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TMiRob
Intelligent Disinfection Robot
Product White Paper

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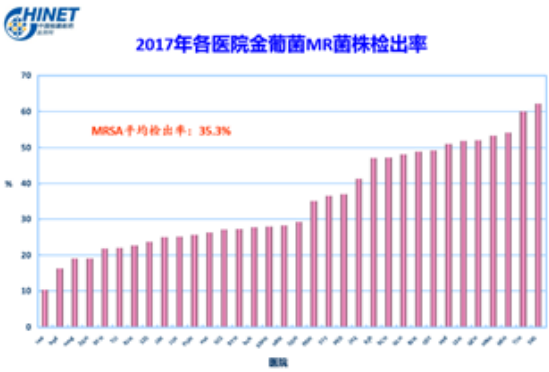
contents

chapter 1Introduction

Disinfection is the core and foundation of hospital infection management and control. At present, the disinfection of hospital object surface mainly includes manual wiping and ultraviolet irradiation. It is difficult to guarantee the quality of manual wiping. At the same time, Aldehydes disinfectants, Chlorine-containing disinfectants, Peroxyacetic acid and other disinfectants have strong irritating and is harmful to human body. There are occupational injuriestodisinfection operators. Ultraviolet disinfection also needs manual movement and operation, and has the limitation of too short irradiation distance, and the sterilization range is within 1 meter. At the same time, ultraviolet cannot reach the back of an object, resulting in poor disinfection effect and a lot of disinfection dead corners. The air disinfection of medical institutions mainly adopts laminar system,

O3 sterilizer and other disinfection equipment, but they are expensive and cannot be shared in different places. So these devices are difficult to install in large quantities.

In recent years, with the widespread use of hormones, immunosuppressant and broad-spectrum antibiotics, a large number of multidrug-resistant bacteria and super bacteria have emerged, which has led to the global hospital infection rate and hospital infection accidents increasing year by year. According to the Centers for Disease Control and Prevention report, there are 2 million hospital infections every year

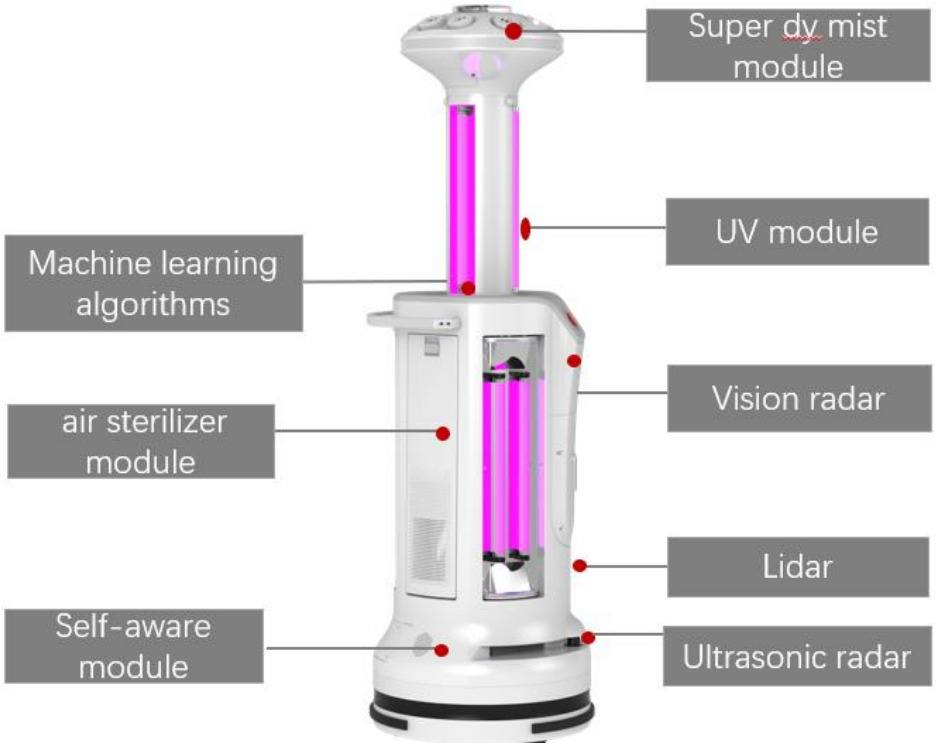


in the United States, with an economic loss of up to $7.5 billion. China reports four million hospital infections a year.

chapter 2 Product Overview

TRD-01 intelligent disinfection robot is the first intelligent disinfection robot that applies artificial intelligence algorithm to the field of disinfection at home and abroad, and integrates a variety of disinfection and sterilization methods. With the mobile robot platform as the carrier, the intelligent disinfection robot is equipped with three disinfection modules: ultraviolet, ultra-dry fog hydrogen peroxide generator and plasma air purification, which can meet the disinfection requirements of multiple environments in the hospital, and the disinfection effect meets the requirements of technical specifications for disinfection of medical institutions.

Disinfection robot consists of omnidirectional mobile chassis, hydrogen peroxide dry fog generator, ultraviolet lamp, charging spot, panel, etc.



2.1 product model

According to different needs, TMI robot high technology corps. has launched different configurations and models of intelligent disinfection robots to meet customer needs if possible.

Product model and name	Disinfection ability (spore)	Disinfectant	Product Brief
TRD-01hydrogen peroxideEnhanced Edition	6log	35%hydrogen peroxide 7.5%hydrogen peroxide Hypochloric acid	Using hydrogen peroxide as disinfectant to realize fast and high level disinfection without dead angle Use hypochlorite as disinfectant to realize air disinfection and human-machine co-existence Equipped with hydrogen peroxide, temperature, humidity, PM2.5 sensors for precise control
TRD-01hydrogen peroxideStandard Edition	6log	35% hydrogen peroxide 7.5% hydrogen peroxide Hypochloric acid	Using hydrogen peroxide as disinfectant to realize fast and high level disinfection without dead angle Use hypochlorite as disinfectant to realize air disinfection and human-machine co-existence No sensor, suitable for the scene with fixed disinfection process and low control requirements
TRD-02 UV verson	6log	/	Only install UV lamps, with the help of autonomous mobile robot platform, realize 360-degree surround disinfection and minimize dead angle of UV irradiation

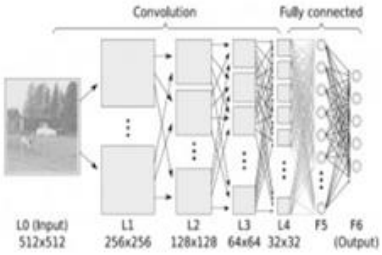
2.2 Key Technologies

TMI intelligent disinfection robot applies a variety of cutting-edge artificial intelligence algorithms to the traditional disinfection field, so as to realize the automatic and intelligent completion of disinfection in the complex environment of the hospital, achieve the expected disinfection level and enhance the level of the hospital infection control management.

2.2.1 Scene and personnel recognition based on machine vision

Machine vision is a branch of artificial intelligence which is developing rapidly. It uses machine instead of human eye to measure and judge object. The machine vision system converts the object to image signal through image capturing device, and transmits it to the special image processing system to obtain the shape information of the object, and transforms it into digital signal according to the pixel distribution, brightness, color and other information. The image system extracts the features of the target by various operations on these signals, and then controls the field equipment

actions according to the results of the discrimination. Machine vision mainly uses computer to simulate human visual function, extracts information from the image of objective things, processes and understands it with depth learning algorithm, and finally uses it in actual detection, measurement and control.



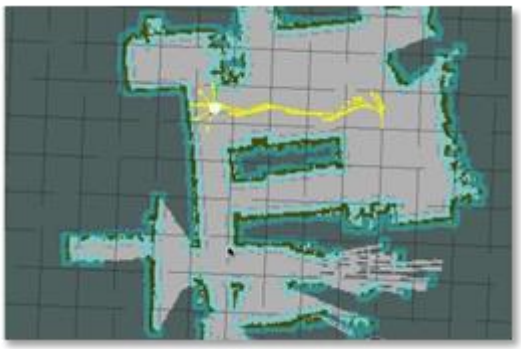
Through the vision sensor and image recognition algorithm, the TMI intelligent disinfection robot can identify the target disinfection department, key disinfection targets and surrounding personnel, and adopt the corresponding disinfection mode:

- After automatic identification of the environment to be disinfected, different disinfection plans and methods shall be adopted according to the different environment and required cleanliness, such as high-level disinfection in the operating room, medium level disinfection in the auxiliary room of the operating room, multi-point ultraviolet disinfection in the outpatient area, etc
- For the identified key disinfection targets, such as operating table, cabinet, etc., targeted disinfection measures shall be taken, such as proximity disinfection, local enhanced disinfection, surrounding UV irradiation, etc.

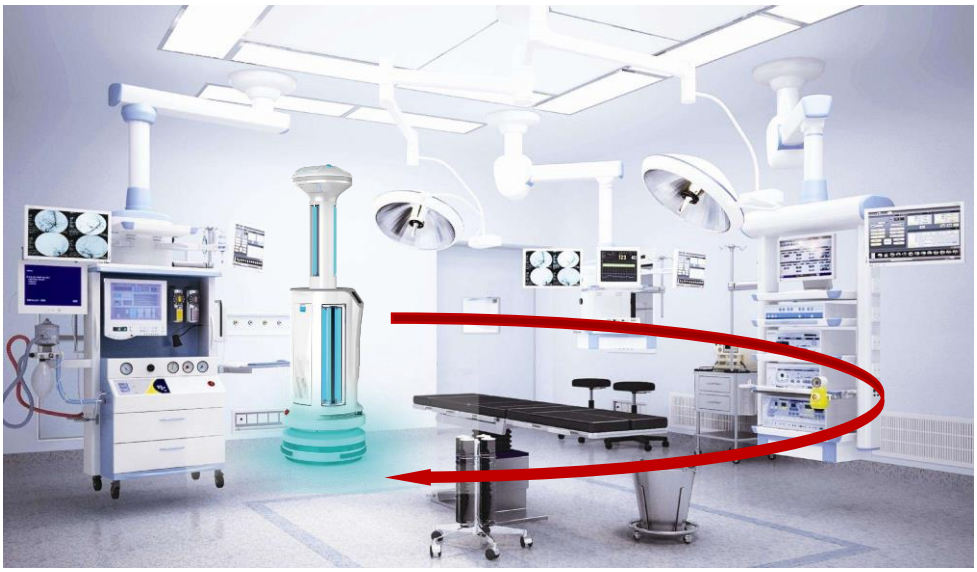
- The robot can detect the safety situation of the personnel in the operation area, except for voice and light to remind the personnel to evacuate before disinfection. The robot will scan around the site. If any personnel are found stranded, the start time of disinfection will be postponed until the personnel leave the site. In the process of disinfection, if someone breaks in suddenly, the robot will stop

disinfection by ultraviolet or hydrogen peroxide, and give voice prompt to ensure the safety of personnel in the process of disinfection.

2.2.2 High independence of robot platform based on autonomous mobile path planning



The hospital scene is complex, changeable and narrow. TMI-VSLAM technology is used to integrate multimodal sensors, including high-precision radar, real-sense depth of field camera and ultrasonic radar, to construct and locate the map in real time, and to make dynamic global and local path planning. Based on the segmentation of RGBD data and the obstacle recognition algorithm, using the data stream of RGBD image to find the optimal segmentation of RGBD image, greatly improving the navigation accuracy, obstacle recognition and independent working ability. The multi robot scheduling system can efficiently and orderly coordinate the task allocation, robots scheduling, multi robot path planning and other aspects.



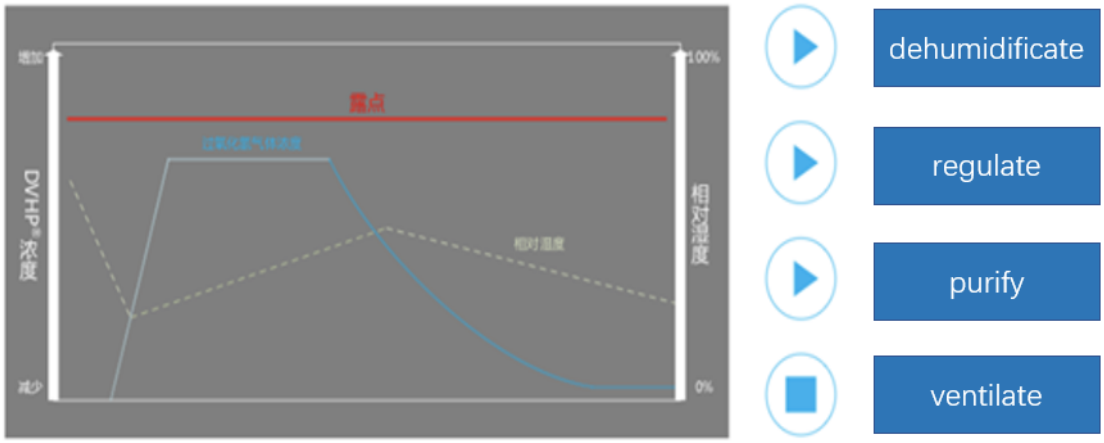
After the robot arrives at the disinfection operation area, through machine vision and image recognition technology, it can identify the key disinfection target, take the disinfection target as the center, and carry out 360 degree disinfection around without dead angle.

For some large open spaces, such as the outpatient hall, the robot can divide the global space into several local spaces and carry out multi-point disinfection to ensure that there is no dead angle for disinfection.

2.2.3 Process control and disinfection cycle based on multi-sensor closed-loop feedback

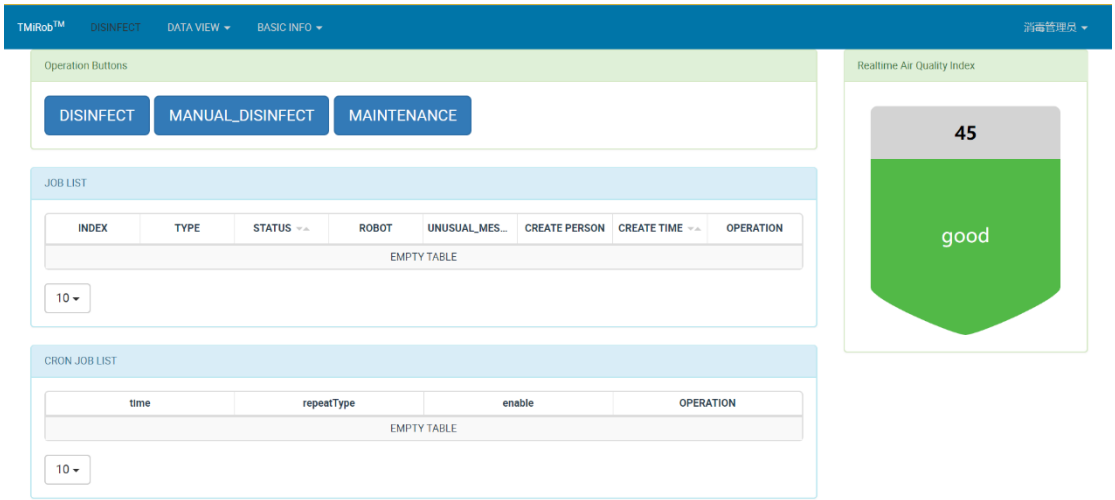
In order to achieve stable and consistent disinfection results, the robot uses its own integrated multiple sensors to collect environmental information, including ATI hydrogen peroxide gas concentration monitoring probe, PM2.5, temperature and humidity sensors, to reflect the environmental characteristics completely and accurately,

and take corresponding auxiliary measures to ensure the quality and speed of disinfection. It includes the following aspects:



- Humidity sensing and control before disinfection: humidity affects the disinfection effect of dry fog hydrogen peroxide, and has a direct impact on the degree of condensation on the surface, and then has a certain impact on the corrosiveness of metals, so it is necessary to measure and control the humidity in the disinfection environment. The robot is equipped with dehumidification device and desiccant. If the relative humidity is too high (> 90%), the robot will start the dehumidification device to reduce the humidity in the air to about 50%.When the humidity reaches the requirement, the robot starts the hydrogen peroxide module to generate hydrogen peroxide dry fog for disinfection.
- Air dust particle number control: the number of dust in the air not only affects the air disinfection effect, but also affects the disinfection effect of dry fog hydrogen peroxide. In the hydrogen peroxide dry fog, the air dust will become concretion, which will cause the hydrogen peroxide dry fog to condense into coarse fog, so as to reduce the concentration of hydrogen peroxide in the air, the dispersion of dry fog, improve the risk of surface condensation and metal corrosion. The robot is equipped with pm2.5 sensor and 10000 level air filter module. Before the disinfection work, the robot starts the sensor to measure the number of dust particles in the air is too high. If the number of particles is too high, the robot starts

the 10000 level air filter module to filter the dust in the air until it meets the requirements (below), then starts the hydrogen peroxide dry fog generation module to start the disinfection work.



- Real time air hydrogen peroxide concentration detection: after starting the hydrogen peroxide dry fog generator, the robot uses the hydrogen peroxide concentration sensor to detect the hydrogen peroxide concentration in the air in real time. When the concentration reaches the sterilization concentration, the robot works intermittently to maintain the sterilization concentration until the desired disinfection effect is achieved in the area. In this way, the quality of disinfection can be guaranteed, the amount of hydrogen peroxide can be accurately controlled, and the waiting time of digestion after disinfection can be shortened. In addition, in the digestion waiting stage after disinfection, the robot can continuously monitor the decrease of concentration. Once the concentration reaches the safe concentration of the personnel, the robot will prompt the personnel with voice and light at the first time, and the area is safe, so as to avoid unnecessary waiting time and improve the utilization rate of the room.

2.2.4 Combined disinfection method

The disinfection machine uses 35% or 7.5% hydrogen peroxide disinfectant, together with ultraviolet lamp as the main sterilization factor. This sterilizer has many working modes: mode 1: 35% or 7.5% hydrogen peroxide solution cooperating with

UV sterilization; mode 2: single UV sterilization; mode 3: hypochlorite ultra-dry fog mode sterilization; mode 4: plasma air purification.

2.2.4.1 Super dry fog hydrogen peroxide

The robot head is an ultra-dry fog hydrogen peroxide module (patented technology of TMI high-tech corp.).The oscillator in the atomization generation circuit outputs high-frequency electric energy, excites the crystal transducer to convert it into ultrasonic energy, which makes the disinfectant spray out as tiny droplets, and the generated droplets are small and uniform (3 μ m ultra-dry fog).The high-speed air flow brings the atomized droplets into the air quickly and accelerates its evaporation and ultra-dry fog atomization, forming the ultra-dry fog atomization of hydrogen peroxide in the fog state. The module is equipped with nine ultrasonic shock nozzles, which use ultrasonic energy to make the liquid form micro droplets in the gas phase, that is, ultrasonic wave is generated on the surface of the vibrating liquid, and the vibration peak formed by the amplitude separates and breaks the droplets from the surface.

Sprinkler number	9
Atomization speed	400g/h
Atomized particle size	< 3um
Reservoir capacity	1,000 ml

Outlet temperature	Normal atmospheric temperature

2.2.4.2 Low ozone ultraviolet lamp group

The disinfection robot is equipped with nine 25W Philips low ozone tubes. The irradiance intensity of a single tube is more than 90 μ w / cm2 at one meter distance, which is 6-8 times higher than that of the ordinary UV device. During operation, the lamp protection flap is opened, and the top of the robot is raised to expose the UV lamp. When the lamp is not in working state, the top will fall and the flap will be closed, so

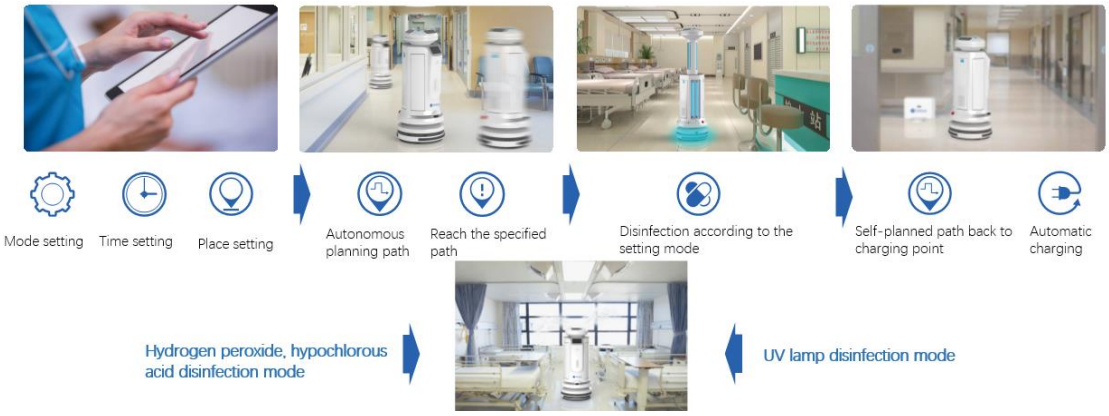
as to protect the lamp from damage, and at the same time, it is easy to keep the lamp clean.

UV wavelength	253.7nm
Ultraviolet lamp	3 in the upper layer and 6 in the lower layer
power	Single lamp power 25W
Irradiation intensity at one meter distance	More than 90 uW/cm2

2.2.4 Plasma air purification module

Two sets of plasma air purification modules are installed on the side of the robot. The module can provide plasma air disinfection and air purification.PM2.5 filter module is placed in the 10,000-level filter and can be replaced.

2.3 Typical operation process



In a disinfection cycle, the sterilizer includes four stages: disinfection prediction stage; (germicidal factor) concentration rise stage; (germicidal factor) maintenance stage; decomposition stage. In the disinfection prediction stage, the disinfection robot automatically calculates the expected dosage and the expected time of each stage through the space size of the target space, the current ambient temperature and humidity, and the preset disinfection level. In the phase of concentration rising, the disinfection robot monitors the concentration of hydrogen peroxide in the room at any time through

the hydrogen peroxide concentration probe, and makes fine adjustment to the actual use of sterilization. Adjust the dosage of disinfectant or the duration of maintenance stage through ppm value feedback to ensure the desired disinfection level. The disinfection robot synchronously monitors the PM2.5 level in the room, and controls the quantity and condensation of hydrogen peroxide particles in the disinfection process through this level, so as to ensure the minimum corrosion to valuables and electronic components in the disinfection space.

2.4 Single room disinfection

According to the size of the room, the disinfection robot will prejudge the specific disinfection needs of the target space before performing each disinfection task. The main considerations for single room sterilization include disinfection level, disinfection mode, required amount of hydrogen peroxide (for example, 35% hydrogen peroxide used for high-level disinfection 6g / m3), and the required disinfection factor diffusion time , The disinfection factor maintenance time, the current remaining liquid volume of the disinfectant reservoir, the dual mode or single mode power consumption per hour, the current battery level, etc.

Spray volume g/h	**400**		**Stock solution**		**1L**
Technical Parameters	**Dosage**	**m3/h**	**m2 (2.8meters)**	**1L/m2**	**applicable scene**
35% hydrogen peroxide high-level disinfection	6	67	24	60	Operating room, ward, ICU terminal disinfection
35% hydrogen peroxide mid-level disinfection	3	133	48	120	Operating room, ward, ICU terminal disinfection
35% hydrogen peroxide low-level disinfection	2	200	71	180	Outpatient emergency department, ward preventative disinfection
35% hydrogen peroxide air	2	200	71	180	Outpatient emergency department, ward preventative disinfection
7.5% hydrogen peroxide high-level disinfection	9	44	16	40	Operating room, ward, ICU terminal disinfection
7.5% hydrogen peroxide mid-level disinfection	6	67	24	60	Operating room, ward, ICU terminal disinfection

7.5% hydrogen peroxide low-level disinfection	3	133	48	120	Outpatient emergency department, ward preventative disinfection
7.5% hydrogen peroxide air	3	133	48	120	Outpatient emergency department, ward preventative disinfection
150mg / L hypochlorous acid high-level disinfection	9	44	16	40	Operating room, ward, ICU terminal disinfection
150mg / L hypochlorous acid mid-level disinfection	6	67	24	60	Operating room, ward, ICU terminal disinfection
150mg / L hypochlorous acid low-level disinfection	3	133	48	119	Outpatient emergency department, ward preventative disinfection
150mg / L hypochlorous acid air disinfection	3	133	48	119	Outpatient emergency department, ward preventative disinfection

Take a 35-square-meter operating room (capacity of about 105 cubic meters) as an example:

Laminar flow	**Disinfection level**	**H2O2 concentration**	**Time required (minutes)**	**Time required (hours)**	**Charging times**	**Total charging time (hours)**
Laminar free flow	High level disinfection (dual mode)	35%	69	1	0	0
		7.50%	140	2	0	0
	Medium level disinfection (dual mode)	35%	35	1	0	0
		7.50%	70	1	0	0
	Low level disinfection (single UV)	nothing	4	0	0	0
Laminar flow	High level disinfection (dual mode)	35%	140	2	0	0
		7.5% (not recommended)	279	5	0	0
	Medium level disinfection (dual mode)	35%	70	1	0	0
		7.50%	140	2	0	0
	Lowlevel disinfection (single UV)	nothing	4	0	0	0

Large space ICU ward, taking a 70 square meter ICU as an example (about 210 cubic meters)

2.5 Multi room continuous disinfection

Laminar flow	Disinfection level	H2O2 concentration	Required time (minutes)	Required time (hour)	Charging times	Total charging time (hours)
Laminar free flow	High level disinfection (dual mode)	35%	139	2	0	0
		7.50%	279	5	0	0
	Medium level disinfection (dual mode)	35%	69	1	0	0
		7.50%	140	2	0	0
	Low level disinfection (single UV)	/	7	0	0	0
Laminar flow	High level disinfection (dual mode)	35%	279	5	0	0
	Medium level disinfection (dual mode)	35%	140	2	0	0
		7.50%	279	5	0	0
	Low level disinfection (single UV)	/	7	0	0	0

Whether it is ICU(intensive care unit), infectious ward or outpatient hall, it is always a big problem to achieve good disinfection effect and consider the timely transfer of ward. The robot fully considers the practical needs of clinical practice, and makes a detailed plan for the application of unattended night as a continuous disinfection scene in multiple wards. Take a large standard operating room as an example (35 square meters, 105 cubic meters):

High level disinfection (emergency)

Medium level disinfection (daily)

Disinfection related parameters are as follows:

Liters (35%)	project	High level disinfection	Medium level disinfection
1 L	Number of operating rooms (one time)	3 rooms	6 roooms
	Time consuming (leaving after spraying)	3 hours	6 hours

	8:00pm-8:00am at night	9rooms,2 times charging , 2 Cans.	11 rooms,1 times charging, 1 cans.

2.6 Man machine co-existence mode disinfection

2.6.1 Ultra dry fog hypochlorite disinfection

It is not convenient to use dry fog hydrogen peroxide for disinfection in areas where it is difficult to clear the site, such as ICU and ward, because of the harm of hydrogen peroxide to human body.For such places, hypochlorite version can be used to disinfect the robot. Hypochlorite is one of the efficient **disinfectants**. In the actual experiment, it can kill the spores of Bacillus subtilis in three logarithms, but it takes more time and dosage than that of hydrogen peroxide in dry fog. Considering the human safety of its use, it is recommended to use for such scenes.

Liter (120mg / L Hypochloric acid	project	High level disinfection	Medium level disinfection
1L	Number of operating rooms (one time)	3 rooms	6 room
	Time consuming (leaving after spraying)	3 hour	6 hour
	8PM-8AM	9 room, 2 times charging, 2 cans.	11 room,1 time charging, 1 cans.
2 L	Number of operating rooms (one time)	6 room	12 room
	Time (hours)	6 hour	12 hour
	8PM-8AM	11room,1 time charging, 1 Cans.	12rooms,non-charging, 0 Cans.

2.6.2 UV screen with antibacterial coating

TMI intelligent disinfection robot is equipped with UV partition screen. For some places that can only be disinfected by ultraviolet radiation, such as multi room ward, ICU room, etc., ultraviolet screen can be used for shielding. Screen with antibacterial coating, beautiful appearance, and small space occupation.

2.7 Interfacing the disinfection record report with the system

The disinfection robot provides a traceable disinfection record report, which can be randomly checked to monitor the disinfection effect of the target space at any time. The robot can interface with the hospital's quality control system, upload disinfection data, or interface with the hand anesthesia system to obtain surgical scheduling information and operation type information, so as to arrange the robot's disinfection operation more reasonably and efficiently.

2.8 Consumables and replacement

Consumables	Unit	Replacement cycle
Philips UV Lamp	Set (9 pieces)	Replace once every year (according to the sense of hospitality)
Sprinkler	Set (9 pieces)	Replaced in groups of three months. The replacement nozzles can be recycled.
Ten thousand special filters	Set	Replace every three months

2.9 Features

- For air and surface disinfection
- High-level disinfection that meets the requirements of Medical Institution Disinfection Technical Specifications
- Taking autonomous mobile host as the carrier, comprehensive hydrogen peroxide dry mist disinfection, ultraviolet disinfection and air purification
- With autonomous navigation technology, can move autonomously according to the set route
- Meet the needs of automatic, regular and accurate disinfection
- Disinfection time can be set according to different scenarios as required, intelligent operation interface, easy to operate
- Quantitative management of disinfection process to improve the quality of sensory management in the hospital
- Full intelligent operation, human-machine separation to ensure personnel safety

- Large flow, porous, and strengthened air outlet design to promote the rapid diffusion of hydrogen peroxide dry mist
- Less residue, the final decomposition products of hydrogen peroxide are water vapor and oxygen, no toxic and side effects

2.10 Main bactericidal factors and their strengths

The sterilization factor of the disinfection robot includes two types of hydrogen peroxide, ultra-dry mist of hypochlorous acid, and 235.7nm ultraviolet light. According to different application scenarios, its use mode can be a dual mode in which two sterilization factors work together and ultraviolet light Single mode two.

Main bactericidal factor 1	**Disinfectant Ultra Dry Atomization**
Bactericidal factor strength	35% food-grade hydrogen peroxide solution, atomized at a maximum speed of 400g / h and diffused into the air. The particle size of ultra-dry mist is <3um
	7.5% food-grade hydrogen peroxide solution, atomized at a maximum speed of 400g / h and diffused into the air, the particle size of ultra-dry mist is <3um
	It is recommended that 80-200mg / L hypochlorous acid solution be atomized at a rate of 400g / h and diffused into the air. The particle size of ultra-dry mist is <3um
Main bactericidal factor 2	235.7nm UV lamp
Bactericidal factor strength	9 lamps, 25 single lamps, irradiance ≥90μW / cm2 at 1 meter vertical
Role object	Hard surface, air, fabric
Microbicide category	Bacterial spores, viruses, intestinal pathogens, pyogenic cocci

2.11 Simulated field test for hard surface disinfection

This sterilizer is used with supporting food-grade hydrogen peroxide solution (content: 35%). According to the dosage of 6ml / m3, it is evenly

distributed in a closed space of 180m3 after being atomized. It can be left for 60 minutes to achieve 6 logarithmic spore kill rate.

Matching disinfectant	See physical and chemical test report of disinfectant 2019-XD-055
Active ingredient content	35% （31.5%～38.5% w/w%）
PH	2～5
Expiration date	One year
Storage conditions	Protect from light and heat, store at room temperature

2.12 Real-time monitoring of hydrogen peroxide concentration

The disinfection robot is equipped with a real-time monitoring probe for hydrogen peroxide concentration. When using this sterilizer for sterilization, the dry hydrogen peroxide concentration in the sterilized space can be monitored in real time to ensure that the dry hydrogen peroxide concentration meets the disinfection requirements.

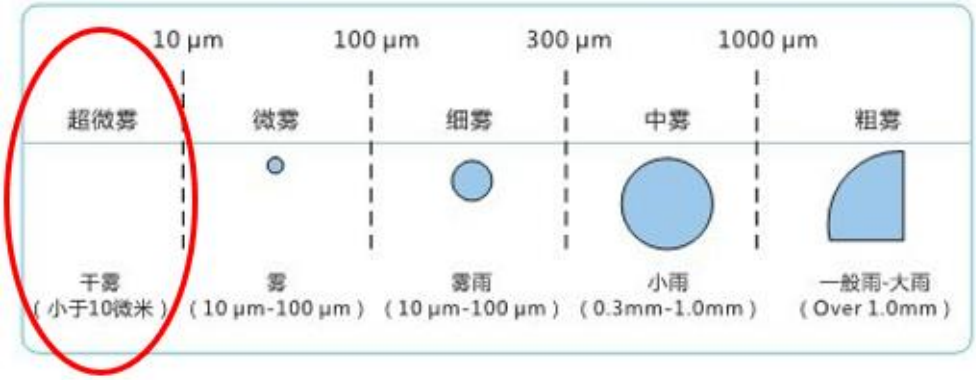
You can choose a handheld gas pump type hydrogen peroxide gas detector with a range of 0-2,000ppm, such as the American ATI brand Portasens II C16 type hydrogen peroxide gas detector for real-time monitoring of the disinfection process.

2.13 Monitoring and Tips for Residual Hydrogen Peroxide

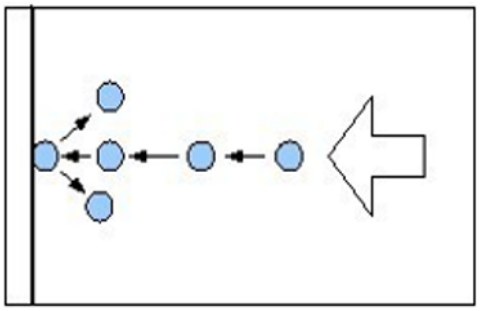
After disinfection, the residual amount of hydrogen peroxide in the disinfection space shall comply with the requirements of GBZ 2.1-2007 through air conditioning, exhaust fans, natural ventilation, and catalytic decomposition, that is, the allowable concentration of 1.5mg / m3 for 8h time. The disinfection robot uses its own hydrogen peroxide concentration probe to monitor the hydrogen peroxide concentration in the air after disinfection, and displays a red light reminder. When the residual concentration of hydrogen peroxide gas in the sterilized space is lower than 1ppm (equivalent to 1.5mg / m3), the light on the top of the robot will prompt the operator to enter.

2.14 Corrosion test of hydrogen peroxide solution on metal

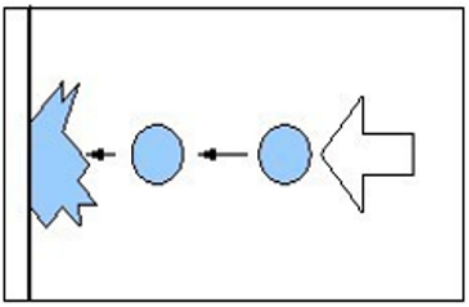
The small particles of dry hydrogen peroxide undergo irregular Brownian motion in the air and do not settle, making it very diffusive, leaving no dead angle when disinfecting. The smaller the atomized particles, the longer and longer the suspension time in the air, the more chance there is for full contact with bacteria in the air to achieve the purpose of disinfection.



The irregular Brownian motion also makes small droplet particles not aggregate together to produce large droplets, which will rebound after contacting the surface of the object without wetting the surface, thereby avoiding corrosion of the equipment.



Dry fog particles will rebound and spread after hitting the wall



Liquid particles will spatter after hitting the wall and cannot spread

Metal corrosion test report: no corrosion to stainless steel, mild corrosion to copper, moderate corrosion to aluminum. The Shuangxiong hydrogen peroxide disinfectant used with this sterilizer is basically non-corrosive to stainless steel and carbon steel, and belongs to copper Mild corrosion. Studies have shown that the hydrogen peroxide dry metal is less corrosive than the hydrogen peroxide solution.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检 验 报 告

检验受理编号 2019-XD-056

样品名称 双氧水过氧化氢消毒液

委托单位 上海钛米机器人科技有限公司

2019 年 03 月 28 日

2.15 Electrical safety and its use requirements

The electrical safety of the equipment should meet the requirements of GB 9706.1-2007.

chapter 3disinfection mechanism

3.1 Disinfection mechanism of ultra-dry fog atomized hydrogen peroxide

In recent years, with the development of the technology of ultra dry fog atomizing hydrogen peroxide, the sterilization method of ultra dry fog atomizing hydrogen peroxide has also become the method highly praised by pharmacopoeia and sterilization technical specifications of various countries, and widely used in medical and health, packaging containers, food industry, pharmaceutical manufacturing and other fields. Many studies have proved that H2O2 solution with a certain concentration can kill bacteria, fungi, viruses and spores [1-3].

Hydrogen peroxide is a strong oxidant, which can form free hydroxyl and active derivatives with strong oxidation ability. The sterilization mechanism can be divided into two categories: destroying the outer protective structure of microorganisms, changing the permeability of the protective layer, resulting in the change of cell osmotic pressure, and the death of microorganisms due to the destruction of the balance system inside and outside the body; destroying the enzymes, protein and DNA in the body of microorganisms, resulting in the death of microorganisms. The sterilization mechanism of ultra dry fog atomization of hydrogen peroxide is the same as that of liquid hydrogen peroxide, but the ultra dry fog atomization of hydrogen peroxide has better sterilization effect than that of liquid hydrogen peroxide. This is mainly because the ultra dry fog atomization of hydrogen peroxide can generate free hydroxyl and greatly enhance the contact probability with microorganisms. Therefore, the atomization of hydrogen peroxide with lower concentration is more effective than that of liquid hydrogen peroxide with higher concentration. It has higher bactericidal ability [4].

Due to the weak penetration of hydrogen peroxide gas, it is generally only suitable for disinfection of object surface or air. Hydrogen peroxide has bactericidal effect due to its redox effect, especially for anaerobic bacillus.The principle of hydrogen peroxide

is to dissociate highly active hydroxyl groups through complex chemical reactions, which are used to attack cell components, including cell membrane, lipids, proteins and DNA.In the 1980s, researchers in the United States first found that the bactericidal capacity of vapor hydrogen peroxide was more than 200 times higher than that of liquid hydrogen peroxide [5-6].That is to say, only a lower concentration of hydrogen peroxide in the vapor state can achieve the sporicidal ability of high concentration liquid hydrogen peroxide.Comparison between liquid hydrogen peroxide and atomized hydrogen peroxide:

Test organism	**D value (time required to kill 90% of Bacillus)**	
	liquid state 370mg/L 24-25℃	atomization 1-2mg/L 24-25℃
Bacillus thermophilus	1.5	1.2
Bacillus subtilis	2.0-7.3	0.5-1
Bacillus	0.8	0.5-1

Note: achieve the same sterilization effect, 300 times of the fog state when the liquid concentration is

Compared with other traditional disinfection methods, dry fog hydrogen peroxide technology has obvious advantages: fast, large space, uniform sterilization and no secondary pollution of the production products only water and oxygen [7].Traditional disinfection methods and disinfectants such as formaldehyde fumigation are not only lengthy but also very dangerous. Formaldehyde has been classified by the World Health Organization as a carcinogen to human beings. Formaldehyde disinfection in the room usually recommends 12 hours of exposure time, followed by a long exhaust and ventilation process (about 24 hours).In contrast, the hydrogen peroxide disinfection cycle in the room can be as low as 2 hours.

The traditional sterilization technology is compared with dry fog hydrogen peroxide.

Project parameters	**Formaldehyde fumigation**	**ozone**	**Dry mist hydrogen peroxide**
Concentration and dosage	40%, 4G. M-3	50~100mg·m-33·h-1	5-8%,5-10ml·m-3

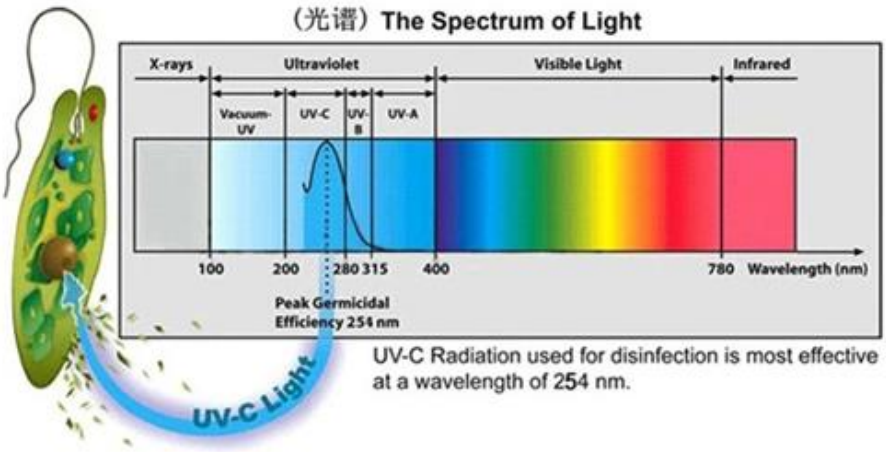
Sterilization concentration in air	5To 10 per thousand	About 0.02 per thousand.	0．05～0.1‰
Sterilization effect	Unable to completely kill 106 spores	It is difficult to achieve sporicidal effect in clean area due to fast decomposition	Completely kill 106 spores
Influence of air humidity	The higher the humidity, the better the disinfection	The higher the humidity, the better the disinfection	Humidity has little effect, Rh < 60%
Time required for sterilization	> 24h	1~ 2H	2~ 4H
Safety	Highly toxic, flammable, class a carcinogen.Steam has strong irritation to eyes, respiratory tract and skin. Concentrated solution can cause coagulative necrosis of skin.	It is irritant to human respiratory mucosa. When the ozone concentration in the air is 2-5mg · L-1, it can cause pulse acceleration, tiredness and headache. If people stay for more than 1h, they may have emphysema and die.	It is almost non-toxic and can be decomposed into water and oxygen
residue	It is difficult to decompose after sterilization and needs to be neutralized. After neutralization, there are white crystals, which are difficult to be completely removed	Automatic decomposition to oxygen without residue	Automatic decomposition into water and oxygen, no obvious residue

Compared with the wet hydrogen peroxide steam (HPV), the titanium rice dry mist hydrogen peroxide belongs to the hydrogen peroxide dry disinfection (VHP), obvious advantages:

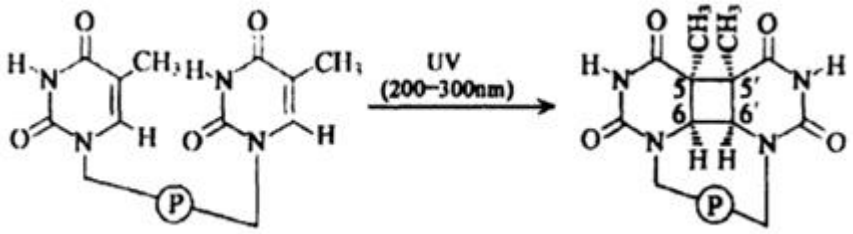
3.2 Ultraviolet

The principle of ultraviolet sterilization is to destroy the molecular structure of DNA (DNA) or RNA (RNA) in the cells of the organism by using the ultraviolet light of appropriate wavelength, resulting in the death of growth cells and / or regenerative cells, so as to achieve the effect of sterilization and disinfection.According to the wavelength range, ultraviolet light can be divided into UVA (315-400nm), UVB (280-315nm), UVC (200-280nm) and vacuum ultraviolet (100-200nm).In terms of

sterilization speed, UVC is within the range of microbial absorption peak, and can kill viruses and bacteria by destroying the DNA structure of microorganisms within 1s.



As shown in Figure 1 below, the adjacent Thymine Nucleotides in the same DNA strand generate thymine dimers under the action of short wave ultraviolet light. After the DNA absorbs UV light, the energy will be localized on the thymine in the DNA strand.This is because thymine has the lowest triplet energy level in DNA base. The base excited singlet produced after light absorption will transfer to thymine to generate the triplet excited by thymine if it undergoes spin conversion to form triplet.The triplet can react with another adjacent thymine (or cytosine C) in the same DNA chain to form cyclobutane pyrimidine dimer.The reaction between adjacent pyrimidine bases in DNA, which makes two p bonds (one for each pyrimidine base) into two R bonds, is controlled by orbital symmetry.Therefore, the ring addition of two pyrimidine bases is allowed by the orbit, and the thermal reaction is forbidden.Similarly, for the reverse reaction, the cyclobutane type product (i.e. pyrimidine dimer) cannot return to the pyrimidine base by non photochemical process (ground state thermal reaction).This damage of DNA hinders the normal replication of genes, which leads to the inactivation and death of microorganisms.



DNAGeneration of thymine dimers by the adjacent Thymine Nucleotides in the same chain

UV can kill all kinds of microorganisms, including bacteria, spores, mycobacteria, viruses, Rickettsia and mycoplasma.The surface, water and air polluted by the above microorganisms can be disinfected by ultraviolet.UV disinfection lamp generally uses 250-270nm wave band with the strongest bactericidal effect. Generally, quartz glass tube of grade is used. The UV irradiation intensity should reach the national standard (for 30W bulb, the vertical distance at 1m should be greater than 70 μ w / cm2) [8].It can be equipped with a reflector made of materials with high UV reflection coefficient (such as polished aluminum plate) to enhance the radiation intensity.

The main factors that affect the efficacy of UV disinfection are UV irradiation dose, irradiation intensity, irradiation time and penetration rate.The germicidal ability of ultraviolet lamp is closely related to the irradiance. The irradiance is inversely proportional to the distance. The closer the distance is, the stronger the germicidal ability is.Therefore, it is better to sterilize the articles to be sterilized by direct exposure.The penetration ability of ultraviolet rays is weak, which can only kill the microorganism directly exposed. Therefore, the disinfection part should be fully exposed to ultraviolet rays.Compared with ozone and other chemical disinfection methods, ultraviolet disinfection has shorter time and no secondary pollution.

3.3 Synergistic effect of ultraviolet and hydrogen peroxide on killing microorganisms

The method of photocatalytic decomposition of hydrogen peroxide by ultraviolet light is one of advanced oxidation technology (AOT).According to the different ways

of producing free radicals and reaction conditions, they can be divided into photochemical oxidation, catalytic wet oxidation, sonochemical oxidation, ozone oxidation, electrochemical oxidation, Fenton oxidation, etc.Photochemical oxidation can be divided into photo activated oxidation and photo catalytic oxidation.In this system, the photo activated oxidation method is used, that is, the photocatalytic production of hydroxyl radicals under the irradiation of UV light.Under UV irradiation, one H2O2 molecule provides two hydroxyl groups, twice as much as Fenton reagent method, and the reaction process is [9-10]:

H_2O_2/UV 过程，即 H_2O_2 和紫外光组合过程一般描述如下

过程机理： H_2O_2 + 紫外光(UV) → 2OH

$OH^- + H_2O_2 \longrightarrow H_2O + HO_2^-$

$HO_2 + H_2O_2 \longrightarrow H_2O + O_2 + OH$

$2OH \longrightarrow H_2O_2$

总反应：$2H_2O_2 \longrightarrow 2H_2O + O_2$

The results show that the synergistic effect of ultraviolet and hydrogen peroxide can greatly reduce the killing time of microorganisms under the same conditions [11-13].The synergistic effect of 35% hydrogen peroxide mist and ultraviolet light is shown in 5.2.Through repeated tests and the test report provided by the tripartite testing organization with CMA qualification, 35% hydrogen peroxide mist can reach three pairs of deserts against Bacillus subtilis spores in 70 minutes under the synergistic effect of ultraviolet light.

3.4 Plasma sterilization

The TMI intelligent disinfection robot uses the bipolar plasma electrostatic field to decompose and break down the negative bacteria, polarizes and adsorbs the dust, and then combines the pharmaceutical impregnated activated carbon, electrostatic net, photocatalyst catalytic device and other components for secondary sterilization and filtration. After treatment, the clean air circulates rapidly and a large amount, so that

the controlled environment remains in the "sterile and dust-free room" standard.The germicidal efficacy is fast and thorough, the germicidal rate of natural bacteria in the air reaches 100% in 30 minutes, and that of Escherichia coli, Staphylococcus aureus and Candida albicans reaches over 99% in 40 minutes.45 minutes after starting the machine, air settling bacteria ≤ 15 CFU / dish · 30min, floating bacteria in the air ≤ 800 / m3, and air cleanliness reaches above 300000 level (ISO9 standard), up to 100 level.It can be used in cooling, filling, packaging workshop, medical system, aseptic laboratory, etc.Plasma air purification will not cause harm to human body. It can be used completely under the condition of people. It can continuously disinfect and purify the air in the disinfection space dynamically, realize "disinfection while working", and effectively prevent the reproduction and regeneration of bacteria in the air.It can eliminate and purify toxic and harmful gases and odor in the air, and has the function of automatically increasing oxygen, and can automatically adjust the indoor air quality to the best state.

3.5 Performance comparison of similar products

The technical innovation of the disinfection robot includes the breakthrough of disinfection efficiency of main sterilization factors and the combination of traditional disinfection means and artificial intelligence technology.The breakthrough in the disinfection efficiency of the main sterilization factors is reflected in: 1. The synergistic effect of hydrogen peroxide dry fog and ultraviolet radiation on the disinfection effect is greatly enhanced; 2. The disinfection can identify the disinfection target in the space independently, and adjust the disinfection strategy independently, including multi-point irradiation, so as to maximize the disinfection efficiency.It has been nearly 40 years since the ultra dry fog atomized hydrogen peroxide disinfection technology was found in 1980 that the ultra dry fog atomized hydrogen peroxide has a bactericidal effect of 300 times that of hydrogen peroxide solution.It has been widely used in pharmaceutical production and food packaging for many years.At present, the mainstream ultra dry fog

atomization hydrogen peroxide disinfection technology includes VHP, HPV and dry fog.Compared with the former two disinfection technologies, the dry fog disinfection machine has the characteristics of low concentration, low metal corrosiveness and more flexible use on the basis of ensuring the disinfection effect, which is more suitable for the changing environment of ward, outpatient and other occasions with higher personnel safety requirements.

chapter 4 target disinfection level and working mode

4.1 High level disinfection

- *Disinfection Objective: according to the technical code for disinfection of medical institutions 2012, "high level disinfection method can kill (3-6 logarithm reduction) all kinds of microorganisms and kill bacterial spores to achieve disinfection effect.This kind of disinfection method should be able to kill all bacterial propagules (including Mycobacterium tuberculosis), viruses, fungi, their spores and most bacterial spores.Methods of this kind include: heat, electric power radiation, microwave and ultraviolet radiation, etc. and methods of disinfection with disinfection factors such as chlorine, chlorine dioxide, peracetic acid, hydrogen peroxide, brominated disinfectant, ozone, dibromohydrin and some compound disinfectants. "*
- Typical scene: operating room, hematology isolation cabin, etc
- Recommended operating mode:

  1) Start plasma air purification, purify the air and reduce the number of air dust

  2) Start the ultra dry fog hydrogen peroxide module (use 35% or 7.5% hydrogen peroxide) to increase the hydrogen peroxide concentration to the maximum in the shortest time

  3) After the concentration of hydrogen peroxide in the air reaches the maximum, start the ultraviolet lamp group and carry out two-mode disinfection

  4) For the key disinfection items or places, the robot moves close to ensure the concentration of hydrogen peroxide and the UV radiation value, and carries out 360 round enhanced disinfection

  5) When the expected disinfection time is reached, the hydrogen peroxide module stops working, and the ultraviolet module continues to work to accelerate the

decomposition of hydrogen peroxide residues until the safe concentration level is reached

- Conditions to achieve high level of disinfection:
  - The humidity of the disinfection space is below 70RH;
  - When using 35% hydrogen peroxide solution, without laminar flow and other ventilation equipment, it can be used for high-level disinfection in spaces below 200m3, and the predetermined dosage is 5-6g / m3;
  - When 7.5% hydrogen peroxide solution is used, without laminar flow and other ventilation equipment, it can be used for high-level disinfection of space below 150m3, and the predetermined dosage is 8-10g / m3;
  - 7.5% hydrogen peroxide solution is not recommended for high-level disinfection in spaces with laminar flow or other ventilation equipment.
  - Taking appropriate measures to reduce the humidity in the air or increase the temperature can speed up the high-level disinfection process;
  - For key disinfection areas, such as the desktop, bed, handle, and instrument panel that patients or healthcare workers often touch with their hands, when the hydrogen peroxide concentration reaches the highest point, open the dual mode and move the machine to the key disinfection area For example, at 100ppm, the outer diameter of the disinfection machine is within 1 meter from the disinfection target, and high-level disinfection can be achieved in 5 minutes; the outer diameter of the disinfection machine is within 3 meters from the disinfection target, and high-level disinfection can be achieved in 15 minutes; and so on, Higher PPM concentrations and closer UV exposure can be more efficient to achieve high levels of disinfection.

4.2 Medium level disinfection

- *Disinfection target: "the medium level disinfection method is a disinfection method (3-6 logarithm reduction) that can kill and remove all kinds of pathogenic microorganisms other than bacterial spores, including ultrasonic wave, iodine disinfectant (iodophor, tincture, etc.), alcohol, alcohol and chlorhexidine compound, alcohol and quaternary ammonium salt (including double chain quaternary ammonium salt) compound, phenol and other disinfectants for disinfection"*
- Typical scene: laboratory, ward, etc
- Recommended operating mode:

  1) Start plasma air purification, purify the air and reduce the number of air dust

  2) Start the ultra dry fog hydrogen peroxide module (use 35% or 7.5% concentration of hydrogen peroxide) to increase the concentration of hydrogen peroxide to the maximum in the shortest time

  3) After the concentration of hydrogen peroxide in the air reaches the maximum, start the ultraviolet lamp group and carry out two-mode disinfection

  4) For the key disinfection items or places, the robot moves close to ensure the concentration of hydrogen peroxide and the UV radiation value, and carries out 360 round enhanced disinfection

  5) When the expected disinfection time is reached, the hydrogen peroxide module stops working, and the ultraviolet module continues to work to accelerate the decomposition of hydrogen peroxide residues until the safe concentration level is reached
- Conditions to achieve medium level disinfection:
  - The humidity of the disinfection space is below 70RH;

- When using 35% hydrogen peroxide solution, without laminar flow and other ventilation equipment, it can be used for medium-level disinfection in spaces below 300m3, with a predetermined amount of 3-4g / m3;
- When using a 7.5% hydrogen peroxide solution, without laminar flow and other ventilation equipment, it can be used for medium-level disinfection in spaces below 200m3, with a predetermined dosage of 5-6g / m3;
- When using hypochlorous acid for disinfection, it can be used for fixed-point disinfection, or according to the dosage of 10-12g / m3, to achieve intermediate level disinfection;
- Taking appropriate measures to reduce the humidity in the air or increase the temperature can speed up the high-level disinfection process;
- For key disinfection areas, such as the desktop, bed, handle, and instrument panel that patients or healthcare workers often touch with their hands, when the hydrogen peroxide concentration reaches the highest point, open the dual mode and move the machine to the key disinfection area For example, at 50ppm, the outer diameter of the disinfection machine is within 1 meter from the disinfection target, and it can reach mid-level disinfection within 5 minutes; the outer diameter of the disinfection machine is within 3 meters from the disinfection target, and it can reach mid-level disinfection within 15 minutes; and so on, Higher PPM concentrations and shorter distances of UV light can reach intermediate level disinfection more efficiently.

4.3 Low level disinfection

- *Disinfection target: "low level disinfection can only kill bacterial reproduction (except Mycobacterium) and lipophilic virus chemical disinfectant, ventilation, ventilation, washing and other mechanical sterilization. Such as single chain quaternary ammonium salt disinfectant (benzalkonium bromide, etc.), biguanide*

disinfectant such as chlorhexidine, plant disinfectant and metal ion disinfectant such as mercury, silver, copper, etc

- Typical scenario: outpatient service, etc
- Recommended operating mode:

1) Start plasma air purification, purify the air and reduce the number of air dust
2) Start the UV lamp group, and divide the large area into several small areas for disinfection to minimize dead angle; for example, the outer diameter of the machine is 3 meters, which is the effective distance of UV sterilization, the machine will automatically plan the path, and stay on the path every 5-6 meters for 15 minutes, to ensure that the surface within 3 meters around the point is fully sterilized
3) For the key disinfection items or places, the robot moves close to ensure the ultraviolet radiation value, and conducts 360 degree encircling and strengthening disinfection
4) After reaching the expected disinfection time, complete the disinfection

Conditions for low level disinfection:

- Single UV light can achieve a high level of disinfection, some studies have shown that the cumulative irradiation intensity of 10000 μ w.s/cm2 can kill spores; the disinfection effect of UV light directly depends on the cumulative irradiation amount.However, the ultraviolet light penetration is weak and does not have dispersion. Under sufficient long-term irradiation, the air and local surface can achieve high or medium level disinfection, and other surfaces can achieve low or medium level disinfection,
- Taking appropriate measures to reduce the humidity in the air can accelerate the process of low-level disinfection;
- Key disinfection parts, such as tabletop, bed, handle, instrument panel, etc. that patients or medical workers often touch with their hands, can be

considered when planning the path. On the basis of comprehensive coverage, closer UV irradiation can more effectively achieve low-level disinfection.

- The robot path can be planned in advance. A disinfection point is set every 5-8 meters, and each point is sterilized for 15 minutes. The ambient air and material table can reach a low level of disinfection.

chapter 5 Effect Evaluation

5.1 Microbiological laboratory test

TMI intelligent disinfection robot has been tested by CMA qualified testing agency, and has completed the registration of disinfection products.

5.2 Ultraviolet light enhanced disinfection of hydrogen peroxide

The second group of test robots with hydrogen peroxide plus UV disinfection performed better than the first group of tests with only hydrogen peroxide. In the second group of tests, the average logarithm of killing was 1.84 after 70min disinfection; in the second group of tests, the maximum logarithm of killing was greater than 3.70 after 70min of disinfection.

距离(cm)	时间 (min)	稀释倍数				菌落数 (CFU/ml)	对数值	杀灭对数值	杀灭率
		$\times10^{-3}$		$\times10^{-4}$					
		A	B	A	B				
250	20	多不可计	多不可计	116	132	1,240,000	6.09	0.61	75.32%
250	30	92	96	8	9	94,000	4.97	1.73	98.13%
250	40	78	88	9	7	83,000	4.92	1.78	98.35%
250	50	68	75	8	6	71,500	4.85	1.85	98.58%
250	60	67	69	8	6	68,000	4.83	1.87	98.65%
250	70	67	62	5	7	64,500	4.81	1.89	98.72%

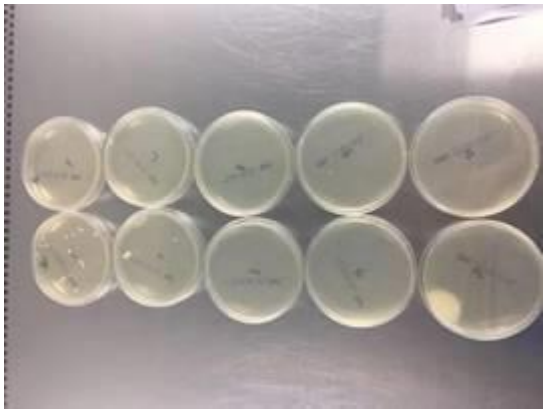
距离(cm)	时间 (min)	稀释倍数				菌落数 (CFU/ml)	对数值	杀灭对数值	杀灭率
		$\times10^{-3}$		$\times10^{-4}$					
		A	B	A	B				
250	20	22	26	1	2	24,000	4.38	2.32	99.52%
250	30	18	25	2	3	21,500	4.33	2.37	99.57%
250	40	15	19	2	1	17,000	4.23	2.47	99.66%
250	50	12	13	1	0	12,500	4.10	2.60	99.75%
250	60	6	9	1	0	7,500	3.88	2.83	99.85%
250	70	2	0	0	0	1,000	3.00	3.70	99.98%

5.3 Clinical experiment

5.3.1 Bacterial quantitative killing test

- Objective: to verify the clinical effectiveness and availability under different clinical strains
- Verified strains:
  - ✓ Bacillus subtilis black variety (representative of bacterial spores) ATCC 9372
  - ✓ Staphylococcus aureus (G + bacteria common in Hematology) ATCC 6538
  - ✓ Escherichia coli (G-bacteria common in Hematology) ATCC 8099
  - ✓ Candida albicans (a common fungus in Hematology) ATCC 10231

- ✓ Bacillus anthracis
- ✓ Clostridium gangrenosum



- Disinfection test: after the test environment is closed, put the bacterial carriers and virus carriers of different strains at 0.8m and 1.7m, and take 5 points each.Start the second generation intelligent disinfection robot for disinfection. The disinfection solution is 35% 1530456075min5ml 0.5% Na2SO4 hydrogen peroxide. Put the bacterial carrier directly into the tube containing neutralizer at,,, respectively. After full elution, collect and count the residual bacteria by pouring method.At the same time, the culture medium, diluent and neutralizer of the same batch were used as the negative control.Repeat the test 3 times.
- Effect judgment: the test was repeated 3 times, and the killing rate of all samples was ≥ 99.90% (the killing value was 3).The dose group was qualified.Killing rate = (average colony number of positive control samples - average colony number of disinfection test samples) / average colony number of positive control samples × 100%.
- Results analysis: according to the test results, determine the killing ability of intelligent disinfection robot to different pathogens, and determine the best disinfection dose.

5.3.2 Surface disinfection effect identification experiment

- Objective: to verify the clinical effectiveness and availability in different clinical departments and different microbial environments
- Clinical trial hospital:
  - ✓ Shanghai Zhongshan Hospital

✓Shanghai Renji Hospital

✓Shanghai Chest Hospital

✓Shenzhen People's Hospital

✓Shenzhen Bao'an maternal and Child Health Hospital

✓The Second Affiliated Hospital of Shanxi Medical University

5.3.3 Air disinfection effect identification experiment

- Detection of air disinfection effect by floating method

According to the selected test scenario, the disinfection effect was evaluated in the case of no one.During the observation, the natural bacteria in the air were sampled with the six stage impact air sampler before the disinfection treatment as the samples before the disinfection (positive control group).After disinfection, it is used once as the test sample (experimental group) after disinfection.

- Sampling method: the sampling method of laminar flow clean ward shall be in accordance with GB 50333, the sampler shall be placed at a height of 0.8-1.5m in the center of the room, and the operation shall be in accordance with the instructions for the use of the sampler, and the room surface method shall be in accordance with the technical code for disinfection of medical institutions (WS / t367-2012).

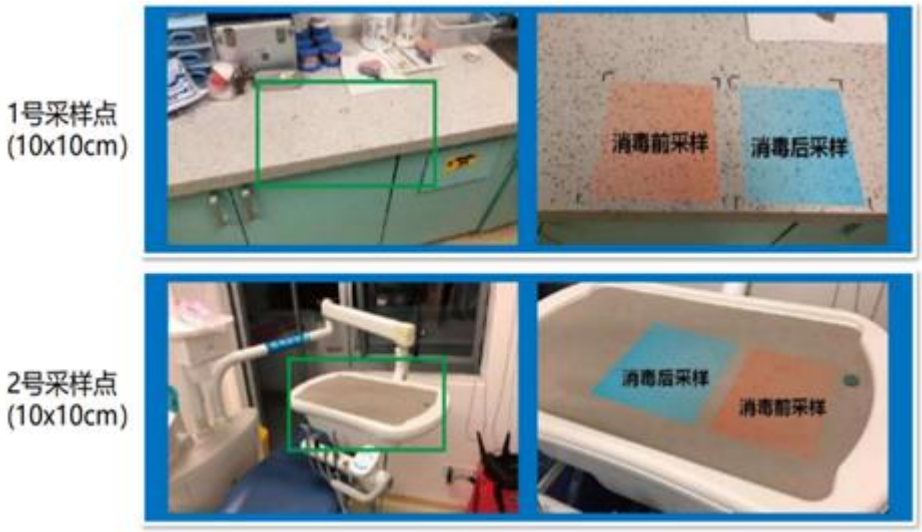
After sampling, the unused culture medium of the same batch shall be cultured with the above test samples at the same time or cultured after inoculation as a negative control.

- Calculation method: calculate the total number of colonies in the air (CFU / m3) = the sum of the colonies in each plate of the sampler (CFU) / [sampling rate (L / min) × sampling time (min)] × 1000
- Effect judgment: repeat the test 3 times, and calculate the bacterial extinction rate = (average number of bacteria in the sample before disinfection - average number of bacteria in the sample after disinfection) / average number of bacteria in the sample before disinfection × 100%.The rate of bacterial death ≥ 99.90% is qualified.

5.3.4 Comparative test of robot disinfection and manual disinfection

Test purpose: Compare the quality of robot and traditional artificial

Contrast group	Sampling point	operation
Artificial disinfection group(day one)	Sampling point A-1	Sample (material surface) and culture after the completion of resuscitation room experiment on the same day
	Sampling point A-2	Sample after normal manual disinfection (do not tell the sterilizer where to sample) and cultivate
Robot disinfection group(several days later)	Sampling point B-1	Sample (material surface) and culture after the completion of resuscitation room experiment on the same day
	Sampling point B-2	Sample after robot disinfection (do not tell the sterilizer where to sample) and cultivate



Test method:

Conclusion:Better than manual disinfection

1） In some scenes, it can achieve the disinfection effect that manual disinfection fails (the outpatient sofa is tested with Staphylococcus aureus)

2） Standardization and information hospital disinfection management

3） Improve work efficiency: less time (15-30mins) to disinfect the whole room or most of it, and can use non working time such as night to complete disinfection work by yourself

5.3.5 Data report of clinical disinfection test

Clinical trial structure	Test environment	test method	Experimental strain	Before disinfection	After disinfection	conclusion
Shanghai Renji Hospital	**Surgery or resuscitation room**	Staphylococcus on the left side of the blood gas machine, sterilized and cultured	Staphylococcus epidermidis	Staphylococcus and active	No bacterial growth	It can disinfect the surface of blood gas machine in operating room
The second hospital of Shanxi Medical University	**Neurosurgery monitoring center**	Bacteria on the surface of injection pump, machine disinfection treatment	Bacteria on the surface of objects	0cfu/cm2	0cfu/cm2	With disinfection effect
		Bacteria on the surface of the stope, machine disinfection treatment		0cfu/cm2	0cfu/cm2	
		Collect bacteria on the surface of the treatment table and sterilize it with machine		0cfu/cm2	0cfu/cm2	
		Bacteria on the surface of the bedside table, machine disinfection treatment		1cfu/cm2	0cfu/cm2	
Shenzhen Baoan maternal and Child Health Hospital	**Operating room 6**	Take a place in the operating room as the disinfection point 1, and sterilize with machine for 30min	Bacteria on the surface of objects	2cfu	Not detected	The base number of bacteria in the selected site of artificial disinfection is low, and it is close to the background after wiping; machine disinfection has effect on surface bacteria
		Take a place in the operating room as the disinfection point 2, and sterilize with machine for 30min		6cfu	Not detected	
	Operating room 7	Take a place in the operating room as the disinfection point 1, and conduct manual disinfection	Bacteria on the surface of objects	3 CFU	Not detected	
		Take a place in the operating room as the disinfection point 2. Conduct manual disinfection		1cfu	Not detected	
	Operating room 10	Take a place in the operating room as the disinfection point 1, and sterilize with machine for 30min	Bacteria on the surface of objects	> 100cfu	Not detected	The base number of bacteria in the selected site of artificial disinfection is low, and it is close to the background after wiping; machine disinfection has effect on surface bacteria
		Take a place in the operating room as the disinfection point 2, and sterilize with machine for 30min		> 100cfu	4cfu	
	Operating room 15	Take a place in the operating room as the disinfection point 1, and conduct manual disinfection	Bacteria on the surface of objects	1 CFU	Not detected	
		Take a place in the operating room as the disinfection point 2. Conduct manual disinfection		3 CFU	Not detected	

	Operating room 9	Take a place in the operating room as the disinfection point 1, and sterilize with machine for 30min	Bacteria on the surface of objects	Not detected	1cfu	The disinfecting treatment of manual wiping is effective in killing bacteria
		Take a place in the operating room as the disinfection point 2, and sterilize with machine for 30min		4 CFU	Not detected	
	Operating room 13	Take a place in the operating room as the disinfection point 1, and conduct manual disinfection	Bacteria on the surface of objects	> 100cfu	Not detected	
		Take a place in the operating room as the disinfection point 2. Conduct manual disinfection		> 100cfu	Not detected	
	Book bar	Somewhere on the sofa, machine disinfect for 30min	Bacteria on the surface of objects	> 100cfu	8cfu	Sterilization robot can kill bacteria and Staphylococcus aureus on sofa surface
		Somewhere on the sofa, machine disinfect for 30min	Staphylococcus aureus	> 100cfu	65cfu	
		Sofa somewhere, not disinfected, control group		> 100cfu	> 100cfu	
	Dental Department	Room 1, working table 1, machine disinfection for 30min	Bacteria on the surface of objects	53cfu	Not detected	The disinfecting robot has certain disinfecting effect on the working table of Stomatology Department
		Room 1, working table 2, machine disinfection for 30min		> 100cfu	1cfu	
		Room 2, working table 1, machine disinfection for 30min	Bacteria on the surface of objects	Not detected	Not detected	
		Room 2, working table 2, machine disinfection for 30min		40cfu	Not detected	
	Microbiological laboratory of laboratory	Machine single UV lamp disinfection for 15min	Staphylococcus aureus	> 105	0	UV lamp has bactericidal effect on Staphylococcus aureus and bacteria on the surface of objects
			Bacteria on the surface of objects	0	0	
		Disinfection of machine single ultraviolet lamp for 30min	Staphylococcus aureus	> 105	0	
			Bacteria on the surface of objects	1	0	
	Neonatal premature delivery room	Machine disinfection for 30min	Staphylococcus aureus	/	/	Undetected
	Children's psychological and behavioral rehabilitation training room	Machine disinfection for 30min	Bacteria on the surface of objects	6	0	Disinfect the surface
summary	**The effect of disinfection robot is better in the field; The disinfecting machine has stable disinfecting effect compared with manual wiping**					

**See Appendix for some original documents*

chapter 6 Typical Working Scenarios and Cases

Operation room

Scene features: The operating room is the key area of disinfection and control, and also the area with the highest requirement of cleanliness. Operating room disinfection mainly includes opening disinfection, changing disinfection and terminal disinfection.

Target disinfection level: High level disinfection

Disinfection method:

- Because the high-level disinfection takes a long time, and the time for changing the disinfection table is short, while the opening disinfection and the final disinfection are often time-consuming and labor-consuming, which are suitable for automatic completion by the disinfection robot
- It is recommended that laminar flow be closed.If it cannot be closed, the disinfection time shall be increased.Take the operating room with an area of 35 square meters as an example. The following is the disinfection configuration scheme:

Laminar flow	Disinfection level	H2O2 concentration	Time required (minutes)	Time required (hours)	Charging times	Total charging time (hours)
Laminar free flow	High level disinfection (dual mode)	35%	69	1	0	0
		7.50%	140	2	0	0
	Medium level disinfection (dual mode)	35%	35	1	0	0
		7.50%	70	1	0	0

	Low level disinfection (single UV)	nothing	4	0	0	0
Laminar flow	High level disinfection (dual mode)	35%	140	2	0	0
		7.5% (not recommended)	279	5	0	0
	Medium level disinfection (dual mode)	35%	70	1	0	0
		7.50%	140	2	0	0
	Low level disinfection (single UV)	nothing	4	0	0	0

classic case

华中科技大学同济医学院附属 协和醫院

(one case of gas gangrene was disinfected at the end of the operating room)

深圳市人民醫院 SHENZHEN PEOPLE'S HOSPITAL 暨南大学第二临床医学院 2ND CLINICAL MEDICAL COLLEGE OF JINAN UNIVERSITY 南方科技大学第一附属医院 1ST AFFILIATED HOSPITAL OF SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

华中科技大学同济医学院
武汉市中心医院
THE CENTRAL HOSPITAL OF WUHAN

Infection ward

Scene characteristics: infectious diseases are easy to come into contact with. Terminal disinfection is very important to avoid cross infection and protect medical staff.

Target disinfection level: High / medium level disinfection

Disinfection method:

- Robot completes daily or emergency terminal disinfection
- It is recommended that laminar flow be closed.If it cannot be closed, the disinfection time shall be increased.

classic case

复旦大学附属 中山医院 ZHONGSHAN HOSPITAL

上海市中山 红十字医院 RED CROSS HOSPITAL

(robot terminal disinfection of the first anthrax case in China)

Intensive care unit (ICU)

Scene characteristics :ICU is easy to cross infection and multi drug resistant bacteria. Disinfection and control are particularly important.

Target disinfection level: High level disinfection

Disinfection method:

- For single ICU room, the robot completes daily or emergency terminal disinfection
- For the opening of ICU, the UV mode is mainly used for automatic disinfection in combination with the UV screen.Use ultra dry mist hydrogen peroxide for disinfection according to site clearing conditions.

classic case

養和醫院
Hong Kong Sanatorium & Hospital

复旦大学附属 中山医院 ZHONGSHAN HOSPITAL

上海市中山 红十字医院 RED CROSS HOSPITAL

(terminal disinfection of anthrax cases)

上海市胸科医院

山西医科大学第二医院 山西医科大学第二临床医学院
Second hospital of Shanxi Medical University 山 西 红 十 字 医 院

Hematology

Scenario features: Bone marrow transplantation and other operations, patients with low resistance, high cleanliness requirements, and heavy disinfection tasks.

Target disinfection level: high level disinfection

Disinfection method:

The robot automatically completes daily terminal disinfection

Laboratory

Scenario features: Exposure to multiple test samples is prone to contamination.

Target disinfection level: High and medium level disinfection

Disinfection method:

Robot automatically completes daily terminal disinfection

classic case

复旦大学附属 中山医院 ZHONGSHAN HOSPITAL

上海市中山 红十字医院 RED CROSS HOSPITAL


TMiRob

Day operating room ward

Scene characteristics: There are many beds, frequent access to hospitals, and heavy task of final disinfection.

Target disinfection level: Medium level disinfection

Disinfection method:

Robot automatically completes daily terminal disinfection

classic case

上海交通大学医学院附属 仁濟醫院

Medical examination center

Scene characteristics: large flow of people, create a safe physical examination environment and reduce the cost of disinfection manpower.

Target disinfection level: Medium level disinfection

Disinfection method: Automatic disinfection every night

classic case

深圳市人民醫院 SHENZHEN PEOPLE'S HOSPITAL 暨南大学第二临床医学院 2ND CLINICAL MEDICAL COLLEGE OF JINAN UNIVERSITY 南方科技大学第一附属医院 1ST AFFILIATED HOSPITAL OF SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

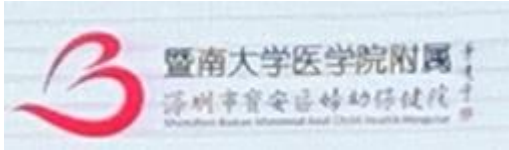
Outpatient Department

Scene characteristics : Large flow of people, creating a safe outpatient environment, protecting doctors and patients in medical treatment and working environment, reducing labor costs for disinfection.

Target disinfection level: Medium and low level disinfection

Disinfection method: Hypochlorous man-machine coexist during the day; automatic disinfection every night, multi-point ultraviolet light disinfection mode, focused irradiation on specific objects automatically identified, and task execution results can be recorded and counted.

classic case



Hemodialysis center

Scene characteristics :The patients with hemodialysis have long-term indwelling catheter and poor resistance, which is prone to drug-resistant bacteria.Bacteria spread through different media, which is easy to cause nosocomial infection.The common gram-positive cocci were Staphylococcus aureus (32.5%), fecal field cocci (15.0%), Staphylococcus haemolyticus (7.5%), gram-negative bacilli were Pseudomonas aeruginosa (20.0%), Acinetobacter lugei (9.1%), Enterobacter cloacae (7.5%), Klebsiella pneumoniae (7.5%).

Target disinfection level: According to the regulations in the standard operating procedures for blood purification (2010 version) (prepared by the nephrology branch of the Chinese Medical Association under the leadership of the Ministry of Health): dialysis treatment room (purification room): it should meet the three environmental standards specified in the hygienic standard for hospital disinfection gb15982-1995, and it should be equipped with air disinfection device, etc.The number of bacteria on the surface of the object is less than 10cfu / cm2. Generally, the tabletop and table top shall be wiped and disinfected with 250mg / L chlorine containing disinfectant, and the obviously polluted surface shall be disinfected with a chlorine containing disinfectant containing at least 500mg / L; the ultraviolet radiation shall be used for 1 hour every day.

Disinfection method:

- Carry out automatic terminal disinfection and multi-point ultraviolet disinfection to the dialysis treatment room every night

- For the positive patients in the dialysis treatment room (such as hepatitis B), UV + dry fog hydrogen peroxide double mode disinfection was adopted
- Task execution results can be recorded and counted

classic case

Campus disinfection

Scene characteristics: As a special group, primary and secondary school students and children have high susceptibility and low immune level. Once there is infectious source input in campus, it is easy to cause epidemic transmission, which seriously affects students' physical and mental health and life and learning.The outbreak of infectious diseases in primary and secondary schools and kindergartens accounted for 82.60% - 96.73% of the total outbreak of infectious diseases, indicating that schools have become a key place for epidemic control of infectious diseases.

Mode of transmission:

- Respiratory tract transmission: it can be transmitted by air, short-distance droplets or contact with respiratory secretions, such as varicella, influenza, mumps, measles, rubella, scarlet fever, etc
- Gastrointestinal transmission: hand foot mouth disease (herpetic angina), hepatitis A, bacterial dysentery, infectious diarrhea, etc
- Contact transmission: acute hemorrhagic conjunctivitis (red eye disease)

Disinfection process safety:

1） Safety of disinfectants

According to "technical code for hospital disinfection" and "national standard: hygienic requirements for chlorine containing disinfectants", micro acid hypochlorite is one of the efficient disinfectants, which is harmless to human body and has been widely used in schools, hospitals and even in oral disinfection.

2） Safety of disinfection process

Before disinfection, robots use voice and warning lights to remind people to leave the field.In the process of disinfection, the robot can recognize that the robot is in the process of disinfection through the light.

3) Safety of robot operation

The robot is equipped with laser radar, ultrasonic radar, depth of field camera and other multi-sensor. Combined with autonomous navigation and obstacle avoidance algorithm of the robot, it can safely and reliably avoid static and moving objects and people, and ensure the safety of teachers and students, objects and robot operation.

Disinfection method:

1) Routine disinfection scheme

- Daily routine disinfection robot is used to enter the classroom every night for UV and hypochlorite spray disinfection.
- Double mode disinfection of hydrogen peroxide and hydrogen peroxide shall be carried out every Sunday night to ensure clean classroom on Monday

2) Disinfection scheme in high epidemic period

- It is used for routine disinfection during the period of high epidemic, and the robot enters the classroom every night for ultraviolet disinfection
- Hydrogen peroxide and ultraviolet dual mode disinfection on the night of 1, 3, 5 every week

3) Disinfection plan of emergency plan

- In order to deal with the epidemic in schools, we should take emergency measures and strengthen disinfection
- The disinfector assigned robots to enter the isolated classes for hydrogen peroxide and ultraviolet disinfection
- Enter the classroom every night for dual mode and UV until the epidemic contact

chapter 7 References

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chapter 8 Certified product

Appendix 1: Robot CE certificate

SiT

Certificate of Conformity

Certificate No. : SIT180117160601S
Product : Medical service robot
Model : TM-MD-NM-P, TRS-01, TRS-02, TRS03, TRS-04, TRS-05, TRS-48, TM-MD-NM-Q, TM-MD-NM-R, TM-MD-NM-S, TRD-01, TRD-02, TRD03, TRD-04, TRG-01, TRG-02, TRG-03, TRG-04
Trade Mark : TMiRob
Applicant : Shanghai Taimi Robotics Technology Co., Ltd.
Address : Floor 9, Building 3, No. 111 Xiangke road, Pudong new district, Shanghai
Manufacturer : Shanghai Taimi Robotics Technology Co., Ltd.
Address : Floor 9, Building 3, No. 111 Xiangke road, Pudong new district, Shanghai

The above products have been tested by us with listed standards and found in compliance with the council LVD 2014/35/EU. It is possible to use CE marking to demonstrate the compliance with this LVD.

Test standards:	Report(s) Number	Issued By	Issued Date
EN 60950-1:2006+A11:2009+A1:2010 +A12:2011+A2:2013	SIT180117160601SR	SIT	January 25, 2018

This certificate of conformity is not transferable and based on an evaluation of a sample of the above mentioned product.

CE

APPROVED

Authorized Signer: Department Manager

Date: January 25, 2018

Shenzhen SIT Testing Technology Co., Ltd.
Hotline:400-6633-940 Tel: (86)-0755-29173399 Fax: (86)-0755-29179933 Http://www.sit-cert.com

SiT

Certificate of Conformity

Certificate No. : SIT180117160601E
Product : Medical service robot
Model : TM-MD-NM-P, TRS-01, TRS-02, TRS03, TRS-04, TRS-05, TRS-48, TM-MD-NM-Q, TM-MD-NM-R, TM-MD-NM-S, TRD-01, TRD-02, TRD03, TRD-04, TRG-01, TRG-02, TRG-03, TRG-04
Trade Mark : TMiRob
Applicant : Shanghai Taimi Robotics Technology Co., Ltd.
Address : Floor 9, Building 3, No. 111 Xiangke road, Pudong new district, Shanghai
Manufacturer : Shanghai Taimi Robotics Technology Co., Ltd.
Address : Floor 9, Building 3, No. 111 Xiangke road, Pudong new district, Shanghai

The above products have been tested by us with listed standards and found in compliance with the council EMC 2014/30/EU. It is possible to use CE marking to demonstrate the compliance with this EMC.

Test standards:	Report(s) Number	Issued By	Issued Date
EN55032:2015 EN61000-3-2:2014 EN61000-3-3:2013 EN55024:2010+A1:2015	SIT180117160601ER	SIT	January 25, 2018

This certificate of conformity is not transferable and based on an evaluation of a sample of the above mentioned product.

CE

APPROVED

Authorized Signer: Department Manager

Date: January 25, 2018

Shenzhen SIT Testing Technology Co., Ltd.
Hotline:400-6633-940 Tel: (86)-0755-29173399 Fax: (86)-0755-29179933 Http://www.sit-cert.com

Appendix 2: Robot RoHs certificate

SiT

Certificate of Conformity

Certificate : SIT180117160601R
Product : Medical service robot
Model : TM-MD-NM-P, TRS-01, TRS-02, TRS03, TRS-04, TRS-05, TRS-48, TM-MD-NM-Q, TM-MD-NM-R, TM-MD-NM-S, TRD-01, TRD-02, TRD03, TRD-04, TRG-01, TRG-02, TRG-03, TRG-04
Trade Mark : TMiRob
Applicant : Shanghai Taimi Robotics Technology Co., Ltd.
Address : Floor 9, Building 3, No. 111 Xiangke road, Pudong new district, Shanghai
Manufacturer : Shanghai Taimi Robotics Technology Co., Ltd.
Address : Floor 9, Building 3, No. 111 Xiangke road, Pudong new district, Shanghai

The above products have been tested by us with listed standards and found in compliance with the council RoHS 2011/65/EU. It is possible to use RoHS marking to demonstrate the compliance with this RoHS.

Test standards:	Report(s) Number	Issued By	Issued Date
IEC 62321-3-1:2013 IEC 62321-5:2013 IEC 62321-4:2013 IEC 62321-6:2015 IEC 62321-7-1:2013 IEC 62321:2008 ANNEX C	SIT180117160601RR	SIT	January 25, 2018

This certificate of conformity is not transferable and based on an evaluation of a sample of the above mentioned product.

RoHS

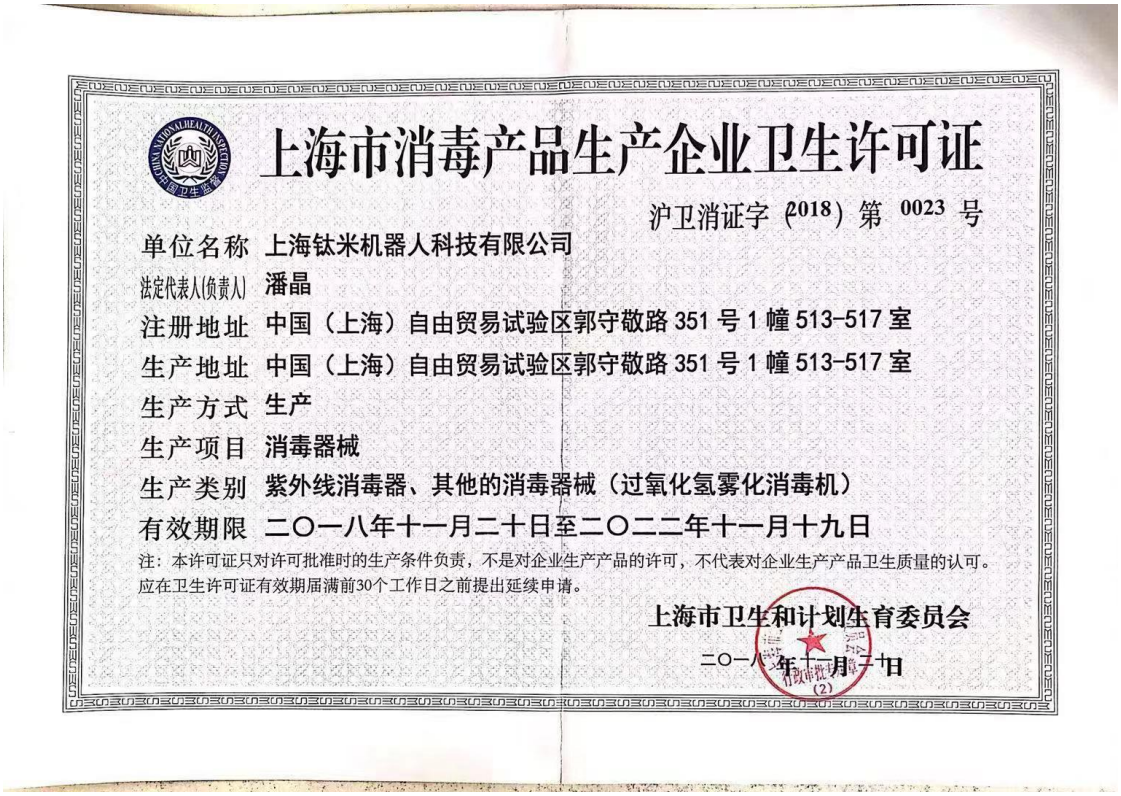
APPROVED

Authorized Signer: Department Manager

Date: January 25, 2018

Shenzhen SIT Testing Technology Co., Ltd.
Hotline:400-6633-940 Tel: (86)-0755-29173399 Fax: (86)-0755-29179933 Http://www.sit-cert.com

Appendix 3: Production license for titanium sterilization products



上海市消毒产品生产企业卫生许可证

沪卫消证字（2018）第 0023 号

单位名称 上海钛米机器人科技有限公司

法定代表人(负责人) 潘晶

注册地址 中国（上海）自由贸易试验区郭守敬路 351 号 1 幢 513-517 室

生产地址 中国（上海）自由贸易试验区郭守敬路 351 号 1 幢 513-517 室

生产方式 生产

生产项目 消毒器械

生产类别 紫外线消毒器、其他的消毒器械（过氧化氢雾化消毒机）

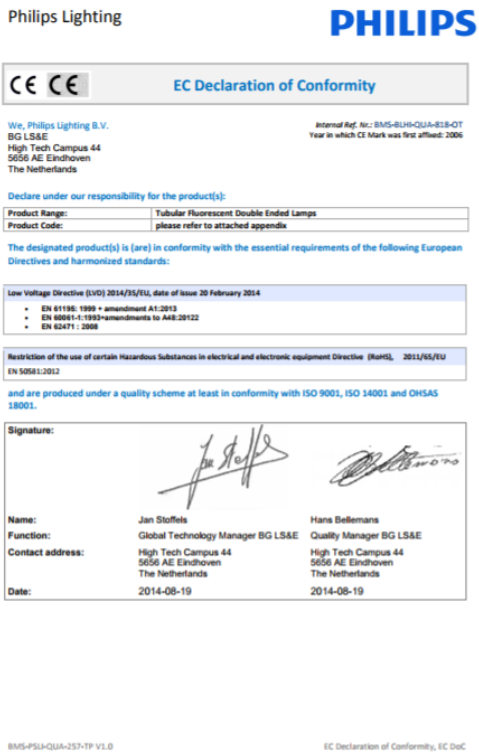
有效期限 二〇一八年十一月二十日至二〇二二年十一月十九日

注：本许可证只对许可批准时的生产条件负责，不是对企业生产产品的许可，不代表对企业生产产品卫生质量的认可。应在卫生许可证有效期届满前30个工作日之前提出延续申请。

上海市卫生和计划生育委员会

二〇一八年十一月二十日

Appendix 4: CE Certificate of Philips UV Lamp



Philips Lighting PHILIPS

CE CE EC Declaration of Conformity

We, Philips Lighting B.V.
BG LS&E
High Tech Campus 44
5656 AE Eindhoven
The Netherlands

Internal Ref. Nr.: BMS-BLHI-QUA-818-OT
Year in which CE Mark was first affixed: 2006

Declare under our responsibility for the product(s):

Product Range:	Tubular Fluorescent Double Ended Lamps
Product Code:	please refer to attached appendix

The designated product(s) is (are) in conformity with the essential requirements of the following European Directives and harmonized standards:

Low Voltage Directive (LVD) 2014/35/EU, date of issue 20 February 2014

- EN 61195: 1999 + amendment A1:2013
- EN 60061-1:1993+amendments to A48:20122
- EN 62471 : 2008

Restriction of the use of certain Hazardous Substances in electrical and electronic equipment Directive (RoHS), 2011/65/EU
EN 50581:2012

and are produced under a quality scheme at least in conformity with ISO 9001, ISO 14001 and OHSAS 18001.

Signature:

Name:	Jan Stoffels	Hans Bellemans
Function:	Global Technology Manager BG LS&E	Quality Manager BG LS&E
Contact address:	High Tech Campus 44 5656 AE Eindhoven The Netherlands	High Tech Campus 44 5656 AE Eindhoven The Netherlands
Date:	2014-08-19	2014-08-19

BMS-PSLI-QUA-257-TP V1.0 EC Declaration of Conformity, EC DoC

Philips Lighting PHILIPS

CE EC Declaration of Conformity

We,

Philips Lighting Poland S.A.
Kossaka Street 150
64-920 Piła
Poland

Product family: Purification lamp
Document N°:PQQ-2009-300
Date: 2009-06-15

declare that the electrical products specified in the annex supplied by us to which this declaration relates, and as far as applicable, are in conformity with the European standard(s):

EN 61195 Double-capped fluorescent lamps for TL Lamp – Safety specifications
EN 61199 Single-capped fluorescent lamps for CFLni Lamp – Safety specifications

Following the provisions of the EC-directives:

Directive 2006/95/EC date of issue: December 2006

The earliest year in which the CE-mark was affixed : 2000

Responsible and authorized for these products:

Signature:

Mr. Wojciech Rękawiecki
Quality Manager
PHILIPS LIGHTING POLAND S.A
Lighting Site Piła

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Page: 1/2

Appendix 5: Lidar CTUVus Certificate

TYPE:
TIM5..

SICK

SICK AG
Erwin-Sick-Straße 1
D-79183 Waldkirch
Germany

Ident-Nr.: **9186351 YTF9**

EC declaration of conformity en

The undersigned, representing the following manufacturer herewith declares that the product is in conformity with the provisions of the following EU directive(s) (including all applicable amendments), and that the respective standards and/or technical specifications have been used as a basis for this (download: www.sick.com).

You can obtain the EC declaration of conformity with the standards used at: www.sick.com

Date: 2016-04-20

i.V. Pastor
(Manager R&D Distance & Ranging)

ppa. Walter
(Manager Production Division Identification & Measuring)

EU-Konformitätserklärung de

Der Unterzeichner, der den nachstehenden Hersteller vertritt, erklärt hiermit, dass das Produkt in Übereinstimmung mit den Bestimmungen der nachstehenden EU-Richtlinie(n) (einschließlich aller zutreffenden Änderungen) ist, und dass die entsprechenden Normen und/oder technischen Spezifikationen zugrunde gelegt sind (Download: www.sick.com).

ЕС декларация за съответствие bg

Подписаният, който представя долуспоменатия производител, обявява, че продуктът съответства на разпоредбите на долуизброените директиви на ЕС (включително на всички действащи изменения) и че се базира на съответните норми и/или технически спецификации за приложение (изтегляне: www.sick.com).

ES prohlášení o shodě cs

Níže podepsaný, zastupující následujícího výrobce, tímto prohlašuje, že výrobek je v souladu s ustanoveními následující(ch) směrnice (směrnic) EU (včetně všech platných změn) a že podkladem byly odpovídající normy a/nebo technické specifikace. (Ke stažení: www.sick.com).

EF-overensstemmelseserklæring da

Undertegnede, der repræsenterer følgende producent, erklærer hermed, at produktet er i overensstemmelse med bestemmelserne i følgende EU-direktiv(er) (inklusive alle gældende ændringer), og at alle tilsvarende standarder og/eller tekniske specifikationer er blevet anvendt (download: www.sick.com).

Δήλωση συμμόρφωσης ΕΕ el

Ο Υπογράφων, εκπροσωπών τον ακόλουθο κατασκευαστή, δηλώνει με το παρόν έγγραφο ότι το προϊόν συμμορφώνεται με τους όρους της(των) ακολουθη(ς-ών) Οδηγία(ς-ών) της ΕΕ (συμπεριλαμβανομένων όλων των εφαρμοζόμενων τροποποιήσεων) και ότι έχουν ληφθεί υπόψη το αντίστοιχο πρότυπο ή/και οι τεχνικές προδιαγραφές (λήψη: www.sick.com).

Declaración de conformidad UE es

El abajo firmante, en representación del fabricante indicado a continuación, declara que el producto es conforme con las disposiciones de la(s) siguiente(s) directiva(s) de la UE (incluyendo todas las modificaciones aplicables) y que las respectivas normas y/o especificaciones técnicas han sido utilizadas como base. (Download: www.sick.com).

EÜ vastavusdeklaratsioon et

Allakirjutanu, kes esindab järgmist tootjat, kinnitab käesolevaga, et antud toode vastab järgneva(te) EÜ-i direktiivi(de) sätetele (kaasa arvatud kõikidele asjakohastele muudatustele) ja et on rakendatud vastavaid nõudeid ja/või tehnilisi kirjeldusi. (Allalaadimine: www.sick.com).

EY-vaatimustenmukaisuusvakuutus fi

Allekirjoittanut, joka edustaa alla mainittua valmistajaa, vakuuttaa täten, että tuote on seuraavan (-ien) EU-direktiivin (-ien) vaatimusten mukainen (mukaan lukien kaikki sovellettavat muutokset) ja että sen perustana ovat vastaavat standardit ja tekniset erittelyt (Latausosoite: www.sick.com).

Déclaration de conformité UE fr

Le soussigné, représentant le constructeur ci-après, déclare par la présente que le produit est conforme aux exigences de la (des) directive(s) de l'UE suivantes (y compris tous les amendements applicables) et que les normes et/ou spécifications techniques correspondantes ont servi de base (téléchargement: www.sick.com).

EU izjava o sukladnosti hr

Potpisnik, koji zastupa proizvođača navedenog u nastavku, ovime izjavljuje da je proizvod usklađen s odredbama dolje navedenih direktiva EU-a (uključujući sve nastale izmjene) i da je u skladu s odgovarajućim normama i/ili tehničkim specifikacijama (preuzimanje: www.sick.com).

EK megfelelőségi nyilatkozat hu

Alulírott, az alábbi gyártó képviseletében ezennel kijelenti, hogy a termék megfelel az alábbi EU-irányelv(ek) követelményeinek (beleértve azok minden vonatkozó módosítását) és kijelenti, hogy a megfelelő szabványokat és/vagy műszaki előírásokat vette alapul. (Letöltés: www.sick.com).

ESB-samræmisyfirlýsing is

Undirritaður, fyrir hönd framleiðandans sem nefndur er hér að neðan, lýsir því hér með yfir að varan er í samræmi við ákvæði eftirtalinna ESB-tilskipana (að meðtöldum öllum breytingum sem við eiga) og að þessu til grundvallar samræmist varan viðeigandi stöðlum og/eða tæknilýsingum (niðurhal: www.sick.com).

Dichiarazione di conformità EU it

Il sottoscritto, in qualità di rappresentante del costruttore sotto indicato, dichiara con la presente che il prodotto è conforme alle disposizioni della(e) seguente(i) direttiva(e) EU (comprese tutte le modifiche applicabili) e che si basa sulle rispettive norme e/o specifiche tecniche (scaricabili dal sito web: www.sick.com).

EU atitikties deklaracija lt

Pasirašiusysis, atstovaujantis šiam gamintojui deklaruoja, kad gaminys atitinka šios (šių) ES direktyvos (ų) reikalavimus (įskaitant visus taikytinus keitinius) ir kad buvo remtasi antrajame puslapyje nurodytais standartais ir (arba) techninėmis specifikacijomis (atsisiųsti: www.sick.com).

EK atbilstības deklarācija lv

Apakšā parakstījusies persona, kas pārstāv zemāk minēto ražotāju, ar šo deklarē, ka izstrādājums atbilst zemāk minētajai (-ām) ES direktīvai (-ām) (ieskaitot visus atbilstošos grozījumus) un ka izstrādājuma izgatavošanā par pamatu ņemti attiecīgie standarti un/vai tehniskās specifikācijas (lejupielāde: www.sick.com).

EG-verklaring van overeenstemming nl

Ondergetekende, vertegenwoordiger van de volgende fabrikant, verklaart hiermee dat het product voldoet aan de bepalingen van de volgende EU-richtlijn(en) (inclusief alle van toepassing zijnde wijzigingen) en dat de overeenkomstige normen en/of technische specificaties als grondslag werden gebruikt (Download: www.sick.com).

EF-samsvarserklæring no

Undertegnede, som representerer nedennevnte produsent, erklærer herved at produktet er i samsvar med bestemmelsene i følgende EU-direktiv(er) (inkludert alle relevante endringer) og at relevante normer og/eller tekniske spesifikasjoner er blitt anvendt (Nedlasting: www.sick.com).

Deklaracja zgodności WE pl

Niżej podpisany, reprezentujący wymienionego poniżej producenta oświadcza niniejszym, że wyrób jest zgodny z postanowieniami podanej/podanych poniżej dyrektyw/y UE (wraz z odnośnymi poprawkami) oraz, że za podstawę wzięto odpowiednie normy i/lub specyfikacje techniczne (download: www.sick.com).

Declaração CE de conformidade pt

O abaixo assinado, que representa o seguinte fabricante, declara deste modo que o produto está em conformidade com as disposições da(s) seguinte(s) directiva(s) UE (incluindo todas as alterações aplicáveis) e que foram usadas como base as respectivas normas e/ou especificações técnicas. (Download: www.sick.com).

Declarație de conformitate CE ro

Semnatarul, în calitate de reprezentant al producătorului numit mai jos, declară prin prezenta că produsul este în conformitate cu prevederile directivelor UE enumerate mai jos (inclusiv cu toate modificările aferente) și se întemeiază pe normele și/sau specificațiile tehnice corespunzătoare (download: www.sick.com).

EÚ vyhlásenie o zhode sk

Dolu podpísaný zástupca výrobcu týmto vyhlasuje, že výrobok je v súlade s ustanoveniami nasledujúcej (nasledujúcich) smernice (smerníc) EÚ (vrátane všetkých platných zmien) a že ako základ boli použité príslušné normy a/alebo technické špecifikácie (Download: www.sick.com).

Izjava ES o skladnosti sl

Podpisani predstavnik spodaj navedenega proizvajalca izjavljam, da je proizvod v skladu z določbami spodaj navedenih direktiv EU (vključno z vsemi ustreznimi spremembami) in da so osnova ustrezni standardi in/ali tehnične specifikacije (prenos: www.sick.com).

EU-försäkran om överensstämmelse sv

Undertecknad, som representerar nedanstående tillverkare, försäkrar härmed att produkten överensstämmer med bestämmelserna i följande EU-direktiv (inklusive samtliga tillämpliga tillägg till dessa) och baseras på relevanta standarder och/eller tekniska specifikationer (nedladdning: www.sick.com).

2019-01-20 9186351.pdf 1 / 3

Appendix 6: Lidar EU declaration of conformity certificate

TYPE:
TIM5..

SICK

SICK AG
Erwin-Sick-Straße 1
D-79183 Waldkirch
Germany

Ident-Nr.: **9186351 YTF9**

EC declaration of conformity en

The undersigned, representing the following manufacturer herewith declares that the product is in conformity with the provisions of the following EU directive(s) (including all applicable amendments), and that the respective standards and/or technical specifications have been used as a basis for this (download: www.sick.com).

You can obtain the EC declaration of conformity with the standards used at: www.sick.com

Date: 2016-04-20

i.V. Pastor
(Manager R&D Distance & Ranging)

ppa. Walter
(Manager Production Division Identification & Measuring)

EU-Konformitätserklärung de

Der Unterzeichner, der den nachstehenden Hersteller vertritt, erklärt hiermit, dass das Produkt in Übereinstimmung mit den Bestimmungen der nachstehenden EU-Richtlinie(n) (einschließlich aller zutreffenden Änderungen) ist, und dass die entsprechenden Normen und/oder technischen Spezifikationen zugrunde gelegt sind (Download: www.sick.com).

ЕС декларация за съответствие bg

Подписаният, който представя долуспоменатия производител, обявява, че продуктът съответства на разпоредбите на долуизброените директиви на ЕУ (включително на всички действащи изменения) и че се базира на съответните норми и/или технически спецификации за приложение (Изтегляне: www.sick.com).

ES prohlášení o shodě cs

Níže podepsaný, zastupující následujícího výrobce, tímto prohlašuje, že výrobek je v souladu s ustanoveními následující(ch) směrnice (směrnic) EU (včetně všech platných změn) a že podkladem byly odpovídající normy a/nebo technické specifikace. (Ke stažení: www.sick.com).

EF-overensstemmelseserklæring da

Undertegnede, der repræsenterer følgende producent, erklærer hermed, at produktet er i overensstemmelse med bestemmelserne i følgende EU-direktiv(er) (inklusive alle gældende ændringer), og at alle tilsvarende standarder og/eller tekniske specifikationer er blevet anvendt (download: www.sick.com).

Δήλωση συμμόρφωσης ΕΕ el

Ο Υπογράφων, εκπροσωπών τον ακόλουθο κατασκευαστή, δηλώνει με το παρόν έγγραφο ότι το προϊόν συμμορφώνεται με τους όρους της(των) ακόλουθης(-ων) Οδηγίας(-ών) της ΕΕ (συμπεριλαμβανομένων όλων των εφαρμοζόμενων τροποποιήσεων) και ότι έχουν ληφθεί υπόψη τα αντίστοιχα πρότυπα ή/και οι τεχνικές προδιαγραφές (Λήψη: www.sick.com).

Declaración de conformidad UE es

El abajo firmante, en representación del fabricante indicado a continuación, declara que el producto es conforme con las disposiciones de la(s) siguiente(s) directiva(s) de la UE (incluyendo todas las modificaciones aplicables) y que las respectivas normas y/o especificaciones técnicas han sido utilizadas como base. (Download: www.sick.com).

EÜ vastavusdeklaratsioon et

Allakirjutanu, kes esindab järgmist tootjat, kinnitab käesolevaga, et antud toode vastab järgneva(te) EU-i direktiivi(de) sätetele (kaasa arvatud kõikidele asjakohastele muudatustele) ja et on rakendatud vastavaid nõudeid ja/või tehnilisi kirjeldusi. (Allalaadimine: www.sick.com).

EY-vaatimustenmukaisuusvakuutus fi

Allekirjoittanut, joka edustaa alla mainittua valmistajaa, vakuuttaa täten, että tuote on seuraavan (-ien) EU-direktiivin (-ien) vaatimusten mukainen (mukaan lukien kaikki sovellettavat muutokset) ja että sen perustana ovat vastaavat standardit ja tekniset erittelyt (Latausosoite: www.sick.com).

Déclaration de conformité UE fr

Le soussigné, représentant le constructeur ci-après, déclare par la présente que le produit est conforme aux exigences de la (des) directive(s) de l'UE suivantes (y compris tous les amendements applicables) et que les normes et/ou spécifications techniques correspondantes ont servi de base (téléchargement: www.sick.com).

EU izjava o sukladnosti hr

Potpisnik, koji zastupa proizvođača navedenog u nastavku, ovime izjavljuje da je proizvod usklađen s odredbama dolje navedenih direktiva EU-a (uključujući sve nastale izmjene) i da je u skladu s odgovarajućim normama i/ili tehničkim specifikacijama (preuzimanje: www.sick.com).

EK megfelelőségi nyilatkozat hu

Alulírott, az alábbi gyártó képviseletében ezennel kijelenti, hogy a termék megfelel az alábbi EU-irányelv(ek) követelményeinek (beleértve azok minden vonatkozó módosítását) és kijelenti, hogy a megfelelő szabványokat és/vagy műszaki előírásokat vette alapul. (Letöltés: www.sick.com).

ES-samræmisyfirlýsing is

Undirritaður, fyrir hönd framleiðandans sem nefndur er hér að neðan, lýsir því hér með yfir að varan er í samræmi við ákvæði eftirtalinna ESB-tilskipana (að meðtöldum öllum breytingum sem við eiga) og að þessu til grundvallar samræmist varan viðeigandi stöðlum og/eða tækniforskriftum (niðurhal: www.sick.com).

Dichiarazione di conformità EU it

Il sottoscritto, in qualità di rappresentante del costruttore sotto indicato, dichiara con la presente che il prodotto è conforme alle disposizioni della(e) seguente(i) direttiva(e) EU (comprese tutte le modifiche applicabili) e che si basa sulle rispettive norme e/o specifiche tecniche (scaricabili dal sito web: www.sick.com).

EU atitikties deklaracija lt

Pasirašiusysis, atstovaujantis šiam gamintojui deklaruoja, kad gaminys atitinka šios (ių) EU direktyvos (ų) reikalavimus (įskaitant visus taikytinus keitinius) ir kad buvo remtasi antrajame puslapyje nurodytais standartais ir (arba) techninėmis specifikacijomis (atsisiųsti: www.sick.com).

EK atbilstības deklarācija lv

Apakšā parakstījusies persona, kas pārstāv zemāk minēto ražotāju, ar šo deklarē, ka izstrādājums atbilst zemāk minētajai (-ām) ES direktīvai (-ām) (ieskaitot visus atbilstošos grozījumus) un ka izstrādājuma izgatavošanā par pamatu ņemti attiecīgie standarti un/vai tehniskās specifikācijas (lejupielāde: www.sick.com).

EG-verklaring van overeenstemming nl

Ondergetekende, vertegenwoordiger van de volgende fabrikant, verklaart hiermee dat het product voldoet aan de bepalingen van de volgende EU-richtlijn(en) (inclusief alle van toepassing zijnde wijzigingen) en dat de overeenkomstige normen en/of technische specificaties als grondslag werden gebruikt (Download: www.sick.com).

EF-samsvarserklæring no

Undertegnede, som representerer nedennevnte produsent, erklærer herved at produktet er i samsvar med bestemmelsene i følgende EU-direktiv(er) (inkludert alle relevante endringer) og at relevante normer og/eller tekniske spesifikasjoner er blitt anvendt (Nedlasting: www.sick.com).

Deklaracja zgodności WE pl

Niżej podpisany, reprezentujący wymienionego poniżej producenta oświadcza niniejszym, że wyrób jest zgodny z postanowieniami podanej/podanych poniżej dyrektyw/y UE (wraz z odnośnymi poprawkami) oraz, że za podstawę wzięto odpowiednie normy i/lub specyfikacje techniczne (download: www.sick.com).

Declaração CE de conformidade pt

O abaixo assinado, que representa o seguinte fabricante, declara deste modo que o produto está em conformidade com as disposições da(s) seguinte(s) directiva(s) UE (incluindo todas as alterações aplicáveis) e que foram usadas como base as respectivas normas e/ou especificações técnicas. (Download: www.sick.com).

Declarație de conformitate CE ro

Semnatarul, în calitate de reprezentant al producătorului numit mai jos, declară prin prezenta că produsul este în conformitate cu prevederile directivelor UE enumerate mai jos (inclusiv cu toate modificările aferente) și se întemeiază pe normele și/sau specificațiile tehnice corespunzătoare (download: www.sick.com).

EÚ vyhlásenie o zhode sk

Dolu podpísaný zástupca výrobcu týmto vyhlasuje, že výrobok je v súlade s ustanoveniami nasledujúcej (nasledujúcich) smernice (smernic) EÚ (vrátane všetkých platných zmien) a že ako základ boli použité príslušné normy a/alebo technické špecifikácie (Download: www.sick.com).

Izjava ES o skladnosti sl

Podpisani predstavnik spodaj navedenega proizvajalca izjavljam, da je proizvod v skladu z določbami spodaj navedenih direktiv EU (vključno z vsemi ustreznimi spremembami) in da so osnova ustrezni standardi in/ali tehnične specifikacije (prenos: www.sick.com).

EU-försäkran om överensstämmelse sv

Undertecknad, som representerar nedanstående tillverkare, försäkrar härmed att produkten överensstämmer med bestämmelserna i följande EU-direktiv (inklusive samtliga tillämpliga tillägg till dessa) och baseras på relevanta standarder och/eller tekniska specifikationer (nedladdning: www.sick.com).

2019-01-20 9186351.pdf 1 / 3

Appendix 7: Lidar China-RoHS Certificate

Marking of Hazardous Substances 有害物质标识
according to the **SJ/T 11364-2014** Standard of the
People´s Republic of China for the Electronic Industry
本表格依据中华人民共和国 SJ/T11364 的规定编制

SICK
Sensor Intelligence.

Product Family 产品名称: TIM...
Short Product Type 产品名称: TIM5..

Component Name 部件名称	Hazardous Substances 有害物质					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr (VI))	Polybro-minated biphenyls 多溴联苯 (PBB)	Polybro-minated diphenyl ethers 多溴二苯醚 (PBDE)
Aluminum, Steel, Copper alloy, 铝、铁、铜合金、	X*	O	O	O	O	O
Electrical contacts 电触头	O	O	X*	O	O	O
Filter glasses and glasses for optical applications, printed board assembly 滤光玻璃和光学材料玻璃、印制板装置	X*	O	X*	O	O	O

This table was developed according to the provisions of SJ/T 11364
本表格依据 SJ/T11364 的□定□制

O: The content of such hazardous substance in all homogeneous materials of such component is **below** the limit required by GB/T 26572.
表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求**以下**。

X: The content of such hazardous substance in all homogeneous materials of such component is **beyond** the limit required by GB/T 26572..
表示该有害物质至少在该部件的某一均质材料中的含量**超出** GB/T 26572 规定的限量要求。

Enterprises may further explain the technical reasons for ticking "X" in the table above according to their actual situation herein.
企业可在此处，根据实际情况对上表中打"×"的技术原因进行进一步说明。
*Exemptions according to EU RoHS 2011/65 Annex III and IV might be applied
*欧盟 RoHS 2011/65 附件 III and IV 的豁免可能适用

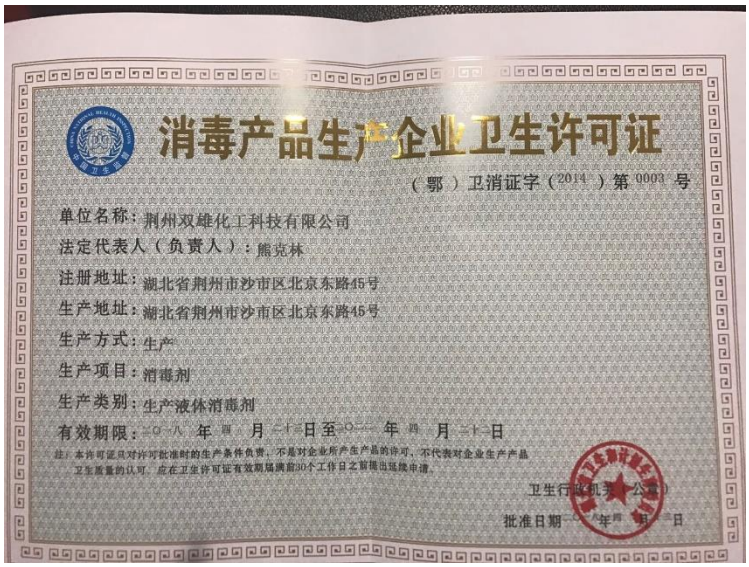
This statement is based on information and data provided from third parties and may not have been verified through destructive testing methods or other chemical analysis.
本声明基于第三方提供的信息和数据，可能未经破坏性检测方法或其他化学分析进行验证。

Producer 生产者

Company Name 公司名称	Street – No. 街-号	ZIP Code City 邮编 城市	Country 国家	
SICK AG	Erwin-Sick-Str. 1	79183 Waldkirch	Germany	http://www.sick.com

Document Ident.-No.: 9247577 2016-06-20

Appendix 8: Hydrogen Peroxide Supplier (Double Male) Production License



消毒产品生产企业卫生许可证

（鄂）卫消证字（2014）第0003号

单位名称：荆州双雄化工科技有限公司

法定代表人（负责人）：熊克林

注册地址：湖北省荆州市沙市区北京东路45号

生产地址：湖北省荆州市沙市区北京东路45号

生产方式：生产

生产项目：消毒剂

生产类别：生产液体消毒剂

有效期限：二〇一八 年 四 月 二十三日至二〇一一 年 四 月 二十二日

注：本许可证只对许可批准时的生产条件负责，不是对企业所产生产品的许可，不代表对企业生产产品卫生质量的认可。应在卫生许可证有效期届满前30个工作日之前提出延续申请。

卫生行政机关（公章）

批准日期 二〇一八年四 月 二十三日

Appendix 9: Hydrogen peroxide supplier (double male) safety production certificate

安全生产标准化

Work Safety Standardization

证书

CERTIFICATE

● 证书编号：AQBIIIWH鄂201500017

荆州双雄化工科技有限公司

安全生产标准化三级企业

（危险化学品）

有效期至：2018年12月

（证书颁发单位章）

二〇一五年十二月十六日

国家安全生产监督管理总局监制

State Administration of Work Safety

Appendix 10: Hydrogen peroxide supplier (double male) safety production license

安全生产许可证

（副本）

编号：（鄂）WH 安许证字【0849】

企业名称：荆州双雄化工科技有限公司

主要负责人：

注册地址：荆州市沙市区北京东路 68 号

经济类型：有限责任公司

许可范围：

有效期：2017 年 8 月 19 日至 2020 年 8 月 18 日

发证机关：

2017 年 8 月 19 日

说　明

1. 《安全生产许可证》是矿山企业、建筑施工企业和危险化学品、烟花爆竹、民用爆破器材生产企业取得安全生产许可的凭证。
2. 《安全生产许可证》分正本和副本，正本和副本具有同等法律效力，正本应放在企业法人住所醒目的位置。
3. 《安全生产许可证》不得伪造、涂改、租赁、出借、转让，除发证机关外，其他任何单位和个人均不得扣留、收缴和吊销。
4. 持证人不得超范围出本许可证规定的许可范围。
5. 《安全生产许可证》的颁发、登记、吊销及撤销适用《安全生产许可证条例》。

信用编码：36088808

荆州双雄化工科技有限公司

信用网址：http：//36088808.11315.com

11315 企业征信

立信单位

征信机构：11315全国企业征信系统

绿盾征信（北京）有限公司

认定时间：2015 年 06 月 23 日

Appendix 11: Certificate of hydrogen peroxide supplier (double male)

Appendix 12: Quality inspection report of hydrogen peroxide supplier (double male)

国联质检
UNITED NATION QUALITY DETECTION

CMA
152717110306
有效期至2021年10月27日

测 试 报 告

TEST REPORT

№ JF20180413-1

产品名称：食品级过氧化氢

委托单位：荆州双雄化工科技有限公司

测试类别：委托测试

西安国联质量检测技术股份有限公司

Xi'an United Nations Quality Detection Technology CO.,Ltd.

UNITED NATION QUALITY DETECTION
Tel:+86 (029) 84346232 E-mail:xaunqd@126.com
UNQD 400-808-2011 www.xaunqd.com
报告解释服务热线：029-89116273(上午10:00-12:00 下午：15:00-17:00)

国联质检
UNITED NATION QUALITY DETECTION

西安国联质量检测技术股份有限公司

Xi'an United Nations Quality Detection Technology CO.,Ltd.

测 试 报 告

TEST REPORT

№ JF20180413-1 共3页 第2页

产品名称 Name of sample	食品级过氧化氢	注册商标 Trade Mark	标称"双雄化工"
规格型号 Specification	SXXD-Ⅱ,35%	生产日期/批号 Production Date/batch	20180302
测试类别 Test Categories	委托测试	到样日期 Date Received	2018年03月05日
测试地点 Test site	西安国联质量检测技术股份有限公司技术中心	测试日期 Date of Observation	2018年03月07日 -2018年03月15日
委托单位 Inspection Requestor	荆州双雄化工科技有限公司	样品数量 Sample Quantity	500mL
制造单位 Manufacturer	标称"荆州双雄化工科技有限公司"	样品基数 Lot Size	/
委托方地址 To the address	湖北省荆州市沙市区北京东路45号	样品状态 Sample Condition	液体，散装样品完好，符合测试要求
抽样地点 Sampling Site	/	经办人 Agent	熊克林
测试项目 Test Items	过氧化氢等10项		
测试依据或综合判断原则 Inspection/Judgement Requlations	GB 22216-2008《食品添加剂 过氧化氢》		
测试结论(Conclusion) 所测项目符合GB 22216-2008标准要求，具体结果见下页。 签发日期：2018年03月16日 Issuing Date			
备注 Remarks	1. 样品信息由委托单位提供，未经本实验室确认，只对来样负责。 2. 此报告代替原报告 JF20180413。		

审批：　主检：　编制：

UNITED NATION QUALITY DETECTION
Tel:+86 (029) 84346232 E-mail:xaunqd@126.com
UNQD 400-808-2011 www.xaunqd.com
报告解释服务热线：029-89116273(上午10:00-12:00 下午：15:00-17:00)

Appendix 13: CMA Test Report

170121340497

中关村国际医药检验认证科技有限公司

Zhongguancun International Medical Inspection and certification Co. Ltd

检 验 报 告

检验受理编号 2019-XD-055

样 品 名 称 钛米牌TRD-01型自主移动式过氧化氢消毒机

委 托 单 位 上海钛米机器人科技有限公司

2019 年 03 月 28 日

Appendix 14: Registration of disinfection equipment

消毒产品备案信息查询 消毒产品责任单位查询

全国消毒产品网上备案信息服务平台

消毒

返回首页

您现在的位置：首页 >> 消毒产品信息查询 >> 钛米牌TRD-01型自主移动式过氧化氢消毒机

钛米牌TRD-01型自主移动式过氧化氢消毒机详细信息如下：

产品评价 投诉举报

风险提示：本网站仅基于已掌握的信息提供查询服务，查询结果不代表本网站对被查询对象信用状况的评价，仅供参考，请注意识别和防范信用风险。

基本信息

产品名称：钛米牌TRD-01型自主移动式过氧化氢消毒机

产品分类：第二类消毒产品

评价日期：2019-04-09

产品责任单位名称：上海钛米机器人科技有限公司

市售产品标签(铭牌)：铭牌.png

市售产品说明书：说明书.pdf

检验报告结论：合格

卫生安全评价结论：合格

备案日期：2019-04-25

检验报告列表

检验机构名称	检验报告编号	检验报告结论
中关村国际医药检验认证科技有限公司	2019-XD-055	检验报告2019-056.pdf
中关村国际医药检验认证科技有限公司	2019-XD-055	检验报告2019-055.pdf

生产企业信息

生产企业名称	生产企业卫生许可证号
上海钛米机器人科技有限公司	沪卫消证字(2018)第0023号

详细信息

剂型：TRD-01

型号：

产品使用范围：硬质物体表面消毒，

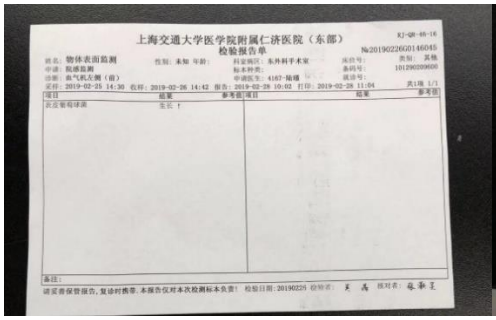
产品条形码：

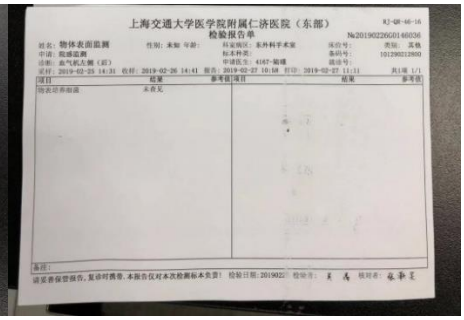
评价信息 好评(0) 中评(0) 差评(0)

返回 历史记录

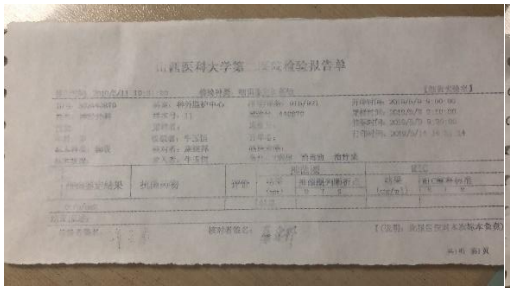
Appendix 15: Original clinical trial report

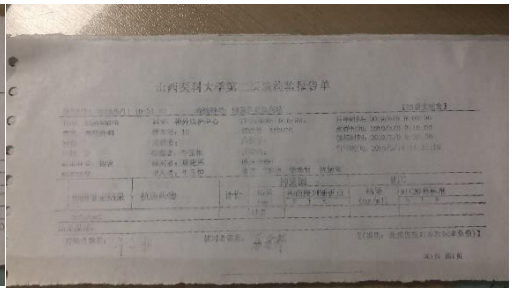

深圳人民医院实验照片


上海交通大学医学院附属仁济医院（东部）
检验报告单


上海交通大学医学院附属仁济医院（东部）
检验报告单

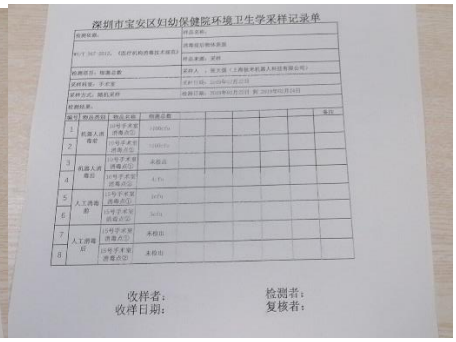
上海仁济医院检验报告（部分）





山西附二检验报告（部分）


深圳市宝安区妇幼保健院环境卫生学采样记录单


深圳市宝安区妇幼保健院环境卫生学采样记录单