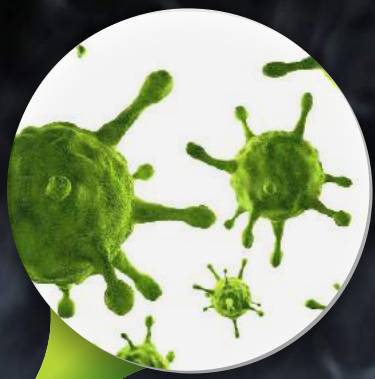
ICS dry ice cleaning systems®

The coolest way to clean...



05/2020

CASE STUDY

EFFICIENCY OF DRY ICE BLASTING TECHNOLOGY IN CLEANING AND DISINFECTING SURFACES AND EQUIPMENT IN THE FOOD INDUSTRY

ilac-MRA SNAS Reg. No. 057/S-075

FOOD INDUSTRY

HYGIENE FIRST

In the food industry, lives are literally at stake. Bakeries, dairies, meat processing facilities and dozens of other operations produce thousands of tonnes of food every day while maintaining flawless sanitation of their production lines. It takes only a microscopic, invisible speck of contamination, and the consequences may be tragic: severe food poisoning, allergic reactions and health problems.

The State Agriculture and Food Inspection issues dozens of food safety warnings each year.

Difficult to find a compromise

Cleanliness in operations is defined according a set of legally binding hygiene regulations, and in practice it is usually supervised by a Quality Manager. This person has a difficult task: ensuring the plant is kept clean without disrupting continuity in production processes, and also making sure products are delivered to customers on schedule. It is not easy to balance these two require-ments. Without proper maintenance, any produced food poses a serious health risk to consumers. If deliveries are delayed, the food company risks sanctions and high contractual penalties.

The reality of food establishments

It takes only a few seconds for residue to form and clog a machine. Dough, molasses and other viscous raw materials can spread throughout a production area and get into belt conveyors, combi ovens or packaging equipment. In meat production, bacterial contamination is a risk. Contamination of raw materials with nut shells introduces undesirable allergens.

Many establishments clean production residues manually. Cleaning and the sanitation of a single production line may take several days. Production has to be shut down, production equipment needs to be disconnected from power and allowed cool down, and sufficient qualified workers are needed for maintenance and to organize their work. An alternative in the form of high-pressure water cleaning creates hectolitres of liquid waste which needs to be pumped out and disposed of. This creates high costs and environmental burdens and also requires waiting for machinery to dry before it can recommence operation.

Dry ice blasting (solid carbon dioxide) has been now used for decades in western countries. The US FDA (Food and Drug Administration) recommends this technology for use in food establishments as the best possible cleaning method.

Cleaning with dry ice pellets reduces downtime to a fifth. Dry ice is not conductive or abrasive, can be applied to hot surfaces, and does not create any secondary waste:

- No need to disconnect or dismantle machinery or production lines
- Cleaning is part of the production process
- Cleaned equipment needs no disinfection afterwards

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2020 | Skúšobňa VETLAB spol. s r.o.
laboratórium je akreditované SNAS na skúšanie
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MICROBIOLOGICAL FINDING

02| TEST

Laboratory diagnostics of bacterial samples from equipment surfaces, mainly from food industry establishments, collected before and after cleaning with innovative dry ice blasting technology by ICS Ice Cleaning Systems s.r.o.

01| DRY ICE

Dry ice is the solid form of CO_2 (carbon dioxide) at a temperature of -79 °C. Dry ice is non-toxic, odourless, inhibits the growth of bacteria, fungi and spores, and reduces biological contamination. It reduces the development of yeast and other bacteria which cause problems in breweries, bakeries and other establishments with environments that have higher temperatures and humidity. Removing these contaminants with detergents and aggressive chemicals is not compatible with hygiene regulations.

SUBJECT OF THE TEST

Product: Two swabs

- before and after use of dry ice blasting technology

TEST PARAMETERS

Date test sample received at the testing laboratory: 27.04.2020

Sample received at a temperature of 6 °C.
Test result performed on: 27–30.04.2020

CHARACTER GROUP

Microbiological finding: Staphylococci, Pseudomonas aeruginosa, Enterobacteriaceae, yeasts, moulds, coliform microorganisms, TPC

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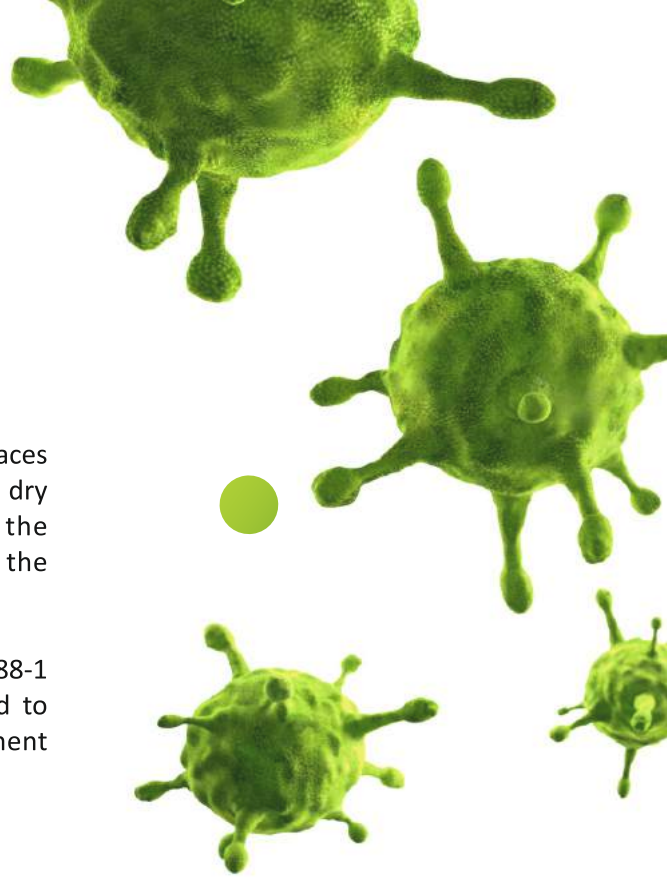
03| MEASUREMENT



Dry ice cleaning equipment and dry ice pellets were provided by ICS Ice Cleaning Systems s.r.o. Dry ice particles were produced from liquid carbon dioxide with a pelletizer. The pellets were applied to surfaces using dry ice blasting equipment. The amount depended on the degree of surface contamination (around 20 kg of 3.0 mm dry ice pellets). Pressure was set at 3–5.5 bar (max).

Smears were taken from surfaces immediately before and after dry ice application to evaluate the overall effect of dry ice on the microbial population.

Standard methods EN ISO 6888-1 and ISO 21527-2 were applied to obtain samples from equipment surfaces.

Parameter	Value		Efficiency	Method	Protocol
Stafylococci	swab 1	4000 CFU	98,75%	M6, M50 STN EN ISO 6881-1 STN EN ISO 6881-1/A1 STN ISO 18593	2022-2023/2020
	swab 2	50 CFU			
Pseudomonas aureginosa	swab 1	7500 CFU	99,90%	M4, M50 STN EN ISO 13720 STN ISO 18593	2022-2023/2020
	swab 2	< 10 CFU			
Enterobacteriaceae	swab 1	5300 CFU	99,90%	STN EN ISO 21528-2 STN ISO 18593 M50	2022-2023/2020
	swab 2	< 0,1 CFU			
Yeasts	swab 1	9100 CFU	99,90%	STN ISO 21527-2 STN ISO 21527-2/O1 STN ISO 18593 M50	2022-2023/2020
	swab 2	< 10 CFU			
Moulds	swab 1	350 CFU	97%	STN ISO 21527-2 STN ISO 21527-2/O1 STN ISO 18593 M50	2016-2017/2020
	swab 2	< 10 CFU			
Coliforms	swab 1	1600 CFU	99%	STN ISO 4832 STN ISO 18593 M3, M50	2022-2023/2020
	swab 2	< 10 CFU			
TPC	swab 1	20 CFU	99%	STN ISO 4833-1 STN ISO 18593 M2, M50	2024-2025/2020
	swab 2	< 0,1 CFU			

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04| RESULTS

The results of all smear samples taken after dry ice blasting indicated a significant reduction of contaminants from equipment surfaces. The largest reductions were in yeast, Pseudomonas aeruginosa and Enterobacteriaceae, with an efficacy of almost 100%. Fungi present on the surfaces were reduced by 97% after dry ice application; staphylococci and coliform microorganisms on the surface samples were reduced by 99%.

05| CONCLUSION

The cleaning effect of dry ice pellets weakens the bond between contaminants and surfaces by inducing a thermal shock. Another benefit of dry ice blasting is elimination of secondary waste and solvents without the need to shut down and disrupt the continuity of production processes.

The effect of the CO_2 pellets was observed on all identified microorganisms on the tested surfaces. This effect was caused by the combined action of kinetic energy from the impact of pellets, direct sublimation of CO_2 pellets to gas, which rapidly multiplies the CO_2 volume by 700–800x, and thermal shock at -78.5 °C.

Many physical decontamination methods comparable to dry ice cleaning are available, for example, cleaning with water, air cooling or high-pressure water, but dry ice is much more effective than any of these combined methods. Unlike high-pressure water cleaning, ice blasting has a bactericidal effect.

After using dry ice cleaning technology, 100% of all burnt and greasy residues were removed, even from hard-to-reach parts of machines. The total amount of yeast, fungi and microorganisms from the samples collected were reduced by almost by 99% as a result of dry ice blasting.

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