

Table 5 – Antimicrobial properties testing results of packaging material treated with biocidal compositions based on cluster silver solutions

Number of the biocidal composition/concentration	Inhibition zone diameter for different treatment methods and different test strains, mm											
	Spraying				Immersion				Technological process			
	<i>Escherichia coli</i> B 4207	<i>Staphylococcus aureus</i> B 8171	<i>Aspergillus niger</i> F 876	<i>Candida albicans</i> Y2808	<i>Escherichia coli</i> B 4207	<i>Staphylococcus aureus</i> B 8171	<i>Aspergillus niger</i> F 876	<i>Candida albicans</i> Y2808	<i>Escherichia coli</i> B 4207	<i>Staphylococcus aureus</i> B 8171	<i>Aspergillus niger</i> F 876	<i>Candida albicans</i> Y2808
No. 3 0.05 wt%	5.0± 0.5	3.0± 0.3	2.0± 0.2	4.0± 0.4	7.5± 0.8	5.5± 0.6	4.0± 0.4	6.0± 0.6	15.0± 1.5	18.5±1. 9	16.0±1. 6	17.0±1. 7
0.15 wt%	10.0±1. 0	7.0± 0.7	5.5± 0.6	8.0± 0.8	12.5±1 .3	9.0± 0.9	7.0± 0.7	10.5±1 .1	23.0± 2.3	25.0±2. 5	24.5±2. 5	26.0±2. 6
0.25 wt%	11.0±1. 1	7.0± 0.7	6.0± 0.6	8.5± 0.9	12.0±1 .2	9.5± 1.0	7.5± 0.8	11.0±1 .1	22.5± 2.3	25.5±2. 6	25.0±2. 5	26.5±2. 7
No. 6 0.05 wt%	0	2.0± 0.2	4.0± 0.4	3.0± 0.3	5.5± 0.6	7.0± 0.7	10.0±1. 0	6.0± 0.6	17.0± 1.7	22.0±2. 2	19.0±1. 9	20.5±2. 0
0.15 wt%	2.5± 0.3	4.0± 0.4	6.0± 0.6	5.0± 0.5	11.0±1 .1	13.5±1. 4	12.0±1. 2	9.0± 0.9	25.0± 2.5	28.0±2. 8	23.5±2. 4	24.0±2. 4
0.25 wt%	3.0± 0.3	4.0± 0.4	6.5± 0.7	5.5± 0.6	11.5±1 .2	14.0±1. 4	12.5±1. 3	9.0± 0.9	25.5± 2.6	28.0±2. 8	24.0±2. 4	24.5±2. 5
No. 9 0.05 wt%	7.0± 0.7	5.5± 0.6	4.5± 0.5	3.0± 0.3	11.0±1 .1	10.0±1. 0	9.5± 1.0	6.5± 0.7	18.0± 1.8	19.5±2. 0	17.0±1. 7	15.0±1. 5
0.15 wt%	14.0±1. 4	12.5±1. 3	10.0±1. 0	7.5± 0.8	16.5±1 .7	13.0±1. 3	12.5±1. 3	10.0±1 .0	26.0± 2.6	25.5±2. 6	23.0±2. 3	20.0±2. 0
0.25 wt%	14.5±1. 5	13.0±1. 3	10.0±1. 0	8.0± 0.8	17.0±1 .7	13.0±1. 3	13.0±1. 3	10.0±1 .0	25.5± 2.6	26.0±2. 6	23.0±2. 3	21.0±2. 1
No. 11 0.05 wt%	5.5± 0.6	6.0± 0.6	7.0± 0.7	4.0± 0.4	8.0± 0.8	13.5±1. 4	16.0±1. 6	9.0± 0.9	20.0± 2.0	23.0±2. 3	21.5±2. 2	18.0±1. 8
0.15 wt%	9.0± 0.9	11.0±1. 1	15.0±1. 5	8.5± 0.9	15.5±1 .6	17.0±1. 7	18.0±1. 8	14.5±1 .5	24.5± 2.5	28.0±2. 8	25.0±2. 5	24.5±2. 5
0.25 wt%	9.5± 1.0	12.0±1. 2	15.5±1. 6	9.0± 0.9	16.0±1 .6	17.5±1. 8	18.0±1. 8	15.0±1 .5	25.0± 2.5	28.0±2. 8	25.0±2. 5	25.0±2. 5

CONCLUSION

Four optimal antimicrobial compositions based on cluster silver firmly fixed with a natural polymer were developed:

1. 0.5 wt% AGM (1 ppm) + 3.0 wt% citric acid + 2.5 wt% hydrogen peroxide + 94.0 wt% water;
2. 0.5 wt% AGL (1 ppm) + 5.0 wt% acetic acid + 5.0 wt% of flax oil + 89.5 wt% water;
3. 0.5 wt% AGM (1 ppm) + 4.0 wt% citric acid + 2.5 wt% linseed oil + 1.0 wt% of glycerin + 92.0 wt% water;
4. 0.5 wt% AGM (1 ppm) + 3.0 wt% citric acid + 2.0 wt% sodium benzoate + 2.0 wt% of glycerin + 89.5 wt% water.

The results of the performed studies of the quality indices of antimicrobial compositions based on cluster silver solutions are presented. The physicochemical, antibacterial and fungicidal properties determining the quality of such a composition have been determined, and an optimal concentration of bactericidal compositions insertion into the structure of the packaging material has been established.

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