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Surface Modification of Crops with Complexes of Polyhexamethylene Guanidine Hydrochloride with Surfactants and Application in Agriculture

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Abstract: To date, the use complexes of polyhexamethyleneguanidine hydrochloride with different surfactants in agriculture is very important. Study of colloid-chemical characteristics (the surface tension and wetting) of complexes of polyhexamethyleneguanidine hydrochloride with anionic surfactant sodium dodecylsulphate and nonionic surfactant Tween 80 (in the early research), allowed to use them to determine the impact of the growing/saw polyhexamethyleneguanidine hydrochloride grains of oats as well as on the length and thickness of a stalk. Analysis of the results shows that the preliminary processing of the barren lands of inoculum of sodium and further spraying systems PHMG/SDS, PHMG/Tween 80 and efficient than using individual components. High efficiency (stem thickness = 0.198 cm, stem length = 18.2 cm) showed complex PHMG/SDS with PHMG concentration = 1×10-2%.

Key words: Surfactant, polyhexamethyleneguanidine hydrochloride, soil, agriculture, stem thickness

INTRODUCTION

It is well known that the well-being of any nation depends on the State of agriculture. Our republic is not an exception. The economic policy of the republic is aimed at the development of agriculture and improvement of the quality of grain, etc. cultures and their long-term preservation. Bad ecological situation in the republic is causing enormous damage to the sowing and cultivation of crops. Therefore, obtaining new microbicides complexes in polymer/surfactant for effective growth and fertility of plants is important.

Reduction of arable land, impoverishment of the soil humus and mineral components, climate change and environmental degradation pose the question of the protection and optimal utilization of the land. Increase in the population and toensure their products to contribute to the development of agriculture. In the scientific literature are becoming increasingly common work where as a fertilizer and the plants apply modifiers surfactants and their compositions with various polymers possessing bactericidal and fungicidal properties (Lima *et al*., 1997; Turganbay *et al*., 2013). Theoretical importance of the problem is to develop a blowing agent based on surfactants and complexes surfactant/polymer having high stability and disinfection efficacy. The practical need to address the problem is to develop new drugs against various kinds of plant pathogens, often lacking in agriculture. Most effective in this regard show humate fertilizer containing. Not only do they increase the productivity of grain crops and improve their quality.

This is understandable because humic substances-macromolecular compounds, water soluble, favorably influencing the feeding and growth of plants. Using these data, we attempted to pre-process the infertile soil inoculum of sodium, then by spraying aqueous solutions of new polymer/surfactant complexes bactericidal effect on growth of wheat grains (Ivanova, 2012; Kudinov *et al*., 1995).

MATERIALS AND METHODS

Experimental procedures: For new microbicides complexes used Polyhexamethyleneguanidine Hydrochloride (PHMG) with molecular weight M = 176.5. Anionic surfactant Sodium Dodecylsulphate (SDS) with molecular weight M = 288 with a purity of 99% provided by the chemical company (USA). Nonionic surfactant Tween 80 with molecular weight M = 320 were used for obtaining fungicidal and bactericidal complexes. Aqueoussolutions of PHMG, SDS and Tween 80 with a concentration in the range of 10^{-5}-10^{-1} % of monomer units of polymer were used.

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Surface tension was measured on sedimentometer-tensiometer CT-2 (Kornienko *et al*., 2001). The study of the productivity of crops carried out in Kazakh Research Institute of Agriculture and Plant.

RESULTS AND DISCUSSION

In connection with the widespread use of surfactant in agriculture defining surface activity of surfactants at various borders section is very important. Study of the surface tension and wetting is an essential criterion for determining surface activity. In the early research identified the surface tension and wetting of individual reagents PHMG, SDS, Twin-80 and sodium humate (Musabekov *et al*., 2014; Kumargalieva *et al*., 2012). Compared to the individual components of the surface activity of complexes PHMG/surfactant at a lot higher. Probably, this behavior is complex due to the formation of large contacts linking the complex with the surface of the grain because of large molecular weight PHMG. A positive result in the colloid-chemical properties reagents led to their application to determine the growth of cereal grains. To determine the growth of oats grains take 100 pieces of grains, then processed by systems. As can be seen from the table, high efficiency in processing complex shows PHMG/SDS ($C_{PHMG} = 1\times10^{-2}$). It is worth noting that the modification of the surface of the grains of humate of sodium was not able to resist infection.

The productivity and disinfection resultscan be seen in Table 1. As can be seen from Table 1, high efficiency in the processing of grain shows complex PHMG/SDS; 1×10^{-2}. It should be noted that the modification of the surface of grains of sodium humate could not resist infection.

Figure 1 presents the sprouted grains, processed complex PHMG/SDS (SPHMG = 1×10^{-2}%). The next stage of the research was to study the effect of reagents on the thickness and length of the stalks of corn. Pretreatment of soil humate of sodium and spraying growing stalks PHMG, surfactants and their complexes is shown in Fig. 2 and 3.

Table 1: The productivity and disinfectionof grain treated SDS, humate of sodium, Tween 80, PHMG and complexes

Reagents (concentration (%))	Productivity (pieces)	Disinfection (pieces)	Productivity (%)
Check sample	90.00	5.50	90
Na humate; 2×10^{-1}	90.75	6.25	91
PHMG; 1×10^{-1}	94.25	5.00	95
SDS; 1×10^{-3}	91.50	5.50	92
SDS; 1×10^{-2}	86.25	8.75	87
Tween 80; 1×10^{-3}	94.00	50.00	94
Tween 80; 1×10^{-2}	81.75	13.25	82
PHMG/SDS; 1×10^{-3}	95.50	3.00	96
PHMG/SDS; 1×10^{-2}	97.50	1.50	98
PHMG/Tween 80; 1×10^{-3}	96.75	1.25	97
PHMG/Tween 80; 1×10^{-2}	96.25	3.75	96

Fig. 1: Photo sprouted grains, processed PHMG/SDS ($C_{PHMG} = 1\times10^{-2}$) complex

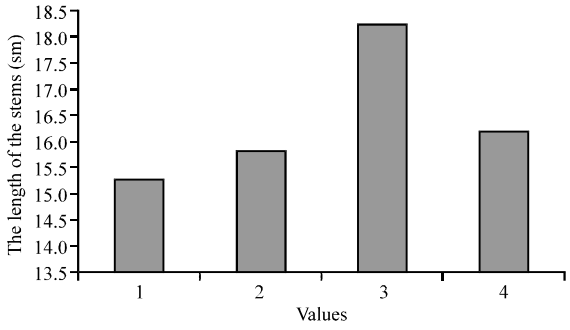

Fig. 2: EffectPHMG; 1) check sample; 2) PHMG/Tween 80; $C_{PHMG} = 1\times10^{-2}$; 3) PHMG/SDS; $C_{PHMG} = 1\times10^{-2}$ and 4) the length of the stalks of grain

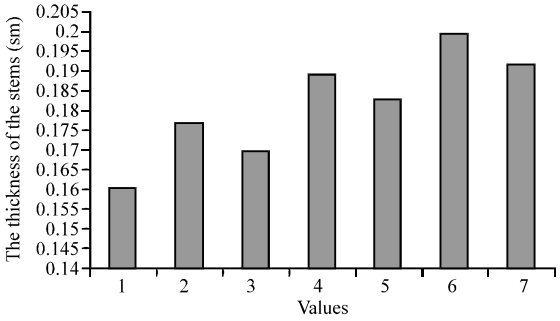

Fig. 3: Effect Humate of sodium; 1) check sample; 2) PHMG; 3) SDS, 10^{-3}%; 4) Tween 80, 10^{-2}%; 5) PHMG/SDS, $C_{PHMG} = 1\times10^{-2}$; 6) PHMG/Tween 80; $C_{PHMG} = 1\times10^{-2}$ and 7) the thickness of the stems

As you can see from the figures the soil barren processing 2, 3 humate of sodium and a sprinkling of grains of cultivated plants and complexes of reagents tested gave a positive result. Moreover, high efficiency (stem thickness = 0.198 cm, stem length = 18.2 cm) showed complex PHMG/SDS with PHMG concentration = 1×10^{-2}%.

CONCLUSION

Studies have shown that the efficiency in planting and growing crops in the barren land can be increased by pre-treatment humate of sodium infertile soil fertilizer; spraying (treatment) growing stems of plants studied reagents and their complexes. Further, the research will continue to provide new bactericidal composition PHMG with different water-soluble polymers and surfactants.

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