ft2
And a typical occupancy density of:	154 ft2 / employee
The average staffing would be (10,000/154)	65 employees
With average salary per employee (Canadian) of	$45,360
The total salary costs are approximately (65x45,360)	$3 million / year
Using an employee productivity loss potential of	7% (maybe conservative)
The productivity loss would be (0.07 x 3 million):	**$210,000 / year**

As seen in the example above, the costs associated with employee productivity loss, due to poor air quality and microbial contamination, could amount to many thousands of dollars.

HIGHLIGHTS – LANDLORD BENEFITS

Yes, believe it or not, even a building owner can benefit from indoor air quality improvement. Although you may own a building and never spend any time there at all you can still benefit financially by improving the indoor air quality. In the following example we'll take a closer look at how this works, and at how much sense it makes for any land manager to look into the indoor air environment inside their rented and leased real estate:

Potential Costs Associated with Losing a Tenant Due to Poor Air Quality

While the individual employee productivity loss is important to employers, it is not the only cost associated with poor air quality. Other costs include increased operation and maintenance costs, increased insurance costs, and even the threat of litigation. Most importantly, poor air quality could result in the possibility of tenants leaving the building if their employees are dissatisfied and production is being effected.

The costs associated with losing established tenants and attracting new tenants are compounded by the cost of vacant tenant space, renovations, refurbishment's required by a new tenant as well as various economic incentives (such as reduced rent for a specific period). Awareness of the problem within the building by other potential tenants would further compound the problem.

Quantifying the potential property management costs associated with poor air quality is difficult. The following example summarizes some of the potential costs:

Costs Associated with Losing a Tenant

Consider an office space of:	10,000 ft2
With a typical lease rate of:	$2.00 / ft2 / month
And a typical utilities cost of:	$0.25 / ft2 / month
The vacancy lost would be (1 x 10,000 x 2.0):	$20,000 / month
The unpaid utilities cost would be (1 x 10,000 x 0.25):	$2,500 / month
Estimated advertising costs to attract new tenants:	$2,000
With remodeling / refurbishment costs of:	$2 / ft2
The new tenant cost would be (2,000+2x10,000):	$22,000
The cost of lost tenant and 1-month vacancy:	**$24,500**
2-month vacancy:	**$49,000**
6-month vacancy:	**$147,000**

In the above example, even the short-term costs can amount to thousands of dollars.

Make the best use of OxyCat, a modern, proven technology, in your own life. Learn how to protect the health and well-being of your family and friends, your business and customers, and yourself, and then do it.