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# Activity of washing-disinfecting means "San-active" for sanitary treatment of equipment of meat processing enterprises in laboratory and manufacturing conditions

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**Abstract**

The article presents the results of the research of the new detergent agent "San-active" for meat processing enterprises. It was established that "San-active" in the concentration from 0.3 to 2.0% is moderately alkaline (concentration of hydrogen ions is 11.44–12.7), at a concentration of 2.5% and above, with very alkaline pH ≥ 13.11 units. In the "San-active" detergent, at the concentration from 0.3 to 2.5%, the surface tension is 34.97–28.24 mN/m. The absorbability of the parts of the technological equipment with the solutions of the "San-active" means sharply increases with increasing concentration. At the temperature of solutions of the medium 19.0 ± 1.0 °C the angle of wetting decreases from 69.8 degrees. at a concentration of 0.3% to 50.5 degrees. at a concentration of 2.5% (in 1.4 times). It has been established that "San-active" in 0.5% concentration provides the bactericidal effect on test cultures of conditionally pathogenic bacteria, spore-forming microorganisms and fungi. The "San-active" agent at 0.5% concentration is bactericidal to *S. aureus* and *E. faecalis* cells that are in a biofilm in 10 minutes of exposition. For the inactivation of *E. coli* and *P. aeruginosa* cells in a biofilm, it is necessary that the "San-active" acts in a concentration not lower than 0.5% and not less than 30 minutes. The agent shows a washing effect on the evaluation of "good" at 0.5% concentration, and 1.0% and above the concentration on the score "excellent". "San-active" in the concentration from 1.0 to 2.0% shows very weak corrosion activity on stainless steel. The use of "San-active" detergent for the sanitary treatment of equipment surfaces in the intestinal workshop at the concentration of the working solution 1.0–2.0% and the temperature 60 ± 5 °C for 20 minutes provides 99.9–100% efficiency of sanitary treatment.

**Key words**: bactericidal action, corrosion, sanitary treatment, "San-active" agent, meat-processing enterprises.

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## 1. Introduction

An important condition for the production of products of animal origin, in particular meat and meat products, is the careful sanitation of processing equipment throughout the entire range from slaughter to the packaging and storage of the product. (Jessen and Lammert, 2003; Sun, 2014; Marriott et al., 2018). Technological equipment must be subjected to such sanitary treatment, in which the "residual" microflora would not affect the safety and quality indicators of the raw material and the finished product (Abdallah et al., 2014; Kukhtyn et al., 2017). Thus, in accordance with the recommendations on sanitary-microbiological study of flushing out of surfaces of objects of veterinary supervision and control, in samples taken from equipment at meat-packing plants and slaughter enterprises, the total number of microorganisms in 1 $cm^3$ of washings, taken from 100 $cm^2$ of the area should not exceed 1 000 CFUs, and the TBC titre should be greater than 1.0 (Bekker et al., 2011). In order to ensure the compliance with the microbiological indicators of the sanitary state of objects, the careful sanitation of all equipment using modern detergents and disinfectants should be carried out (Varzakas and Tzia, 2015; Kukhtyn et al., 2017; Kovalenko et al., 2018). There are such disinfectants for meat industry on the Ukrainian market as: "Virosan", "Bioclore", "Catryl-Dez" and detergents "Santana", "Bioshaum", "Chistoprom" and others. There are practically no remedies for combined washing-disinfectant agents, there are only disinfectants with a cleansing effect, in particular, "Chlorantoin". The importance of developing of washing-

disinfectants is that they combine two important properties - washing and disinfection (Knape et al., 2015; Meireles et al., 2016). This is exactly why "San-active", a washing-disinfectant, was developed by us, which active substances are CHAS, surfactants, alkali, complexones and corrosion inhibitors.

*The purpose of the work* was to investigate the bactericidal properties of the "San-active" agent in relation to test cultures of conditionally pathogenic bacteria, spore-forming microorganisms and fungi; cleaning properties and corrosion of stainless steel to determine the efficiency of sanitary treatment of technological equipment in the intestine workshop of meat processing enterprises.

## 2. Materials and methods

When determining the solubility of the washing-disinfective agent "San-active", 50 cm3 of the agent in small portions of 10 $cm^3$ was introduced into a glass cylinder of 50 $cm^3$ of distilled water, stirring constantly with a glass rod. The solubility of the substance in $cm^3$ per 100 $cm^3$ of water was determined by the formula:

$$X = \frac{(P - P_1) \times 100}{Ó}, \text{ where}$$

$P$ – number of the researched agent taken in the experiment, ($cm^3$);

$P_1$ – remains of the agent after the experiment, ($cm^3$);

$ó$ – volume of solvent, ($cm^3$).

The research on the determination of the surface tension of the solutions of the "San-active" solution was carried out with the aid of the Traube stamagumometer.

The research on the determination of the foaming capacity of the solutions of the "San-active" agent was carried out using the Ross-Miles device, and the results obtained in percentages were calculated using the formula:

$$X = \frac{H_0 \times 100}{H}$$

where, $H_0$ − initial foam volume (mm);

$H$ − column height of the investigated solution, (mm).

The resistance of the foam was determined by the formula:

$$Ó = \frac{Í_{10}}{Í_0}$$

where, $H_{10}$ – reduction of foam for 10 minutes.

Investigation of the wetting capacity of solutions of the "San-active" was carried out by measuring the marginal angle of wetting on the boundary between the phase separation of the solution-air-solid surface using the X-13 device at a temperature of 19 ± 1 °C and 55 ± 5 °C.

Determination of the bactericidal concentration of the "San-active" agent was carried out using *E. coli, P. aeruginosa, S. aureus, E. faecalis, B.cereus, B. subtillis, Candida spp.* and *Penicillium spp* test cultures. Additionally, cultures were tested for temperature stability, phenol and chloramine (Kukhtyn et al., 2017). The daily culture bacteria were prepared in a 0.85% solution of sodium chloride containing bacterial cells of 1 bcm/$cm^3$ according to the optical standard of turbidity. Different concentrations of solutions were prepared from the detergent and disinfectant, they were introduced in 10 $cm^3$ of a Flourinsky jar and heated to a temperature of + 60 ± 5 °C in a water bath. 0.1 $cm^3$ of 1 billion bacterial cells were injected to concentrations of the substance. The compound was stirred and after 10, 20, and 30 minutes, 1 $cm^3$ of solution was taken and put into Petri cups filled with 15 $cm^3$ of nutrient medium. The presence of microorganisms of test cultures after the action of the detergent and disinfectant was determined according to generally accepted methods in microbiology. The control was 0.3% of the working solution of chloranthine. Exposure of 10, 20 and 30 minutes was chosen depending on the time, which is usually spent on the processing of milking equipment in the production environment.

The degree of corrosion activity was determined according to the generally accepted method. Samples of metals were used in the experiments, from which the technological equipment of the meat processing enterprises was manufactured: aluminum, stainless and zinced steel, sizes 50 x 20 mm and thickness from 1 to 4 mm.

The determination of the washing effect was carried out on plates of stainless steel and glass size 10 × 10 $cm^2$. The surface of these plates was pre-applied with a layer of pork fat (mist), which was added 10% of soot and dried at room temperature for two days. Then, using a gauze swab, the plates were washed with the investigated agents. The evaluation of the results was made visually, paying attention to the level of cleanliness of the plates according to the following criteria:

- absence of washing effect, estimation "bad" – the surface of the plates dirty, fatty;
- wash effect is "insignificant" – the surface of the plates is cloudy, oily, it is possible to have single particles of contamination;
- mark "good" – the surface of the plates has a clean appearance, but after rinsing, the water is collected in a drop, when the liquid is applied, to indicate the fatty film appear yellow spots or streaks of colored fat;
- mark "excellent" – the surfaces of the plates are clean, wettability is uniform, even after applying the liquid to indicate the fatty film, the absence of yellow stains and bands.

The obtained research results were processed statistically using programs Microsoft Excel and Statistics 6. The difference was considered probable at $P \leq 0.05$; $P \leq 0.01$ and $P \leq 0.001$.

## 3. Results and discussion

Studies are needed in the development of detergents for the food industry to determine the solubility and dissolution rates (Da Costa Luciano et al., 2016). All detergents should be readily dissolved in water to prevent sediment deposition on the surfaces of technological equipment parts (Le Maire et al., 2000; Seddon et al., 2004; Kowalska, 2016). Therefore, at the dissolution rate, washing-disinfectants are divided into fast-dissolving – dissolution time of 5 minutes, well-soluble – from 6 to 15 minutes and slowly soluble – more than 15 minutes.

We have found that at a temperature of 19 ± 1 °C and 55 ± 5 °C the solubility of the "San-Active" was 100, and in the time of dissolution it turned out to be rapidly soluble, the solution dissolved for 30 minutes. This indicates that the detergent can be used under normal production conditions and dissolve at a temperature of 19 ± 1 °C and at a temperature of 55 ± 5 °C.

In order to separate fat deposits on surfaces of the technological equipment and objects of the environment of slaughter shops and meat processing enterprises, it is neces-

sary that the agents show good sinking property that depends on the pH of solutions (Cazelle et al., 2015).

Fig. 1 shows the dependence of the pH of solutions of the "San-active" on its concentration.

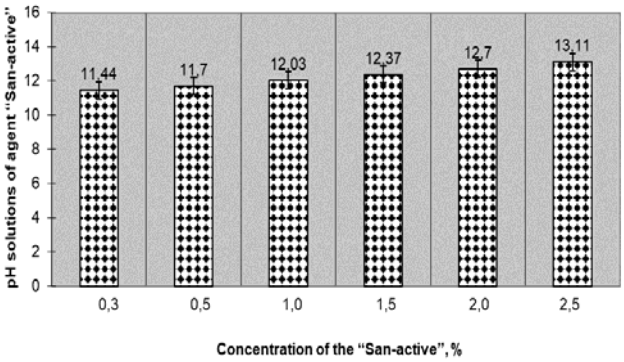


**Fig. 1.** pH solutions of agent "San-active" depending on its concentration

As it can be seen from the data in Fig. 1 solutions of the "San-active" agent at a concentration of 0.3 to 2.0% were moderately alkaline (concentration of hydrogen ions was 11.44–12.7), at a concentration of 2.5% and above, a very alkaline pH ≤ 13.11 units. This indicates that such concentrations will have a good hydrolysis of fats.

It was found that the surface tension of distilled water is 72.72 ± 0.15 mN/m. In solutions of detergents and washing-disinfectants, surface tension should be lower, compared with water (Li et al., 2015). According to normative documents, the value of the surface tension for solutions of detergents and washing-disinfectants, used for sanitary treatment of technological equipment at food industry enterprises, should not exceed 60 mN/m.

Fig. 2 shows results of investigations of the surface tension of solutions "San-active", depending on its concentration.

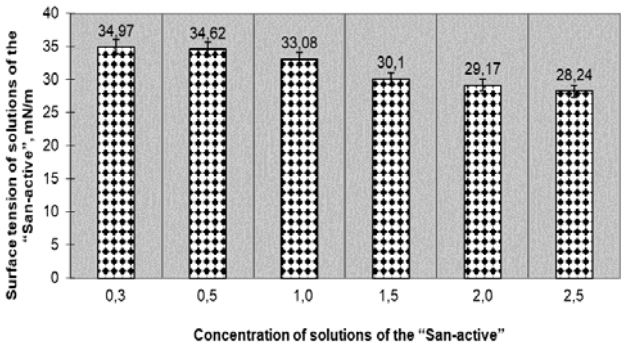


**Fig. 2.** Surface tension of solutions of the "San-active" depending on its concentration

As can be seen from the data shown in Fig. 2, that with increasing concentration of solutions of the "San-active" solution, there is a decrease of the surface tension. In the "San-active", at a concentration of 0.3%, the surface tension was 34.97 mN/m. It is evident from this fact that solution of the detergent in the concentration of 0.3% and above have good washing properties.

In order to ensure the maximum washing effect of the working surfaces of processing equipment, it is necessary that the concentration of detergents and washing-disinfecting means has sufficiently wetting property (Yao and He, 2014). In accordance with the requirements for detergents and washing-disinfectants for the sanitary treatment of processing equipment, the marginal angle of wetting should not be more than 90%. Therefore, a dissolved detergent or washing-disinfectant is a liquid with a reduced surface tension, which has the best wetting and washing properties.

The results of studies on the wetting capacity of the solutions of the "San-active" are shown in Fig. 3

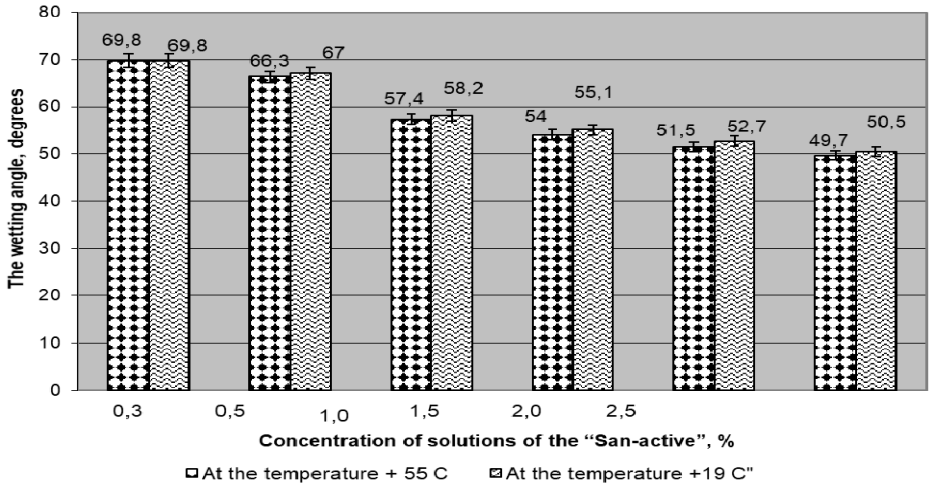


**Fig. 3.** The wetting ability of solutions of the "San-active" depending on its concentration

As can be seen from the abovegiven data, the wettability of the parts of the technological equipment with solutions of the "San-active" will sharply increase with increasing concentrations. At the temperature of the solutions of the detergent 19 ± 1 °C, the wetting angle increased from 69.8 degrees at a concentration of 0.3% of the detergent to 50.5 degrees at a concentration of 2.5%, i.e. in 1.4 times (P ≤ 0.01).

An increase in the temperature of solutions of the "San-active" to 55 ± 5 °C contributed to a growth of the wetting capacity by 1–1.5 degrees, compared with a temperature of 19 ± 1 °C.

Consequently, solutions of the "San-active" detergent, starting with 0.3% concentration, significantly increase the wettability of the surface.

During the sanitary treatment of processing equipment in the meat industry, detergents and washing-disinfectants with moderate foaming are used. If the detergents exhibit high foaming capacity, the washing process does not provide dissolving of contaminants.

The washing-disinfecting agent "San-active" showed a stronger antimicrobial effect on the gram-positive coccal form of the microflora, compared to gram-negative (Table 1).

**Table 1**

Influence of the "San-active" on the test culture of conditional-pathogenic bacteria in the suspension method, n = 36

| Name of the agent | Concentration, % | Test cultures of microorganisms | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *S. aureus* | | | *E. faecalis* | | | *E. coli* | | | *P. aeruginosa* | | |
| | | The duration of the agent action, min | | | | | | | | | | | |
| | | 10 | 20 | 30 | 10 | 20 | 30 | 10 | 20 | 30 | 10 | 20 | 30 |
| San-active | 0.1 | + | + | + | + | + | + | – | + | + | – | + | + |
| | 0.5 | + | + | + | + | + | + | + | + | + | + | + | + |
| | 1.0 | + | + | + | + | + | + | + | + | + | + | + | + |
| | 1.5 | + | + | + | + | + | + | + | + | + | + | + | + |
| Chloranthine | 0.3 | – | + | + | – | + | + | – | + | + | – | + | + |

*Notes:* "+" – bactericidal action; "–" – absence of bactericidal action

The bactericidal action on bacteria *S. aureus* and *E. faecalis* was observed in 10 minutes at 0.1% concentration. During this time, at a concentration of 0.1%, the agent did not inactivate the microorganisms of the *E. coli* and *Pseudomonas aeruginosa*. The bactericidal effect on the *Pseudomonas aeruginosa* and *E. coli*, at the same concentration, manifested after 20 minutes of action of the detergent. "San-active", in a concentration of 0.5%, provided bactericidal effect on all types of conditional-pathogenic bacteria taken in the experiment after 10 minutes of contact with microorganisms.

The detergent "Chloranthine" in the concentration according to the instructions for use, showed a bactericidal effect on all conditional-pathogenetic microorganisms in 20 minutes of an action.

The "San-active" agent at a concentration of 0.1% showed no bactericidal effect on spore-forming microorganisms *B. cereus, B. subtillis*, and fungi of genus *Penicillium* for 30 minutes. However, at this concentration and 30–minute action, the agent inactivated the *Candida spp. Fungi.* (Table 2).

**Table 2**

Influence of "San-active" on spore-forming and fungal microflora in the suspension method, n = 36

| Name of the agent | Concentration, % | Test culture of microorganisms | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *B. subtillis* | | | *B. cereus* | | | *Candida spp.* | | | *Penicillium spp.* | | |
| | | The duration of the agent action, min | | | | | | | | | | | |
| | | 10 | 20 | 30 | 10 | 20 | 30 | 10 | 20 | 30 | 10 | 20 | 30 |
| San-active | 0.1 | – | – | – | – | – | + | – | – | + | – | – | – |
| | 0.5 | – | – | + | – | – | + | + | + | + | – | + | + |
| | 1.0 | + | + | + | + | + | + | + | + | + | + | + | + |
| | 1.5 | + | + | + | + | + | + | + | + | + | + | + | + |
| Chloranthine | 0.3 | – | – | + | – | – | + | – | – | + | – | – | – |

*Notes:* "+" – bactericidal action; "–" – absence of bactericidal action

At the same time, a 0.5% solution of the agent showed a bactericidal effect on spore-forming microflora after 30 minutes, on fungi of genus *Penicillium* – after 20 minutes, and on yeast of the genus Candida – for 10 minutes.

Starting from 1.0% concentration, the "San-active" agent provided a bactericidal effect on spore-forming and fungal microflora for 10 minutes. The bactericidal action of the "Chloranthine" was similar to that of the "San-active" in 0.1% concentration.

According to the results of many studies, microorganisms have a major part of their existence in the environment in a self-generated protein-polysaccharide biofilm that protects them from environmental factors (Burmolle et al., 2006; Langsrud et al., 2016; Moretro and Langsrud, 2017). The planktonic form of its existence is used by microorganisms only for the colonization of other environmental objects (Abee et al., 2011; Coughlan et al., 2016). Therefore, for effective control of bacteria on the technological equipment of the meat processing industry with the help of disinfectants and detergents, evoke the necessity to study their effect on bacteria formed in biofilms.

The results of studies on the influence of the "San-active" on conditionally pathogenic microorganisms that are formed in the biofilm are given in Table. 3.

As can be seen from Table. 3, the "San-active" agent at 0.1% concentration did not exhibit bactericidal action on the conditionally pathogenic microorganisms present in the formed biofilm, even within 30 minutes of exposition. According to table 3, this concentration of the agent provided bactericidal action for 20 minutes of exposure to all conditionally pathogenic microorganisms in planktonic form, indicating an increased resistance of bacteria that are formed in a biofilm.

**Table 3**
Influence of "San-active" on conditional pathogenic microorganisms that are formed in a biofilm at a temperature of 60 ± 5 °C, n = 20

| Researched agent | Concentration, % | Test cultures of microorganisms which are formed in biofilms | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | *S. aureus* | | *E. faecalis* | | *E. coli* | | *P. aeruginosa* | |
| | | Duration of an action, min. | | | | | | | |
| | | 10 | 30 | 10 | 30 | 10 | 30 | 10 | 30 |
| San-active | 0.1 | – | – | – | – | – | – | – | – |
| | 0.5 | + | + | + | + | – | + | – | + |
| | 1.0 | + | + | + | + | + | + | + | + |
| | 1.5 | + | + | + | + | + | + | + | + |
| Control (Distilled water) | | – | – | – | – | – | – | – | – |

*Notes:* "+" – bactericidal action; "–" – absence of bactericidal action

The "San-active" agent at 0.5% concentration provided an inhibitory effect on bacteria *S. aureus* and *E. faecalis* for 10 minutes of actions. However, a ten-minute exposure at such a concentration did not provide complete bactericidal action on *E. coli* and *P. aeruginosa* cultures present in the biofilm. In order to achieve the death of the bacteria of the Pseudomonas aeruginosa and E. coli, which are in the biofilm, it is necessary that the working solution of the "San-active" agent should be at a concentration of not less than 0.5% at an exposure of not less than 30 minutes.

A slight difference in bactericidal concentration and exposure to microorganisms, which are both in planktonic form and formed in a biofilm, is explained by the high alkalinity of the working solutions of the agent with a pH of 12 and more units, as well as a high temperature of 60 ± 5 °C. The presence of alkali in the "San-active" and its use at high temperature provides hydrolysis and temperature denaturation of the matrix of biofilms, while the disinfectant of the catamenium AB exhibits bactericidal action.

Thus, the conducted researches indicate that the developed agent "San-active" can be used for neutralization of conditionally pathogenic bacteria, spore-forming and fungal microflora on the surfaces of objects of the meat processing industry in the concentration of working solutions of 0.5% and above 60 ± 5 °C and exposure not less than 30 minutes.

Washing-disinfectants, used in the meat and dairy industry, in addition to bactericidal action, should have a good washing effect on the mark well or excellent.

The study of the washing properties of the "San-active" was carried out in laboratory conditions. The agent was used at concentrations from 0.1 to 1.5% (Table 4).

**Table 4**
Washing capacity of the "San-active", n = 12

| Name of the agent | Temperature of the working solution, °C | Concentration of washing-disinfecting agents | Evaluation of washing effect |
|---|---|---|---|
| San-active | 60 ± 5 | 0.1 | Good |
| | | 0.5 | Good |
| | | 1.0 | Excellent |
| | | 1.5 | Excellent |
| Chloranthine | 35 ± 5 | 0.3 | Good |

As can be seen from Table. 4, the "San-active" agent at a concentration of 0.1–0.5% showed a good washing effect, and starting from 1.0% concentration – excellent. Consequently, the results indicated that, in order to provide an excellent washing effect of technological equipment at meat industry enterprises, the concentration of the "San-active" should not be lower than 1.0%.

At present, in meat processing enterprises, technological equipment mainly consist of stainless steel (Al-Adawi et al., 2016). Therefore, when developing the means for sanitary treatment of processing equipment, it is important to study the corrosion activity of such means for metal surfaces (Okafor et al., 2009).

Working solutions of detergents or disinfectants should not cause corrosion of metal parts of equipment for more than 2.0 g/m$^2$-year (corrosion rate), for stainless steel – 6.0 mg/m$^2$-hour.

Solutions of the "San-active" from 1.0 to 2.0% concentration exhibited a slight corrosion activity on stainless steel, which ranged from 0.01 to 0.03 g/m$^2$-year, which, respectively, was 200 and 66 times is smaller, compared to allowable indicators (Table 5).

The corrosion speed rate of 1.0–2.0% of solutions of the "San-active" did not exceed 0.16 mg/m$^2$-year. This indicated the possibility of its use for sanitary processing of technological equipment without damaging the working surfaces.

Production testing of sanitary processing of technological equipment in the intestinal workshop was carried out by the "San-active" washing-disinfectant according to the following scheme:

- rinsing the equipment with warm water at a temperature of 40–50 °C using the automatic device Karcher;
- hand washing with 0.5–2.0% solution of the detergent "San-active" at a temperature of 60 ± 5 °C for 20 minutes;
- the final rinse with water at a temperature of 40–50 °C with the help of the automatic device Karcher.

**Table 5**
Corrosive action of solutions of detergent "San-active" on stainless steel, M ± m, n = 9

| Name of the agent | Concentration of solutions of agents, % | Mass of samples | | Size of corrosion, g/m$^2$-year | Speed of corrosion, mg/m$^2$ – hours |
|---|---|---|---|---|---|
| | | Initial | in 182,5 h. | | |
| San-active | 1.0 | 2.625 ± 0.001 | 2.624 ± 0.001 | 0.01 | 0.05 |
| | 1.5 | 2.644 ± 0.001 | 2.642 ± 0.002 | 0.02 | 0.1 |
| | 2.0 | 2.620 ± 0.002 | 2.617 ± 0.002 | 0.03 | 0.16 |
| Chloranthine | 0.3 | 2.515 | 2.513 | 0.02 | 0.1 |

*Notes:* norm – size of corrosion – 2.0 g/m$^2$-year; speed of corrosion – 6.0 mg/m$^2$-hour

At the end of the sanitary treatment, the abovementioned scheme removed the equipment from the equipment for microbiological examination and the detection of residues of the detergent on its surface. On the average, the microbial number of washes from the working surfaces of equipment in the intestinal workshop, after the completion of the technological process, was $10^6$–$10^8$ CFU/cm$^3$ (Table 6).

Conducting sanitation using "San-active" at a concentration of 0.5% contributed to a decrease in the number of microorganisms by 99.8–99.9%. The microbial number of washes was $(4.3 \pm 0.22)\cdot10^3$ – $(1.3 \pm 0.1)\cdot10^4$ CFU/cm$^3$, depending on the type of equipment. The given amount of microflora on the equipment exceeded the microbiological standard of purity (1 000 CFU/cm$^3$ per 100 cm$^2$ of area). Sanitary treatment with a 1.0% concentration provided a reduction of 99.9% of microorganisms, and their amount in washings was $(1.7–5.7)\cdot10^2$ CFU/cm$^3$, for the titre BGKP ≥ 1. For 1.5–2.0% concentration of working solutions of the agent – sanitation efficiency was 100%.

**Table 6**
Microbiological indicators of washings out of technological equipment in the intestinal workshop using the "San-active", M ± m, n = 16

| Solution concentration, % | Research object | Before processing | | After processing with "San-active" | | Efficiency of processing, % |
|---|---|---|---|---|---|---|
| | | MW, CFU/cm$^3$ of flush | the title of BGKP | MW, CFU/cm$^3$ of flush | the title of BGKP | |
| 0,5 | 1 | $(6.7 \pm 0.41)\cdot10^6$ | 0.001–0.01 | $(1.3 \pm 0.10)\cdot10^4$* | 0.1–1 | 99.8 |
| | 2 | $(5.9 \pm 0.37)\cdot10^6$ | 0.1–1 | $(7.3 \pm 0.4)\cdot10^3$* | ≥ 1 | 99.9 |
| | 3 | $(7.3 \pm 0.47)\cdot10^7$ | 0.1–1 | $(4.6 \pm 0.30)\cdot10^3$* | ≥ 1 | 99.9 |
| | 4 | $(8.8 \pm 0.56)\cdot10^8$ | 0.1–1 | $(4.3 \pm 0.22)\cdot10^3$* | ≥ 1 | 99.9 |
| 1,0 | 1 | $(3.8 \pm 0.60)\cdot10^7$ | 0.001–0.01 | $(3.2 \pm 0.16)\cdot10^2$* | 0.1–1 | 99.9 |
| | 2 | $(7.4 \pm 0.47)\cdot10^6$ | 0.1–1 | $(4.3 \pm 0.23)\cdot10^2$* | ≥ 1 | 99.9 |
| | 3 | $(2.1 \pm 0.15)\cdot10^7$ | 0.1–1 | $(1.7 \pm 0.1)\cdot10^2$* | ≥ 1 | 99.9 |
| | 4 | $(7.1 \pm 0.50)\cdot10^7$ | 0.1–1 | $(5.7 \pm 0.30)\cdot10^2$* | ≥ 1 | 99.9 |
| 1,5 | 1 | $(5.1 \pm 0.38)\cdot10^6$ | 0.001–0.01 | $(1.1 \pm 0.10)\cdot10^1$* | 0.1–1 | 99.9 |
| | 2 | $(7.2 \pm 0.51)\cdot10^5$ | 0.1–1 | 0 | ≥ 1 | 100 |
| | 3 | $(8.6 \pm 0.56)\cdot10^6$ | 0.1–1 | $(1.4 \pm 0.10)\cdot10^1$* | ≥ 1 | 99.9 |
| | 4 | $(6.7 \pm 0.39)\cdot10^7$ | 0.1–1 | $(7.2 \pm 0.4)\cdot10^1$* | ≥ 1 | 99.9 |
| 2,0 | 1 | $(4.5 \pm 0.23)\cdot10^8$ | 0.001–0.01 | 0 | 0.1–1 | 100 |
| | 2 | $(3.9 \pm 0.17)\cdot10^6$ | 0.1–1 | 0 | ≥ 1 | 100 |
| | 3 | $(4.2 \pm 0.14)\cdot10^7$ | 0.1–1 | 0 | ≥ 1 | 100 |
| | 4 | $(3.1 \pm 0.21)\cdot10^8$ | 0.1–1 | $(1.2 \pm 0.1)\cdot10^1$* | ≥ 1 | 99.9 |
| Chloranthine 0,3 | 1 | $(5.6 \pm 0.35)\cdot10^5$ | 0.001–0.01 | $(2.7 \pm 0.18)\cdot10^3$* | 1 | 99.5 |
| | 2 | $(4.7 \pm 0.24)\cdot10^7$ | 0.1–1 | $(9.4 \pm 0.61)\cdot10^4$* | ≥ 1 | 99.8 |
| | 3 | $(4.7 \pm 0.21)\cdot10^6$ | 0.1–1 | $(7.3 \pm 0.51)\cdot10^4$* | ≥ 1 | 98.4 |

*Notes:* * − P ≤ 0,001 – in comparison to the number of microorganisms before sanitation processing; Table for the separation of intestines; 2 – Tables of different purposes; 3 – Tanks of different purpose; 4 – Intestine cleaning machine

The use of the "Chloranthine" did not ensure the proper cleanliness of the surfaces of the technological equipment according to the norms. Its effect is similar to the use of 0.5% solution of the "San-active".

Thus, the obtained results indicate that the use of "San-active" detergent from 1.0 to 2.0% concentration at a temperature of 60 ± 5 °C, an exposure of 20 minutes and a rinsing with an automatic device Karcher provides for 99.9–100% efficiency of sanitary treatment in the intestinal shop.

## 4. Conclusions

1. "San-active" disinfectant in the concentration from 0.3 to 2.5% is fast-dissolving in water, from moderately to very alkaline, and surface tension, wettability and foaming ability meet the requirements for facilities for sanitary processing of technological equipment for the meat industry.

2. The "San-active" agent in 0.5% concentration provides a bactericidal effect on test cultures of conditionally-pathogenetic bacteria: *S. aureus, E. faecalis, E. coli, P. aeruginosa* (for 10 min); spore-forming microflora *B. cereus and B. subtillis* (after 30 min); on fungi of genus *Penicillium spp.* (after 20 min) and *Candida spp.* (after 10 minutes).

3. The "San-active" agent has a washing effect for the mark "good" at 0.5% concentration, and 1.0% and above is rated "excellent". In 1.0–2.0% of concentration shows a slight corrosion activity on stainless steel, which is 200–66 times lower than the permissible norm.

4. The use of "San-active" detergent from 1.0 to 2.0% concentration, at a temperature of 60 ± 5 °C, exposure of

20 minutes and rinsing with water using an automatic device Karcher, provides 99.9–100% the efficiency of sanitary treatment in the intestinal shop.

In the future, the normative and technical documentation for the created agent for introduction into production will be developed and agreed upon.

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