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INVESTIGATION OF THE FIXING MECHANISM OF AROMA VARNISH COATING IN WEB OFFSET PRINTING

It was conducted the features of the mechanism of film formation of aroma varnish coating on printout in web offset printing. It was also analyzed the physical and chemical processes of aroma varnishes consolidation based on the simulation and electron microscopic research.

Keywords: aroma varnish; film formation; the chemical and physical processes of consolidation; modeling.

Introduction

Analysis of modern advertising, made by specialists, shows that important place takes internal printing advertising (in the pages of catalogs, brochures, booklets, magazines, newspapers, flyers), etc., which due to its communication function aims to inform consumers about the appearance of new products on the market, and establishes a close link between producers and consumers with advertisers.

Operating conditions and print advertising purpose are requiring from manufacturers to raise the level of printing design. One of these ways is selective or fragmental aromatization of printed images by using aroma varnishes [1–4].

Problem statement

Mechanism of film formation of printing varnishes is difficult complex process that runs in several stages. It is release so-called physical (through absorption) and chemical methods of film formation (due to the chemical reaction of oxidative polymerization).

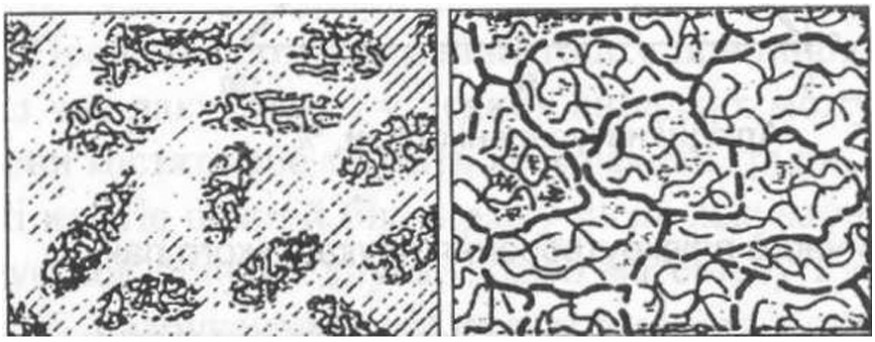
The process of physical consolidation of varnish coating on prints was considered. Klaus Hanke and Andrea Heinemann in their writings noticed that if mineral oil contains soluble macromolecular resin, then it formed clusters of molecules that contain mineral oil, like a sponge saturated with water (Figure 1).

The aim of research

It was analyzed the features of the mechanism of film formation of aroma varnishes coating on printout in web offset printing based on the simulation and electron microscopic research.

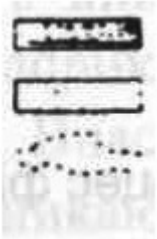
Experiment equipment and method

The objects of research were selected prints on coated paper NovaPres Silk (gsm of 65 g/m^2).



a b

Fig. 1. Model behavior of resin macromolecules clusters in varnish composition before (a) and after (b) film formation(hardening):



solidified solvent

free solvent

clusters size (0,1...0,01)

substance that forms chains of molecules

Prints varnishing was carried out in web offset printing machines KBA C215 with plasma IR drying SIR-IUS. It was used printing oil aroma varnish № 1: Aromit Fragrance and varnish № 2: Aromit Nature Secret

Results

Analysis of physical and mechanical properties of aroma varnish shows that the time of varnish curing depends largely on the ability of absorbing of base material, in this case paper. So, purely physical process of varnish hardening lasts several minutes [5].

Researches show that in view of the binding process of the mineral oil, alkyd part and natural oil it is changing the density of components 1 and 2 (Fig. 3). In this case, after achieving high thickening resins appeared gel-like structure and even entirely new proportions of resins and alkyd compounds.

If printing material is not enough porous or absorbing, it is impossible to reach the mark 2 in such form, as shown in the figure 3. In this case, varnish polymerization is influenced by atmospheric oxygen, and the drying time increases accordingly.

The conditions for the chemical reaction with atmospheric oxygen incorporated in the natural oils and alkyd with double bonds in fatty acids due to the chemical film formation. There reacting oxygen, contained in the air, with double bonds oil in the formation of colorless oxides.

This is due to the fact that chemical compounds with double bonds in the molecules have higher energy than compounds with single bonds.

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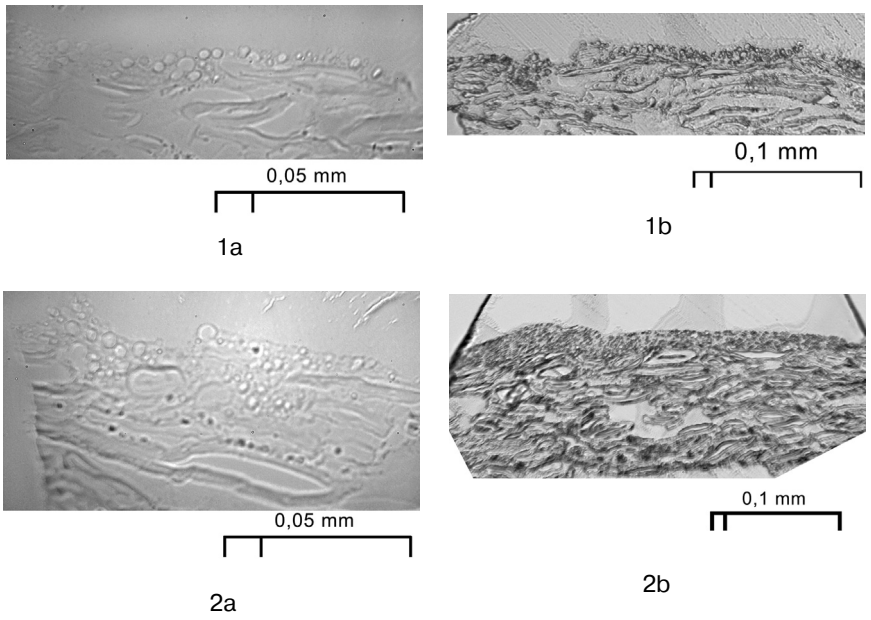

Fig. 2. Microphotographs of aroma varnish coating before (a) and after (b) of film forming: 1 — aroma varnish No. 1, 2 — aroma varnish No. 2

The chemical process of consolidation of aroma varnishes on the print by oxidative polymerization is relatively slow. Therefore, when using oil varnishes must fulfill the conditions to limit the height stocks and compulsory application of against marking powders that significantly reduce gloss, but avoid gluing fingerprints in the stack. Various kinds of siccatives, as catalysts, are using to speed up the oxidative polymerization reaction. Typically, there are the salts of cobalt, lead or manganese. The required concentration of drier determined by trial applying the varnish, as its excess causes a negative effect on the viscosity, transparency of varnish, etc. [6, 7].

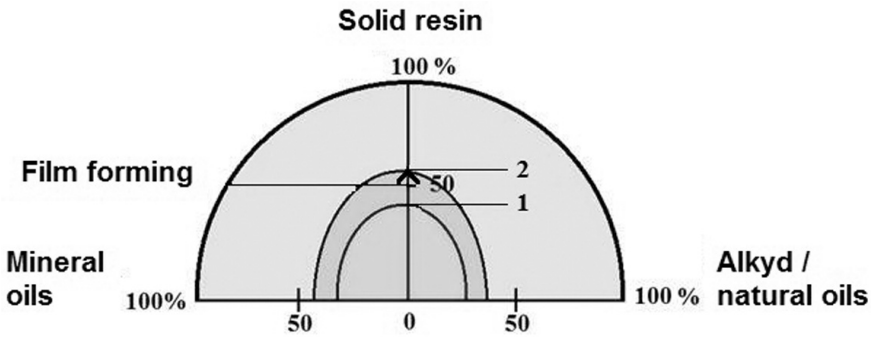

Fig. 3. The main components of oil varnishes and physical process of film formation

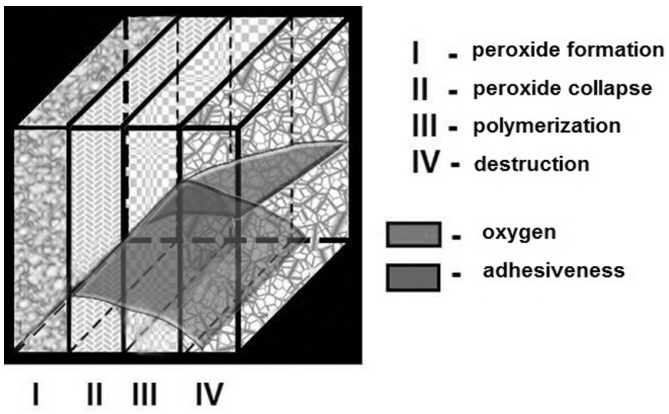

Fig. 4. Simulation model of reaction process of film formation of oil aroma varnish due to its oxidative polymerization

As the drying oil, mentioned above as alkyd resin, containing unsaturated fatty acids, there are reactions occurring in the oxygen atmosphere. The schematic model of these reactions is shown in Fig. 4.

The scheme follows that the process of film formation of aroma varnish, catalytically initiated by drier, provided basic reactions to the double bond. As a result of polymerization of alkyd and vegetable oils during the chemical fixing of oil varnish, there are also side effects that are in chain decay of fatty acids. These reactions are often initiated by the formation of unsaturated acids with short chains of compounds that occur only in the initial phase of drying. As a result of the collapse low-molecular ketones, aldehydes, carbonic acids and their hydrogen compounds appear. The formation of these compounds is called degradation.

The products of decomposition are often the cause of problems that arise during the varnishing products, including yellowing of print. As a result, decreases its linen and there are changes in color prints under a layer of varnish, which can distort the image.

The mass of oil varnish is decreases during its changing from liquid to solid by tidying up and oxidative polymerization. Therefore, the amount of varnish that remains on the print after drying characterized by the value of solids and expressed as a percentage of the primary weight of liquid varnish. Dry residue on the print is 50–75 % for oil varnishes and a total drying time of varnish surface is about two hours.

Conclusions

The results of simulation and electron microscopic researches had confirmed that the mechanism of aroma varnish fixing on prints is due to the physical and chemical processes of film formation and depends from the composition and structure of aroma varnish, its physical and mechanical characteristics.

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Розглядаються особливості механізму плівкоутворення аромолакових покриттів на відбитках рулонного офсетного друку. На основі імітаційного моделювання та електронно-мікроскопічних досліджень аналізуються фізичні та хімічні процеси закріплення аромолаків.

Ключові слова: аромолак; плівкоутворення, хімічні і фізичні процеси закріплення; моделювання.

Рассматриваются особенности механизма пленкообразования аромолаковых покрытий на оттисках рулонной офсетной печати. На основе имитационного моделирования и электронно-микроскопических исследований анализируются физические и химические процессы закрепления аромолаков.

Ключевые слова: аромолак; пленкообразование; химические и физические процессы закрепления; моделирование.

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