Physico-chemical peculiarities of herbicides polymeric preparative form for rice capsulation

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Introduction

Interaction of components or water polymeric solutions has as a rule rather complex character. It is caused by the possibility of various interaction types realization in complex polymeric system. Owing to the mesoscopic level structures are formed and new hierarchic interactions are adjusted with mesoscopic level. In turn it reflects on physical and physico-chemical properties of the films designated for rice and other agricultural seeds covering by capsulation method.
As it has been shown before, one of the main physico-chemical principles under developing of polymeric matrixes for PPHF creation is adhesion strength of polymeric covers [Rashidova S. Sh. et.al., 1999, . Ruban I. N. et.al, 2000, Ruban I.N et.al. 2002, Rashidova S.Sh . et.al.,2006] which allow retain the active substance on seeds surface. To estimate the cover quality we use the next indices: weight of 1000 seeds, cower strewing in some and microscopic data on cover homogeneity.

Material and Methods

Estimation of adhesion strength (GOST A. C.) of polymeric systems using for rice seeds cover on CMC base (75/400 mark, degree of substitution – 0.767, polymeric action degree – 400, main substance - 50.6 %, solubility – 99.5 % it has been shown that it was 54.95 kg/cm^2. After Gulliver introducing of investigations carried out cover adhesive strength was 54.67 kg/ cm^2.
Own strewing is determined in accordance with GOST by use of shaker with oscillation amplitude 2 over 1,3,5.7 hours for 1-7 hours. The strewing of investigated PPNF covers was absent both work herbicide inclusion and without or it. Optimal investigations showed that after treatment seeds with polymeric solvent which covers seeds by continuous film, their surface become smoothened due to formation of this film-line structure of PPNF. Cover thickness various up to 200 nm, depending on the number of cover layers and doesn't almost depend on biologically active ingredients owing to their use in small recommended concentrations in the course of rice seeds presowing treatment.

Results and Discussion

To estimate the interaction of polymeric system components which each other. In spectroscopic method was used. Systems NaCMC + Gulliver in recommended expenditure rate preparation 110-100g/t of seeds, based upon ofproduction recommendations were investigated. It was shown, that in NaCMC spectra use main absorption bands characteristic of this cellulose derivatives were observed – valency OH – and Na-C=0 group, some bands of deformation vibrations Vhr. C-OH (1415 cm^{-1}), CH (1325 cm^{-1}) and bands of C-C, C- OH and C-O-C bending in the region 1000-1100 cm^{-1} . In JR- spectra of Gulliver there are a lot of various absorption bands. It is necessary denote among them intensive wide band on the region 3100-3600 cm^{-1} with maximum 3325 cm^{-1}, very intensive band as 1705 cm^{-1} (C=0 stretching), as well as some bands in the types of stretching and bending of R-O-S- OH (=0) and its components.
In NaCMC spectra with addition of Gulliver small maximum of 1705 and 605 cm^{-1} is present. In the spectra of mechanical mixture NaCMC-Gulliver all component bands are observed, but with very low intensity owing to low content of Gulliver in composition JR- spectra of films cashed from

NaCMC- Gulliver solution, absorption bands, even more weave and their number significantly less. It is interesting that Gulliver absorption band 1705 cm^{-1} (C=0 stretching) disappear, that may by caused by its interaction with NaCMC through these groups. The shift of NaCMC on stretching from 3445 cm^{-1} to 3300 cm^{-1} also evidences in favor of this supposition. However Gulliver absorption bands of of R-O-S-OH (=0) and its components) are seen quite clean and their participation in components interaction is unlikely. These conclusion needs the further experimental confirmation as well as detailed analyses of 400-700 cm^{-1} at higher resolution.
Taking into account the interaction of Gulliver C=0 groups with NaCMC macromolecules and shift of hydrogen bands stretching NaCMC on-groups from 3445 to 3300 cm^{-1} it is possible to suppose formation of new band types in macromolecular film, secondly, it allows to explain, why Gulliver herbicide retained in NaCMC film on the seeds surface and at least, to conclude on the possibility of herbicide Gulliver mechanism from seeds polymeric cover in zone of their sprouting under the influence of conditions which are characteristic of the conditions of their sprouting (soil to-25 C, its humidity 100% - rice is flooding culture).
As a result, it seems, that in the course of swelling and solution of polymeric cover on NaCMC base with herbicide, some zone is formed around the seeds, including Gulliver herbicide with rather high concentration. Experimental data, obtained in conditions of field experiments in seed plants suppress in rice crops.
What is, on our opinion, one of the possible mechanisms of zone formation which contents high concentration of Gulliver herbicide under using in laer-bylaer capsulation of rice seeds plural-component systems on NaCMX base? Taking into account that in the case of film use, consisting of CMC only, its sorption at 100% humidity is 50.0% and interaction in composition Gulliver herbicide leads to its solution at to-100% humidity. That does not allow to internal sufficient for weed plants supposition, where choose the way of laer-by-laer covering of biologically active components from NaCMC solutions of various concentrations.
At first on the seeds surface polymeric cover, formed from 2% (1-2%) NaCMC with BAS is applied sorption - 80% at 100%). After drying the second polymeric cover formed from 1% NaCMC solution with herbicide is applied. Sorption of layer-by-layer formed cover is 85% at 100% PM. Possibly it may provide due to is release from polymeric matrix.
In the course of these films apply on seeds surface (keep in the common tendency) quantitative indices of sorption by capsulated rice seeds change and consist (at 100%PM) after 1-st layer deposition – 6,0% and after 2-nd – 9,02, Untreated rice seeds absorb 5,4% water at 100% PM. The data obtained confirmed realization of above discussed mechanism of defence layer formation around seeds consists of Gulliver herbicide against weed plants.

Conclusions

In common basing on literature data and experimental result obtained the picture of layer-by-layer capsulation may by represented as following: Rice seed rind, polymer matrix of 1-st and 2-nd layers have different by size pores. Let us suppose that the smallest pores are in rice rind, and the largest in the outer layer.
We also assume that Gulliver molecules size smaller, than pores size on polymeric matrix of 2-nd layer and they retained there at the expense of specific interaction described above. On the contact with soil solution, Gulliver molecules get free due to swelling and discussion of 2-nd layer. In this course, Gulliver may emanates is evil or to be sorted by 1-st layer dissolves. Slow emanation of absorbed Gulliver molecules also takes place. This herbicide could enter in soil or in rice seeds. However sorption capacity of untreated rice seeds is low, due to its small pores size, herbicide molecules don't enter in seeds and doesn't show toxic action in them best clear zone of its local concentration around the seed and suppers weed plants.
Thus at present there are very different preparative forms of chemical means of plants putrefaction (from water-solution systems, emulsions, suspensions to west able powders, dusts etc.)

We suppose that to solve some problems of presowing seeds treatment with chemical means of plant protection (CMPP), the optimal are polymeric preparative form, especially when as a matrix, water-soluble macromolecular systems are used. In this case efficacy is stipulated by complex of physical and physical-chemical properties both synthetic and native polymers. First of all they are sorption capacity, adhesion strength, capability to combination with biologically active substances with formation of water-soluble systems.
Such preparative forms retained rightly on the seeds surface. With their swelling and solution active substance emanate outside matrix borders, providing plant protection effects. Under extreme conditions of environment polymeric preparative form provide further seeds stability to unfavorable factors and keep their sowing properties.

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