# INVESTIGATION OF THE AGGREGATION CAPACITY OF GOSSYPIN IN AQUEOUS SOLUTIONS

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It has been shown previously [1] that in aqueous solutions gossypin can exist in several molecular forms and that the ratio between these forms changes during the development of cotton seeds [2]. In an investigation of the rheological propert of interphase adsorption layers (IALs) of gossypin at liquid phase-separation boundaries [3, 4] it was shown that the strength of the layers formed may affect the gossypin aggregation process [4].

TABLE 1. Influence of the pH and the Ionic Strength of the Solution on the Mean Radius ($\bar{R}_w$) of Gossypin Aggregates

| Conditions of the medium | Mean radius of the protein aggregates ($\bar{R}_w$, nm) as a function of time, h | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| $C_p$ = 0.1 g/100 ml | | | | | | | |
| gossypin, pH 4 | 64.4 | 65.5 | 66.8 | 70.4 | 72.3 | 73.8 | 74.6 |
| 11s, pH 4.2 | 65.7 | 66.3 | 63.0 | 60.7 | 51.4 | 48.0 | 42.7 |
| 7s, pH 4.5 | 96.0 | 114.4 | 132.3 | 157.2 | 168.3 | 176.8 | 183.9 |
| $C_p$ = 0.1 g/100 ml | | | | | | | |
| gossypin, pH 8 | 67.7 | 76.9 | 84.2 | 87.9 | 99.4 | 96.6 | 101.8 |
| 11s, pH 8.1 | 77.2 | 80.8 | 82.7 | 86.5 | 86.7 | 87.2 | 94.4 |
| 7s, pH 7.8 | 64.8 | 79.9 | 81.8 | 89.1 | 90.5 | 96.4 | 103.7 |
| $C_p$ = 0.02%, pH 7, I = 0.17 M | | | | | | | |
| gossypin | 518.3 | 1011.0 | 1052.8 | 1054.8 | 1058.4 | 1057.4 | 1053.6 |
| 11s | 356.8 | 428.4 | 643.8 | 687.7 | 708.0 | 742.6 | 755.1 |
| 7s | 566.5 | 782.3 | 899.3 | 907.3 | 908.5 | 910.2 | 910.5 |
| $C_p$ = 0.02%, pH 7, I = 0.35 M | | | | | | | |
| gossypin | 161.8 | 325.8 | 339.1 | 475.0 | 502.9 | 579.6 | 576.7 |
| 11s | 682.2 | 796.2 | 932.5 | 948.4 | 931.6 | 920.6 | 911.3 |
| 7s | 124.3 | 190.3 | 259.4 | 301.0 | 322.0 | 350.6 | 387.6 |
| $C_p$ = 0.02%, pH 7, I = 0.71 M | | | | | | | |
| gossypin | 76.4 | 89.1 | 98.8 | 117.5 | 130.0 | 142.9 | 161.6 |
| 11s | 61.4 | 63.0 | 67.7 | 77.8 | 90.0 | 90.5 | 89.4 |
| 7s | — | — | — | — | — | — | — |
| $C_p$ = 0.02%, pH 7, I = 1.05 M | | | | | | | |
| gossypin | 66.4 | 72.5 | 74.1 | 74.4 | 77.2 | 80.9 | 89.2 |
| 11s | 13.2 | 17.1 | 20.9 | 20.7 | 23.7 | 26.6 | 26.3 |
| 7s | — | — | — | — | — | — | — |
| $C_p$ = 0.02%, pH 7, I = 1.42 M | | | | | | | |
| gossypin | 51.0 | 50.8 | 51.9 | 51.3 | 51.7 | 47.7 | 48.1 |
| 11s | — | — | — | — | — | — | — |
| 7s | — | — | — | — | — | — | — |

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We have used the light-scattering method [5] to study the aggregation of gossypin in aqueous solutions as functions of the time at various pH values and ionic strengths of the solution. The intervals of pH values and ionic strengths of the solution were chosen in the light of properties of gossypin investigated previously [6], and the results are given in Table 1. Gossypin possesses a high aggregation capacity in aqueous solutions, but the aggregation process took place over some time and was not complete after a 6-hour experiment.

At acid pH values of the medium, gossypin and its 7s form underwent aggregation giving particle with mean radii ranging from 64.4 to 74.6 nm and from 96.0 to 183.9 nm, respectively. The 11s form of the protein underwent aggregation in the first two hours and then the mean radius of the partciles decreased by a factor of 1.5.

At weakly alkaline pH values of the medium, all the protein samples showed complex aggregation properties, and the mean radii of the aggregates changed from 65 to 100 nm during a 6-hour experiment. With a change in the ionic strength of the solution, the aggregation of the protein macromolecules was expressed to a greater degree, and the largest aggregates were observed at ionic strengths of 0.17 and 0.35 M NaCl. After a 6-hour experiment it varied between 500 and 1000 nm, depending on the oligomeric form of the gossypin. A rise in the ionic strength of the solution lowered the aggregation capacity of the protein, and at an ionic strength of 1.42 M it was imposible to detect any aggregation capacity of the protein by the light-scattering method in the visible region of the spectrum. Thus the aggregation of the protein molecules in the formation of IALs already takes place in a solution of the protein itself, which complicates the process of forming IALs at liquid phase-separation boundaries.

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