THE PROPERTIES OF OFFSET INKS

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Abstract: *The article gives an overview of the properties of offset printing inks which are leading on the market of printing services. The explanation for this is the availability of a wide range of automatic printing presses of the leading manufacturers and the use of various printing materials and printing inks depending on the intended use of the product. The predominant advantages of this printing method include high graphic accuracy in the reproduction of small line breaks and colour reproduction. During printing, the quality of the reproduction depends on many factors, including the properties and characteristics of the printing inks used, which differ from each other in terms of composition and the quantity of the basic components. The composition and percentage of the basic components of inks differ depending on the printing method, type of printing equipment, dampening system, optical characteristics, fixation method and characteristics of the print material. For printing on absorbent substrates, less viscous inks should be used in comparison to printing on non-absorbent substrates. The higher the viscosity, the lower the tendency of the ink to spread over the print substrate, the higher the print resolution and the lower the dot gain. It follows from this that before selecting and using an ink it is necessary to know the type of printed matter and its quality, colour tone, brightness, colour saturation, etc. In tri-colour, printing it is important to ensure sufficient transparency of the ink; otherwise, the desired colours cannot be achieved in the print. The tack of the inks must be adjusted because they will be applied one after the other; the viscosity of the ink must also be adjusted to the characteristics of the print substrate in order to compensate for dot gain and to ensure better print quality. Conclusions are drawn on the influence of the optical and printing properties of the inks on the colour reproduction of the print.*

Keywords: *offset printing, ink, pigment, coating properties of ink, transparency, colour tone, tackiness, viscosity.*

INTRODUCTION. The widespread use of offset printing is due to the wide range of automated printing presses from leading manufacturers and the use of different printing materials and inks, depending on the intended use of the product [1-8]. The quality of the printed image, i.e. the thickness of the ink layer and its adhesion to the printed surface, depends on the rheological properties of the ink, such as viscosity, flow ability, tackiness, plasticity, etc., which describes its ability to flow and deform.

A uniform ink layer distribution and fine detail reproduction is ensured when an ink with sufficient viscosity is used. If very low viscosity inks are used, the ink layer may be uneven in thickness and smoothness. The use of low viscosity inks leads to uneven transfer of ink onto the print substrate, so that on the printout different values of optical density are attributed to uneven thickness due to ink adhesion on the plate. When printing on absorbent substrates it is recommended to use less viscous inks than when printing on non-absorbent substrates. High viscosity inks are less likely to bleed ink onto the print substrate, resulting in higher resolution with smaller dot gain and therefore lower dot gain. In order to ensure print quality, the viscosity of the ink must be controlled by adding a solvent or colourless binder. The viscosity of the ink must not be exceeded as too low an ink viscosity prevents colour saturation and the optical density of the print [9-10].

When printing, temperature changes contribute to solvent evaporation and changes in ink viscosity values. It is therefore necessary to regularly and constantly monitor this indicator with a viscosimeter, if the printing press does not have an automatic control. In reality, ink viscosity is correlated by the addition of a binder that has a higher or lower viscosity than the ink itself.

When ink is transferred to the mould, the spreading can be explained by the spreading and spreading of the ink layer under its own weight. The degree of spreading depends on the particle size, i.e. the dispersion, the amount and nature of pigments in the ink, its ratio to binders and additives, as well as the degree of grinding of the printing ink. The thixotropy of inks also changes as a result of mechanical influences, e.g. stirring in the inking unit causes the viscosity to decrease and the ink to liquefy. In the resting state, during storage and when the printing press is stopped, the viscosity increases, the ink thickens and thickens.

When paper and ink interact, ink mottling and smudges form on the printout using tacky ink, which "plucks" fibres from the paper surface and transfers them to the printing plate and onto the printout. Ink dusting during the printing process is due to the low tackiness of the ink. Special additives are used to bring the tackiness of printing inks to normative values.

The ink tackiness is evaluated when calculating the speed of the ink rollers, the time and the temperature. In the multi-colour presses the inks are applied one by one on top of the other (wet-on-wet printing). It is therefore necessary to keep the temperature constant, because the change affects the tackiness of the inks. The first ink applied must have a higher tackiness than the next one in order to improve the overlapping conditions. Otherwise the colour of the ink may be distorted on the print due to the poor perception of the subsequent ink by the previous one.

MATERIALS AND METHODS. The quality of printed products depends on many factors, no less important among them are properties of printing inks: stickiness, viscosity, fastening speed and a number of other properties depending on their composition and percentage of basic components [11-12]. The main components are fine-dispersed pigments, binding agents and auxiliary additives, the percentages of which are given in Table 1.

Table 1

Composition of sheetfed offset printing ink

Main components	Quantity, %
Pigments	10-20
Hard resin	25-35
Alkyd resin	5-15
Mineral oil thinner	0-30
Vegetable oil	30-0
Supplements	8-12
Siccatives	1-8

The composition and percentage of the main components of the ink varies depending on the printing method, type of press, wetting system, optical characteristics and fixation method, a general classification is given in Figure 1.

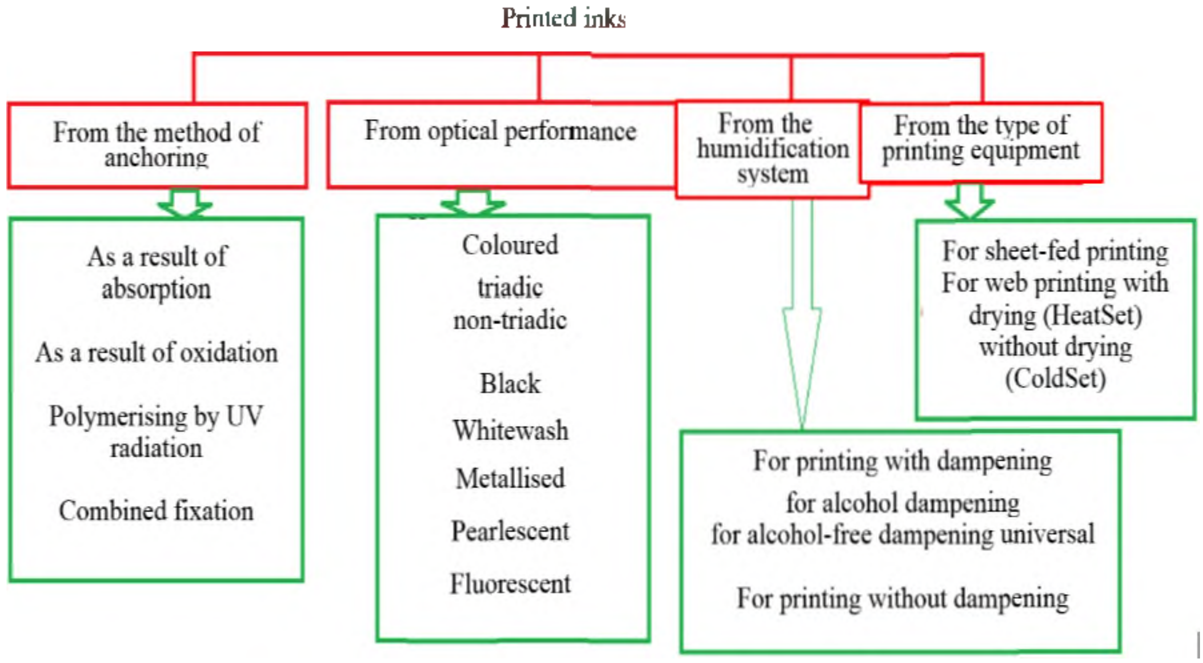

Fig 1. Classification of printing inks

In [11-13] pigments are characterised as highly dispersible powders insoluble in water, oil and other organic solvents. Pigments are divided into organic and inorganic pigments according to their chemical composition (Fig. 2). Colours and halftones are obtained by mixing organic constituents.

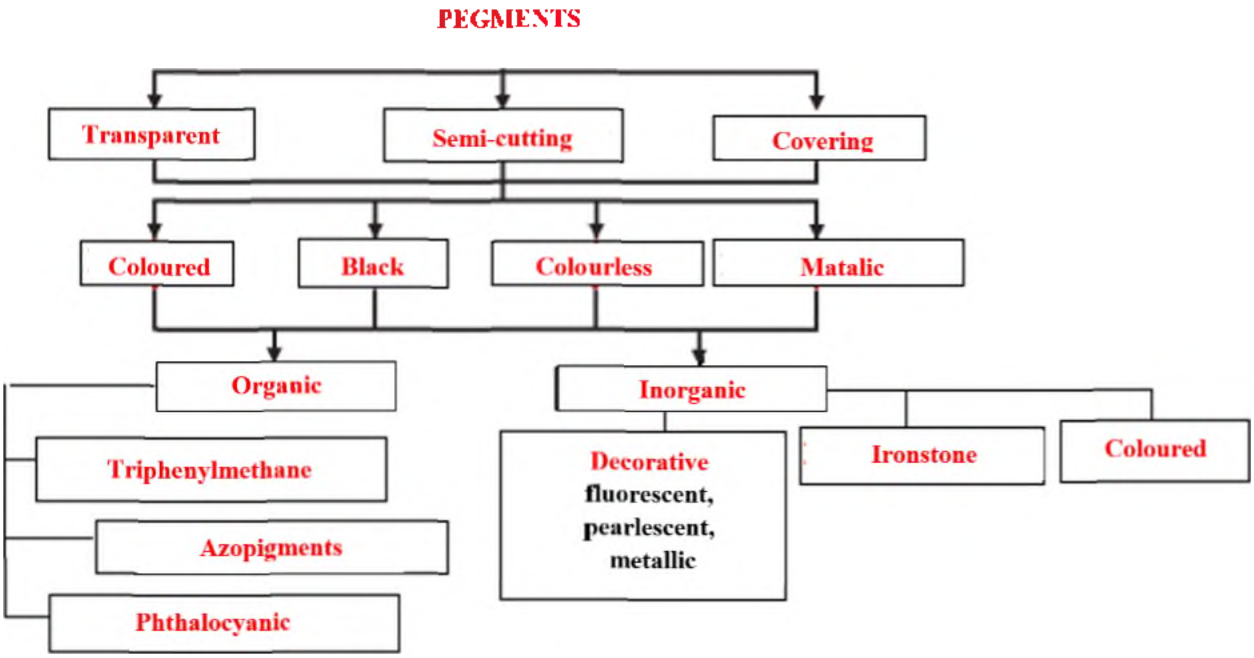

Fig 2. Classification of pigments

RESULTS AND DISCUSSION. Nelson Eldred states that the transparent ink shows through the previously printed ink when printed, while the case ink completely covers the previous print. The ability of pigmented paints to cover the colour of the surface to be painted is called hiding power. The higher the opacity, the lower the paint consumption per surface unit. The hiding power (transparency) of pigments can be divided into transparent, semi-penetrating and hiding.

Colour pigments are divided into colourless, coloured, black and metallic pigments (Fig. 2) or into chromatic and achromatic pigments (Fig. 3). The achromatic pigments are white, metallic grey and black. The black pigments used as covering pigments are fine carbon black and ink. Chromatic - coloured pigments can be opaque, semi-opaque or transparent, while grey (metallic) pigments can only be opaque.

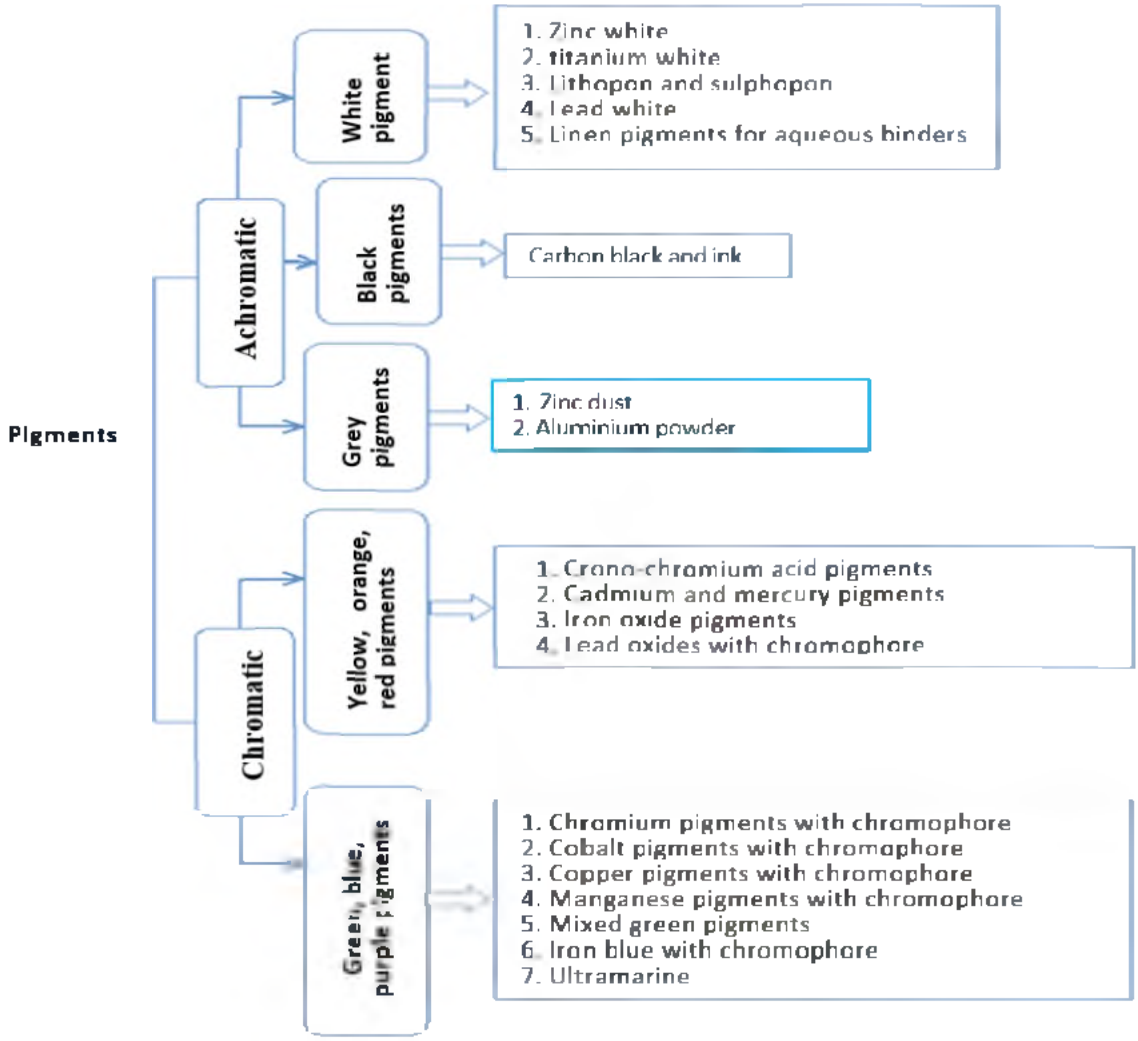

Fig 3. Classification of pigments by colour

Hiding power of ink is determined according to GOST 25117-82 [14] with the use of colour densitometer in reflected light, spectrophotometer, laboratory analytical balance, double-sided coated paper with weight of 140 g/m^2, black printing ink of 2515-03 type, ink with optical density not less than 2,0 with ink layer thickness on the print not more than 2,5 µm, white printing ink type 1715-83, providing ink layer on the print not more than 2,5 µm with optical density not more than.

Transparency of inks is characterized by the ability of directional light transmission through the paint layer, defined according to GOST 7086 [15] by densitometric or spectrophotometric method and evaluated by a ten-point scale, where the point 10 represents the highest transparency, point 1 - the lowest one.

Colour tone depends on the wavelength of monochromatic radiation corresponding to a particular part of the colour spectrum. Long-wavelength emissions have a red colour, while short-wavelength emissions have a blue colour. The visible spectrum can be divided into three main areas: blue, green and red. The achromatic (colourless) colours are white and all greys, from the lightest to the darkest, which have no colour tone and are characterised by lightness. All other colours are called chromatic (coloured) (Fig. 3). Knowing spectral composition of radiation, it is possible to define, what colour sense it will cause, and to specify for it values of its three basic indicators: colour tone, saturation, lightness.

While colour tone is defined as 'blue', 'green', 'red' etc., saturation is a measure of the amount of pure chromatic colour in the overall colour impression. The intensity of an ink colour is determined by the amount of pigment in the ink and the thickness of the ink layer on the print [16-18].

CONCLUSION: Based on the above, the following conclusions can be drawn about the influence of the optical and printing properties of inks on the colour reproduction of a print:
-know the type of printed matter and how important it is to determine the colour tone, brightness, colour saturation and other nuances that are important to the client. The next step is to determine the printing method and materials that are best used in the specific case;
-in tri-colour printing, it is important to ensure sufficient ink transparency, otherwise the desired colours cannot be achieved in the print;
-the tackiness of the printing inks must be adjusted; given that they will be applied consecutively;
-in order to compensate for dot, gain and ensure better print quality, the viscosity of the ink should also be adjusted to the properties of the substrate.

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DETERMINATION OF THE OPTIMAL MODE OF FLASH SMELTING OF SULFIDE COPPER CONCENTRATES

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Abstract. The article describes the main stages of creating autogenous technologies for processing sulfide copper concentrates. It is shown that the introduction of autogenous technologies significantly intensifies the processes, creates the opportunity to work without the consumption of external hydrocarbon fuel, to provide all the necessary heat for metallurgical smelting exclusively due to exothermic reactions. The role of oxygen as the main component ensuring the completeness and rate of physicochemical transformations of the charge components is shown. Briefly given information about processes such as "Outokumpu", "Flash Smelting Furnace (FSF) and others.

Keywords: autogenous processes, environmental problems, reducing copper losses with slag, prospects for improving the smelting of copper sulfide concentrates in smelting furnaces

INTRODUCTION. Such a mode of oxygen-torch melting of sulfide copper concentrates can be considered optimal, in which there are minimal losses of valuable components, minimal dust removal, and maximum unit productivity [1]. An in-depth analysis of production data made it possible to eliminate the shortcomings of flare melting relative to other autogenous processes and to determine its optimal modes. Flash smelting has the following disadvantages: difficulty in regulating the temperature in the furnace without changing the performance.

Since the oxygen consumption is constant (the oxygen station is designed for a certain capacity), the ratio of the amount of charge and the amount of oxygen is controlled by changing the charge flow. The change in the productivity of the oxygen-flare furnace is the reason for the change in the workload of the following units along the technological chain (converters, fire refining furnaces and sulfuric acid and electrolysis shops). Difficulty in regulating the composition of melt products. The mixture has a variable composition, maintaining the temperature regime;