

# Adsorption Interaction in Composite Polymeric Systems

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## Abstract

The majority of toners concerns to polymeric high-dispersion composite materials which properties largely depend on compatibility of components included in their structure.

To characterize interaction, displayed in a polymeric composition adsorption of components present in a mix at toner manufacturing by us is carried out. It's determined the quantity of colloidal dispersion of high-dispersion adsorbents in a colloidal solution of surface-active substances. Adsorption of polystyrene was not complicated by the phenomenon of colloidal dispersion in connection with that, that in quality of adsorptive the samples of polystyrene of rather low molecular weight ( $2.0 \cdot 10^5$ ) were used. With increase of equilibrium concentration under adsorption of polystyrene from a solution of toluene on technical carbon or magnetite the sharp increase of adsorption is observed, we connect it with adsorption of macromolecules.

Adsorption of nigrosine was carried out from two solvents: toluene and chloroform. For equilibrium concentration definition we used a photometry method. It was established, that nigrosine is dissolved in chloroform better than in toluene. Under adsorption of dye with toluene the change of solutions coloring is observed. It is connected with such fact, that the adsorption of blue-black component of nigrosine is better, than that red - black one.

## Introduction

The majority of toners concern to polymeric composite materials, which properties substantially depend on interaction of substances, included in their structure. Especially it concerns toners, structure of which consists of two or more polymeric components, which incompatibility can be reflected in properties of a final product. So at toners manufacturing it is expedient to apply homopolymers or copolymers, instead of mix of polymers, as their basic weight is incompatible. In

some cases at toners manufacturing the process passes through a stage of suspensions formation. One of the most effective ways of increase of suspensions stability is the updating of a surface by surface-active substances or the polymers as a result of which the advanced layers of surface-active substances or high-molecular connections form on a surface of particles.

## Results and discussion

Earlier it was shown by us, that at entering high-dispersion phases into solutions of surface-active substances, in a number of cases steady suspension, which dispersion phase is not separated at centrifugation and does not linger over by the filter are formed.<sup>1,2</sup> This phenomenon was named as colloidal dispergation. In a number of cases spontaneous dispersion of particles of a firm phase is observed. Presence of the dispersion phases in an equilibrium solution after adsorption can be not noticed, especially if at adsorption «white» adsorbents were applied. It can result to the underestimated importance of adsorption, which can accept even negative importance, if the equilibrium concentration of a solution after adsorption was determined by a mass method. Thus, if not to take into account the phenomenon of colloidal dispersion, in a number of cases adsorption of surface-active substances on various samples of technical carbon has negative importance, and so large, that it is deprived of physical sense. Using an independent definition method of equilibrium concentration after adsorption, for example, the method of a surface tension, it is possible to estimate true concentration of surface-active substance in an equilibrium solution after adsorption and, at the end, quantity of a colloidal-dispersion dispersion phase.

In figure 1 and 2 were applied quantities of colloidal-dispersion high-dispersion adsorbents in equilibrium solutions of syntanol and natrium oleate depending on their concentration are given.

Account shows that in the field of critical concentration of micelleforming penetrates one or two parts of a dispersion phase in micelle. The process of colloidal dispersion promotes more uniform distribution of particles of a disper-

sion phase and at the end positively reflects in properties of a dispersion phase.

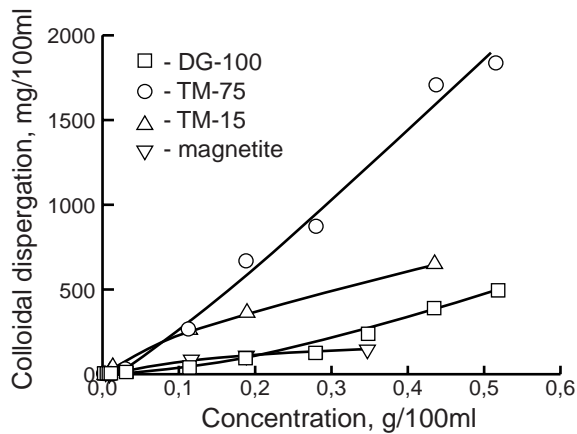


Figure 1. Quantity of colloidal-dispersion high-dispersion adsorbents in equilibrium solutions of syntanol depending on their concentration.

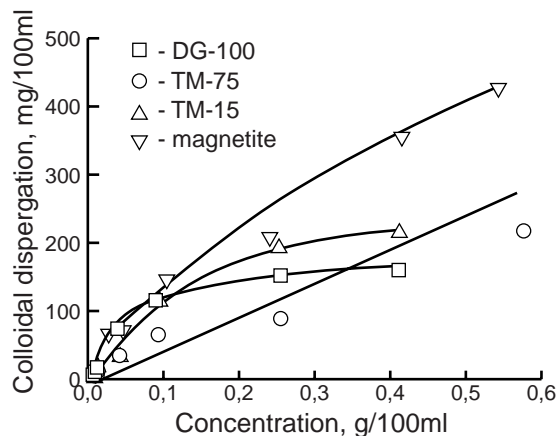


Figure 2. Quantity of colloidal-dispersion high-dispersion adsorbents in equilibrium solutions of natrium oleate depending on their concentration.

At adsorption of nigrosine from chloroform and toluene on selected adsorbents, the process of colloidal dispersion is not observed. A definition of concentration before and after adsorption was carried out by photometry. In figure 3,4 isotherms of adsorption of nigrosine are given.

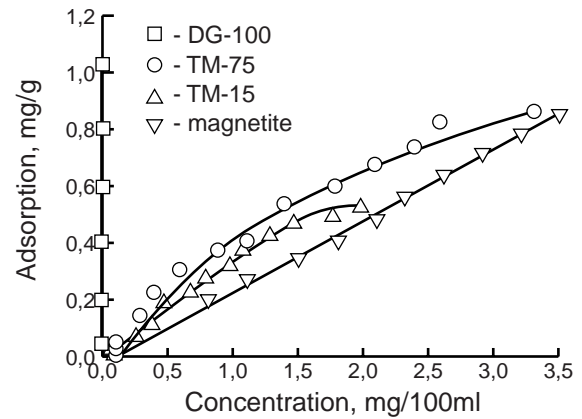


Figure 3. Isotherms of adsorption of nigrosine. The solvent - toluene.

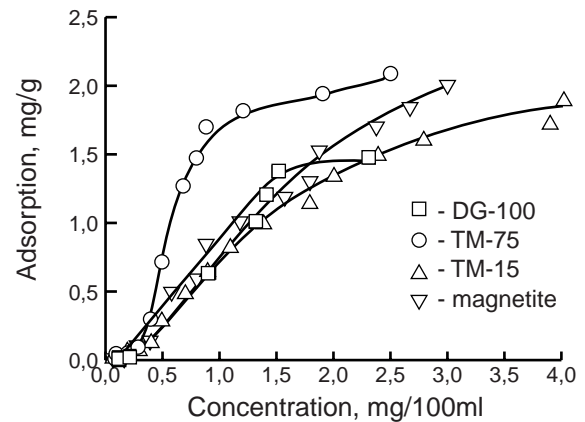


Figure 4. Isotherms of adsorption of nigrosine. The solvent - chloroform.

At adsorption of nigrosine from toluene selective adsorption of a dark blue-black component of nigrosine is observed, in a consequence that equilibrium solutions after adsorption changes color darkly violet on red. At adsorption on adsorbents DG-100 under the selected conditions complete adsorption is observed. Thus adsorption of dye used at manufacturing of toner, obviously, also can render influence on properties of toner.

## Conclusion

Adsorption of components of a composite material on samples of technical carbon and magnetite is carried out. It is shown that at introduction of high-dispersion adsorbents in solutions of surface-active substances at concentration equal and exceeding critical concentration of micelleforming the formation of steady suspensions owing to penetration of particles in micelles of surface-active substances is observed. By analogy with colloidal solution this process is named colloidal dispersion. On a difference of values of adsorption, received at definition of the concentration of equilibrium solutions after adsorption by a mass method and on value of a surface tension a quantity of colloidal-dispersion particles of adsorbents is determined.

It is shown that at adsorption of nigrosine from a toluene solution primary adsorption by a dark blue component of dye is observed. The role of interaction of components and colloidal dispersion is emphasized at reception of toners.

## References

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## Biography

Iryna Opaynych received her M.S. in Physical Chemistry from the University of L'viv in 1965, and her Ph.D. in Chemistry from the University of L'viv in 1983. Dr. Opaynych is current an associate professor of chemistry at the chemical faculty of the L'viv University. She has published over one hundred papers, including inventions, one of inventions has been patented in USA, France, UK, Japan and others countries. Iryna Opaynych works in the area of polymeric composite materials chemistry.