

**THE IMPORTANCE OF TESTING OF THE EFFECTIVENESS
OF DISINFECTANTS**

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Summary

Technological operation processes in primary milk production and food industry inevitably include regular cleaning and disinfection. The selection of a suitable disinfectant depends on many factors. The most important are the devitalisation effectiveness of the active chemical ingredient and its residua in the environment.

Our study focuses on comparison and evaluation of the results of testing of some new disinfectants using various bacterial strains. The results obtained indicate that the concentrations recommended by the producers exhibit frequently insufficient effectiveness under practical conditions with respect to devitalisation of germs.

Key words: devitalisation, residua, suspension test, protein load

Introduction

Disinfection is a part of sanitation measures that focus in general on elimination of unwanted microflora from the environment. The aim of disinfection within the veterinary care activities is to eliminate pathogenic microflora that causes infectious diseases of animals or harmful microflora that decreases the quality of products of the food industry. The methods most frequently used for these purposes are based on chemical disinfectants.

Cleaning preparations and disinfectants are an inevitable part of production and processing of all foodstuffs, particularly of those of animal origin.

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Everyday use of these preparations has eliminated successfully a range of infections and decreased the risk of microbial contamination. However, their selection and everyday use should be based on thorough knowledge of their properties. Cleaning preparations and disinfectants used in the food industry should exhibit very high ability to devitalize microorganisms already at low concentrations, should not induce resistance in microorganisms or leave residues and increase the load on the environment. Their corrosive effects should be minimal. Their recommended and used concentrations must not cause health disturbances in humans or affect negatively the quality of food or raw materials of animal origin.

It is not a simple task to comply with these requirements and, at the same time, to respect the specificity of individual branches of food production and the technical and economical requirements on the availability of such preparations.

Material and methods

Tests were carried out to evaluate commercial disinfectants based on quarternary ammonium salts QVART 3 and TRIOSEPT, recommended for disinfection in the food industry and in animal production.

Bactericidal effectiveness was evaluated by testing under laboratory conditions. The tests were carried out using the following methods:

- suspension test - official standard method (AOAC, 1984)
- method according to Poljakov (1969).

The tests were conducted using *E. coli* (strain CCM 5172) as Gram negative microorganisms, *Staphylococcus aureus* (strain CCM 2022) as a representative of Gram positive microorganisms and *Mucor fragilis* (strain F 236) from the group of moulds.

Values of pH and concentration of aldehydes were determined in all the tested solutions.

Results and discussion

In addition to conventional disinfectants, cleaning and disinfection in the food industry is carried out increasingly using commercially produced disinfectants.

At the present, the commercially produced and supplied disinfectants contain several substances with disinfecting action. Such combinations should exhibit both high bactericidal effectiveness and very low toxicity not only to humans but also to foods and the environment.

The combined disinfectants contain usually some compounds that facilitate the penetration of the preparation into the bacterial cell, increase wettability and eliminate surface tension. Their corrosive effects should be low and some contain also anticorrosive components.

The commercial preparation TRIOSEPT is, according to the producer's data, highly effective disinfectant produced on the basis of quarternary ammonium salts, alcohol, and surfactants. It should be non-toxic, biologically unharmed and rapidly degradable. It should be effective to moulds and bacteria.

TRIOSEPT is recommended for disinfection in milk, meat-processing and other branches of food industry and also for disinfection of freezing stores and transportation means. The recommended concentration is 0.5-1% and exposure time 30 min.

The disinfectant QVART 3 is a highly effective preparation based on quarternary ammonium salts, alcohol, and aldehydes. The combination of these substances ensures its good wetting and penetrating effect and an in-depth action. The manufacturer recommends its use to devitalize moulds, bacteria and viruses. For preventive disinfection in animal houses 1% concentration and 30 min exposure time is recommended. For special disinfecting purposes the concentration should be increased to 2% and exposure time to 1 h.. After the respective exposure time it is necessary to air the houses and rinse the drinkers and feeders. The preparation can be applied by means of high-pressure sprayers but also by applying solutions to disinfectant mats.

The results of testing of the two disinfectants by the suspension test are presented in Table 1. This table shows that both disinfectants showed good bactericidal effect on the test strains *E.coli* and *S.aureus*. The concentration of 0.01% of both disinfectants tested was effective against *E. coli* already after 5 min exposure and against *S. aureus* after 20 min exposure. *Mucor fragilis* was devitalized by 0.5% concentration after 20 min. exposure.

The results of testing of disinfectants QVART 3 and TRIOSEPT by the method of Poljakov with 10 min exposure and incubation at 37°C are presented in Tab. 2. QVART 3 showed bactericidal effects against *E.coli* at 0.019% concentration while 0.02% concentration devitalized reliably *S. aureus* after 10 min exposure. Disinfection effect of QVART 3 on the tested *Mucor fragilis* was observed at concentration of 0.19%. The second tested disinfectant TRIOSEPT showed better disinfectant effect on *Mucor fragilis* (0.1%) and the concentration of 0.02% acted on *E.coli* and 0.03% on *S. aureus*.

Table1. - TESTING THE DISINFECTANTS QVART 3 A TRIOSEPT BY THE SUSPENSION TEST

E coli	Concentration in %				
	0.01	0.1	0.5	1.0	2.0
Exposure in min.					
5	-	-	-	-	-
20	-	-	-	-	-
60	-	-	-	-	-
<i>S. aureus</i>					
5	+	-	-	-	-
20	+	-	-	-	-
60	-	-	-	-	-
<i>Mucor fragilis</i>					
5	+	+	+	-	-
20	+	+	-	-	-
60	+	+	-	-	-

Table 2. - TESTING THE DISINFECTANTS QVART 3 (1) AND TRIOSEPT (2) BY THE METHOD OF POLJAKOV

Concentration in %	Bacterial strain					
	E coli		S. aureus		Mucor fragilis	
	1	2	1	2	1	2
0.019	+	+	+	+	+	+
0.013	-	+	+	+	+	+
0.02	-	-	-	+	+	+
0.03	-	-	-	-	+	+
0.04	-	-	-	-	+	+
0.05	-	-	-	-	+	+
0.07	-	-	-	-	+	+
0.10	-	-	-	-	+	-
0.14	-	-	-	-	+	-
0.19	-	-	-	-	-	-
0.27	-	-	-	-	-	-
0.37	-	-	-	-	-	-
0.52	-	-	-	-	-	-

The concentration of hydrogen ions of 0.1% disinfectant solution of QVART 3 was 7.76, and of 1% solution 7.3. For the preparation TRIOSEPT the pH values of 0.1% - 1% were 7.99 - 7.68.

Analysis of the tested preparations included determination of concentration of aldehydes. The preparation QVART 3 contained 8.5% of aldehydes while their concentration in TRIOSEPT reached 5.5%.

L i n t o n et al. (1989) reported that quarternary ammonium salts are highly effective against Gram positive microorganisms already at concentration of 0.0005 %. Higher concentrations (0.003%) are lethal to Gram negative microorganisms. QAC are not effective against mycobacteria. Their effectiveness is higher in alkaline compared to the acidic environment. The mechanism of their effect is based on reaction with phospholipids in the cellular membranes and can cause denaturation of proteins.

When testing combined disinfectants one should consider the possibility of development of new reactions that can occur after application of cleaning preparations and disinfectants. It is also necessary to point to the fact that some anionic surfactants (soaps), may lose their microbicidal effect after coming into contact with some disinfectants, e.g. quarternary ammonium salts.

Conclusion

Chemical disinfectants cannot be assessed reliably only on the basis of the concentration of the active chemical substance or only a single substance because an interaction with other basic substances in the preparation may occur and affect, for example, pH, solubility, and particularly the disinfectant effect on bacterial strains.

Activity spectrum of disinfectants cannot be predicted only on the basis of their formulations. Generally, it is inevitable to subject each formulation to laboratory tests applying them to a spectrum of microorganisms by means of specific test methods. After the laboratory tests, testing under practical conditions should follow to prove the effect of preparations not only on pure cultures but also under specific conditions.

The most important aspect in disinfection practice, either in animal or food production, is that preference should be given to preparations to which resistance does not develop and which do not put load on the environment.

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VAŽNOST TESTIRANJA EFIKASNOSTI DEZINFICIJENSA

Sažetak

Tehnološki postupci u primarnoj proizvodnji mlijeka i prehrambenoj industriji obavezno uključuju regularno čišćenje i dezinfekciju. Izbor prikladnog dezinficijensa ovisi o više faktora. Najvažnije je oslabljujuća djelotvornost kemijskih sastojaka i njegovi ostaci u okolišu. Naša istraživanja usmjerena su na uspoređivanju i vrednovanju rezultata testiranja nekih novih dezinficijensa koristeći razne bakterijske osobine. Rezultati su pokazali da je količina koju preporučaju proizvođači često nedovoljna u praktičnim uvjetima s naglaskom na oslabljivanje klica.

Ključne riječi: devitalizacija, ostaci, test suspenzije, proteinski

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