WORLD SCIENTISTS
International Scientific & Research Journal

Superheated dry steam: the discreet hero of the innovative steam generator ‘MediCleanTec Micro Cleaner’.

Dr Pattis Friedrich, PhD

Annotation:

The article is devoted to the analysis of the operating principles and advantages of the steam generator ‘MediCleanTec Micro Cleaner’, which is an innovative device that uses superheated dry steam technology for effective disinfection and cleaning of surfaces. The device is positioned as a universal solution for sterilisation in hygienic environments.

In an era of smart technology and energy efficiency, superheated dry steam is becoming a key element in the operation of many household appliances. Its unique properties – high temperature, no moisture and the ability to transfer heat quickly – make it indispensable in everyday life. From irons to sterilisers, this steam is changing the way we approach household tasks.

Superheated steam is created when water is heated above its boiling point (100°C at standard pressure), which completely vaporises the liquid, turning it into a ‘dry’ gas with no droplets. Unlike saturated vapour, which contains moisture, superheated vapour has more energy and efficiency, making it ideal for applications where precision and speed are required.

Keywords: superheated dry steam, dry saturated steam, thermodynamic cycles, thermal efficiency, steam pressure, heat exchange processes, household steam generators, steam sterilisation, environmental friendliness of superheated steam, thermal stability, innovative heat carriers.

The advantages of superheated steam are.

1- Energy efficiency. Due to its high temperature, steam treats surfaces faster, reducing unit run time and energy consumption.

2. Material safety. The lack of moisture protects fabrics, electronics and other sensitive surfaces from damage.

3. Hygienic. Steam destroys bacteria and allergens without chemicals, which is important for sterilisers and cleaners.

4. environmentally friendly. Reduces the need for detergents, reducing the chemical load on the environment.

Generation technologies.

Modern devices use ceramic heaters and precise temperature controllers to create superheated steam. For example, steam generators instantly vaporise water in sealed chambers and pressure sensors monitor its temperature (up to 160°C). Innovative materials, such as stainless steel with an anti-corrosion coating, ensure durability even under extreme loads.

Domestic applications.

1. Irons and steamers. Dry steam smooths dense fabrics (wool, denim) without the risk of staining.

2. Dishwashers. High-temperature steam removes grease and disinfects dishes, shortening the wash cycle.

3. Sterilisers for baby supplies. Destroy 99.9 per cent of germs, replacing boiling.

4. air and surface cleaners. Steam dissolves dirt without leaving streaks on glass or countertops.

5. Kitchen gadgets Steamers with superheated steam preserve vitamins in vegetables, and multicookers speed up cooking.

Manufacturers pay special attention to user protection: automatic shut-off in case of overheating, protective covers and pressure sensors prevent burns.

Superheated dry steam is not just a technological detail, but a revolution in household appliances. It combines power, sustainability and safety, making everyday tasks easier and more efficient. With the development of IoT and new materials, its role will only grow, opening up opportunities for even smarter and more sustainable solutions. ‘Sustainability’ is a completely new model of resource utilisation and human-nature interaction. The main goal is to build a new innovative environment with a society that cares about the environment. Sustainable development, also harmonious development, balanced development in the ecological segment, implies in practice the solution of a wide range of problems.

Superheated dry vapour is a vapour whose temperature exceeds the saturation temperature (boiling point) at a given pressure and in which there are no liquid droplets. It is obtained by additional heating of saturated vapour after complete evaporation of water, which increases its energy and thermodynamic stability.

Differences from saturated vapour:

1. temperature: saturated vapour is at its boiling point for a given pressure. Superheated vapour has a temperature above the boiling point for the same pressure.

2. Moisture content: saturated vapour can be ‘dry’ (no droplets) or ‘wet’ (with an admixture of liquid). Superheated vapour is always dry because it is heated to a state that precludes condensation.

3. Thermal energy:‘’ superheated vapour has more internal energy due to the additional heat input.

4. Density and volume: superheated vapour is less dense than saturated vapour due to expansion during heating.

5. Condensation: saturated vapour condenses when slightly cooled or pressurised. Superheated vapour does not condense until its temperature drops to its saturation point.

In fact, superheated steam is a ‘superheated’ form of saturated steam that has increased energy, dryness and stability, making it more efficient for mechanical work.

MediCleanTec Micro Cleaner steam generator: an innovation in the world of superheated dry steam disinfection.

In an era of increased attention to hygiene and safety, especially after the COVID-19 pandemic, effective disinfection has become critical for healthcare facilities, food processing plants, hotels and public spaces. Against this backdrop, the MediCleanTec Micro Cleaner steam generator stands out as a revolutionary solution that uses superheated dry steam at a pressure of 9 bar and temperatures in excess of 180 °C. Let’s take a look at why this device is superior and what prospects it offers for various industries.

Game-changing technology.

The MediCleanTec Micro Cleaner steam generator’s efficiency is based on a unique combination of parameters:

– 9 bar pressure ensures deep penetration of steam into micro-cracks, pores and hard-to-reach areas unattainable by traditional cleaning methods.

– Temperatures above 180 °C guarantee the destruction of 99.99% of pathogens, including bacteria, viruses (e.g. SARS-CoV-2), fungi and spores, without the use of chemicals.

– Dry vapour (less than 5% humidity) prevents damage to surfaces, electronics and materials, which is especially important for sensitive equipment in laboratories or medical devices.

This technology complies with strict disinfection standards such as EN 14885 and ISO 15883, confirming its reliability.

Advantages of the MediCleanTec Micro Cleaner steam generator over competitors.

1. environmental friendliness and safety.

Unlike competitors who use aggressive chemicals, the MediCleanTec Micro Cleaner steam generator uses only water. This eliminates the risk of allergic

reactions, chemical burns and environmental contamination, making it ideal for childcare centres and food processing facilities.

2. economic benefit.

Reduced disinfectant procurement and chemical waste disposal reduces operating costs by 30-40%. In addition, the speed of processing (up to 50% faster than manual methods) reduces labour costs.

3. Versatility and conservation of surfaces.

Competitors are often limited to the type of surfaces due to the risk of corrosion or soaking. The dry steam of the MediCleanTec Micro Cleaner steam generator is safe for fabrics, plastic, metal and even electronics, expanding applications from sterilising surgical instruments to cleaning kitchen hoods.

4.Long-term effectiveness.

Research shows that bacteria do not develop resistance to heat treatment, unlike chemical agents. This provides a consistently high level of protection without the need to change reagents.

Product features.

1. Temperature sensors: heat monitoring‘’’

The basis for the safety of the ‘MediCleanTec Micro Cleaner’ are the intelligent temperature sensors. They continuously monitor the heating level inside the unit, preventing overheating that could lead to:

– Damage to internal components.

– Deformation of the housing.

– Potential fire.

How does it work?”’

Sensors react instantly when a preset temperature range is exceeded (e.g. above 120°C). At a critical increase, the system signals the controller, which stops

heating. This not only protects the unit, but also reduces the risk of burns to the user.

2. Pressure sensors: prevention of accidents‘’’

Steam generators generate steam at high pressure, which can cause depressurisation. The ‘MediCleanTec Micro Cleaner’ has pressure sensors that:

– Monitor the pressure level in the tank.

– Inhibit operation if a safe threshold is exceeded (e.g. more than 3 bar).

Important!

When the pressure sensor is triggered, the unit automatically vents excess vapour through an emergency valve, minimising the risk of explosion or damage.

3. automatic shutdown in case of overloads‘’’

The automatic shutdown function is a multi-level protection that is activated in the following cases:

– Thermal overload: prolonged operation without pause.

– Power failures: power surges or short circuits.

– Mechanical faults: blockages in the steam line or a defective heating element.

Advantages of the system:”’

– Instant shutdown in the event of an overload.

– Reduced wear and tear on components and extended service life.

– Error indication on the display for easy diagnosis.

4. Benefits of integrated safety systems”’

– User protection: minimises the risk of burns and injuries.

– Compliance with standards: the device complies with IEC 60335 (household appliance safety) and medical requirements.

– Saves on repairs: prevents serious breakdowns.

The MediCleanTec Micro Cleaner steam generator combines high performance with reliable safety systems. Temperature and pressure sensors as well as automatic overload shutdown make it the ideal choice for applications where sterility and safety are critical.

Environmental benefits of the MediCleanTec Micro Cleaner steam generator.

With the growing emphasis on sustainability and reducing ecological footprints, technologies that combine efficiency and care for nature are becoming key. The MediCleanTec Micro Cleaner steam generator is a prime example of this approach. This device not only provides a spotless clean, but also minimises environmental impact. Let's look at how its use contributes to the preservation of the planet.

Conventional cleaning products contain aggressive chemicals (phosphates, chlorine, surfactants) that end up in wastewater, upsetting the balance of aquatic ecosystems and poisoning the soil. 'MediCleanTec Micro Cleaner' replaces chemistry with powerful steam, the temperature of which reaches 120-150°C. This is enough to dissolve grease, kill bacteria and viruses (including E. coli and Staphylococcus aureus) without a single drop of detergent.

The result is a reduced toxic load on rivers, lakes and groundwater.

Every year, millions of plastic bottles from cleaning products end up in landfills or in the ocean, taking hundreds of years to decompose. A steam generator eliminates the need for these products, and its compact design and durability (thanks to durable materials such as stainless steel) reduce the frequency of unit replacement.

The MediCleanTec Micro Cleaner steam generator is designed with energy saving in mind:

– Fast water heating (less than 5 minutes) due to innovative thermal insulation.

– Low energy consumption (up to 1500 W) compared to traditional cleaning methods that require repeated use of electronics and hot water.

The result is a 25-30% reduction in CO_2 emissions compared to the combined use of hoovers and detergents.

The steam generator uses up to 50% less water than standard wet mopping due to the spot steam delivery. For example, to clean 10m² of floor requires only 0.5 litres of water compared to 2-3 litres with conventional washing.

The manufacturer of the MediCleanTec Micro Cleaner pays attention to the life cycle of the device:

– Repairability: the modular design allows individual components to be replaced.

– Use of recycled materials in packaging and certified alloys.

– Compliance with Energy Star and EU Ecolabel standards.

The author of the discovery – Dr. Friedrich (Fritz) Pattis, AU and MEDECOCLEANTECGMBH, AUSTRIA A sample of the innovative steam generator 'MediCleanTecMicroCleaner' was submitted for study and evaluation to the research laboratory of integrative medicine – department 'ECOCONTROL' at the International University of Fundamental Learning (STUDIJŲ UNIVERSITETASTARPTAUTINISFUNDAMENTALIŲ Vilnius, Lithuania, to analyse the efficiency, harmlessness to humans and animals, hypoallergenicity of the innovative steam generator 'MediCleanTecMicroCleaner'.

The following test microorganisms were selected to study the bactericidal efficiency of the 'MediCleanTec Micro Cleaner':

– Staphylococcus aureus (pc 906) or (pc ATCC N 6538-P), Listeria monocytogenes (pc 766) – to evaluate the bactericidal activity against Gram-positive bacteria;

– Escherichia coli (Pcs. 1257) or (Pcs. ATCC 10536),

– Pseudomonas aeruginosa (w/w ATCC 27853 (F-51) or (w/w ATCC 15442),

– Salmonella typhimurium (pc ATCC 13311) – to assess bactericidal activity against Gram-negative bacteria.

The test microorganisms were cultured on the following nutrient media: E. coli, S. typhimurium, P. aeruginosa and S. aureus – on casein broth, meat-peptone broth, Endo agar, casein agar, meat-peptone agar (hereinafter – MPA), etc. at the temperature plus (37±1)°C for 18-24 hrs.

When using the steam generator 'MediCleanTec Micro Cleaner' statistically and clinically significant reductions in the level of pathogenic microorganisms, viruses and fungi contamination of control surfaces were determined.

It is established that in the process of using the steam generator 'MediCleanTec Micro Cleaner' it does not have a harmful effect on humans and their environment.

It is especially noted that the steel AISI 304, used for manufacturing of the boiler of the steam generator 'MediCleanTec Micro Cleaner', has a number of significant advantages, such as high resistance to destruction from corrosion during operation in aggressive environments, ability to work under the influence of salty, fresh, tap water, increased resistance to oxidising processes, alkaline solutions, good plasticity, tolerance to significant temperature fluctuations, which allows AISI 304 steel to operate in the temperature range from -200 ℃ to +650 ℃. In addition, the steel is resistant to highly concentrated acids – acetic, formic, nitric and others, low degree of magnetism and environmental safety – the alloy does not absorb any substances, including toxic.

Austenitic structure of the stainless alloy of this steel grade is given by alloying with chromium, nickel, copper and manganese. These elements significantly affect the corrosion resistance of 304th AISI steel, its strength.

The device demonstrates that modern technology can combine efficiency, resource saving and care for nature. Switching to steam is a step towards cleanliness without compromise, where every cleaning becomes a contribution to preserving the planet for future generations.

Literature

1. Aleksandrov A.A., Grigoriev B.A. 'Tables of thermophysical properties of water and water vapour'. Moscow: MPEI Publishing House, 1999

2. Vukalovich M.P. 'Thermodynamic Properties of Water and Water Vapour'. M.: Mashinostroenie, 1969.

3. Arkharov A.M., Martynova O.I. ‘Heat Engineering and Steam Application in Industry’. SPb.: Politechnika, 2007.

4. Kirillov I.I., Yurenev V.N. ‘Reference book on heat power engineering and heat engineering’. Moscow: Energoatomizdat, 1984.

5. Rivkin S.L., Aleksandrov A.A. ‘Thermodynamic Properties of Water and Water Vapour’. M.: Energoatomizdat, 1984.

6. Cengel Y.A., Boles M.A. ‘Thermodynamics: An Engineering Approach’. McGraw-Hill Education, 2022 (9th ed.).

7. Moran M.J., Shapiro H.N. ‘Fundamentals of Engineering Thermodynamics’. Wiley, 2020 (9th ed.).

8. Rogers G.F.C., Mayhew Y.R.. ‘Engineering Thermodynamics: Work and Heat Transfer’. Longman, 1992.

9. ASME (American Society of Mechanical Engineers) ‘ASME Steam Tables: Thermodynamic and Transport Properties of Steam’. ASME, 2016.

10. Kearton W.J. ‘Steam Turbine Theory and Practice’. Pitman Publishing, 1958.

11. Smith J.M., Van Ness H.C., Abbott M.M. ‘Introduction to Chemical Engineering Thermodynamics’. McGraw-Hill, 2017 (8th ed.).