ISSN 2181-8622

Manufacturing technology problems

Scientific and Technical Journal Namangan Institute of Engineering and Technology

Volume 9
Issue 1
2024

UDC 655.344.022.72.001.53

ANALYSIS OF THE COMPOSITION OF THE FOUNTAIN SOLUTION FOR OFFSET PRINTING

BABAKHANOVA HALIMA

Tashkent Institute of Textile and Light Industry, Tashkent, Uzbekistan
Phone: (0897) 266-9936, E-mail: halima300@inbox.ru

ABDUKHALILOVA MUKHLISA

Namangan Institute of construction- engineering, Namangan, Uzbekistan
Phone: (0890) 552-1901, E-mail: muxlisaabduhalilova56@gmail.com
Corresponding author.

Abstract: The article analyzes the composition of the fountain solution, which is one of the significant components of the "ink – water" balance. An Express method was used to determine the chemical composition of the concentrate of the necessary concentrate and adjust the percentage of isopropyl alcohol to ensure the balance of "ink – fountain solution" and getting stable quality print. The composition of the fountain solution received the results of the analysis on the gas chromatograph of the Agilent firm 8890 GC model. As a result, the gas chromatography method made it possible to quickly and accurately find out about the chemical composition of the fountain solution concentrate used in offset printing. According to the parameters of the resulting gas chromatography, the percentage of isopropyl alcohol that provides a "moisturizing solution-dye" balance is adjusted, depending directly on the type of moisturizing solution, drinking water properties, paint and printing material, and bellows the amount of concentrate, which makes it possible to obtain copies of consistent quality.

Keywords: components of the fountain solution, the fountain solution using gas chromatography, which will determine the amount of the nece water parameters, water hardness and pH, chemical composition of the concentrate.

Introduction. Before offset printing, the blank elements of the printing plate are moistened, thanks to this, only hydrophobic printing elements perceive the ink. Uniform, stable application of water to the printing plate and regulation of the "ink - water" balance is provided by the humidification system. The humidification system of printing machines includes cover knurled rollers placed according to various schemes and designs. In the process of printing the circulation, the main problems associated with the quality of products arise due to the uneven supply of the fountain solution [1]. For example, if the hydrophilic blank elements are incomplete and insufficiently moistened, then this contributes to the shade of the printed form. The excess of the fountain solution on the blank elements contributes to the production of an unsaturated impression with streaks, as well as the transition of the image to the reverse side, which will require more time for the prints to dry. The stable supply of the fountain solution depends on the technological mode of operation of the humidifier.

Numerous scientific works of specialists and scientists of this industry are devoted to solving this problem. M.A.Bozoyan investigated the influence of the modes of applying a fountain solution on the quality of prints [2]. As a result, the dependence between the technological modes of applying the fountain solution and the print quality parameters has been determined. In works [3-4], the influence of the rotation speed of the ductor cylinder of the humidifier on the supply of the solution was investigated. The authors of the work [5] evaluated changes and deviations in the temperature of the fountain solution during printing, depending on climatic conditions. The average temperature range of the ink and the fountain solution is 2.50C, which affects the amount of alcohol content in the fountain solution, and hence the emulsification of the ink, which leads to destabilization of the printing process. To reduce this effect, it is recommended to use printing inks, taking into account their rheological properties.

According to the results of a comprehensive assessment of the effect of the "ink – fountain solution" balance, scientists claim that a high-quality impression can be obtained with constant monitoring of the composition of the fountain solution, the parameters of the solution supply and the climatic conditions of the printing shop [6-7].

Considering the above, we can say that in order to ensure the balance of "ink – fountain solution", it is necessary to study the components of the balance and their interaction in more detail and in advance, depending on the properties of the material being sealed. A change in the amount of the moisturizing solution, which is one of the weighty components of the ink –water balance, leads to such defects in offset printing as ink emulsification, shadowing, overshadowing, violation of color rendering, deformation of the paper sheet appear due to changes in its composition and characteristics. At the same time, the performance characteristics and parameters are very important; the amount of fountain solution, the quality of tap water used in its preparation. The quality of water depends on its origin, that is, on the properties of the land, the natural and climatic conditions of the area and may change from time to time (for example, when the season changes).

The purpose of the article is to analyze the composition of the fountain solution and the properties of tap water in two regions. To achieve the goal, the following factors are considered:

- chemical composition of the concentrate of the fountain solution.
- physico-chemical properties of the water of the two regions;

Methodology. The amount of additives in the fountain solution is determined individually and experimentally, depending on the type of solution, ink, humidification system, and the speed of the printing machine. The proportion of alcohol additives ranges from 2 to 25%, (optimally 10%), when using non-alcoholic solutions, the proportion of alcohol does not exceed 2%. In production, a simple floating hydrometer is used to determine the alcohol content in the solution, the accuracy of which is sufficient.

Salts of magnesium, chromium, phosphorus and citric acid, various sulfates and chlorides in the buffer additive regulate the acidity (pH) of the solution, but cannot change the hardness of the solution, while reducing the negative impact of this indicator on print quality. Depending on the type of fountain solution and the properties of water, various additives are used, for the analysis of the quantitative composition of which different methods are used.

In this work, the chemical analysis of mixtures of organic components and wetting solutions is carried out using the well-known gas chromatography method, the results are presented in table 1. [8-11].

In chromatographic analysis (Fig.1), the carrier gas enters the analytical unit 3 from cylinder 1 under pressure with a high-temperature test solution through a reducer (stabilization unit) 2 [12].

The solution evaporates and is passed by a gas stream into the column of the chromatograph 5. Usually the separation occurs at a temperature of 200–4000C and below. Components separated by the action of gas enter the detector 6. In amplifier 7, the recorder registers changes over time, and according to the data obtained, a potentiometer with a recorder draws a chromatogram (Fig.2).

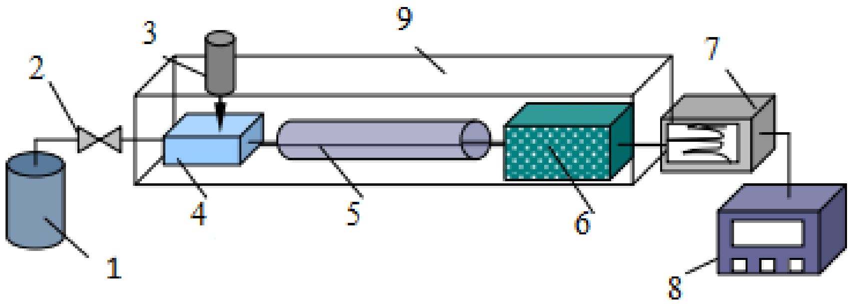

Figure 1. Schematic device of the chromatograph: 1-cylinder with carrier gas; 2-reducer; 3-sample input system; 4-evaporator; 5-chromatographic column; 6-detector; 7-analytical signal registration system; 8-computational integrator; 9-thermostat

Quantitative characteristics of the chromatogram are peak height and surface area. The peak area is proportional to the amount of substance, which is calculated as the product of the peak height (H) and the width (equal to 0.5) measured between the height:

$$S = h \cdot \mu_{0.5}$$

The calculation of the component composition in the test solution is calculated by the formula:

$$\omega_i = \frac{S_i}{S_{\text{ст}}} \cdot r \cdot 100,$$

where S_i and S_{ct} are the peak area of the analyzed and standard substance, mm^2; r is the ratio of the mass of the standard to the mass of the sample. The results are presented in table1.

Results. According to the results obtained on the gas chromatogramm, the following scheme was obtained (Fig. 2):

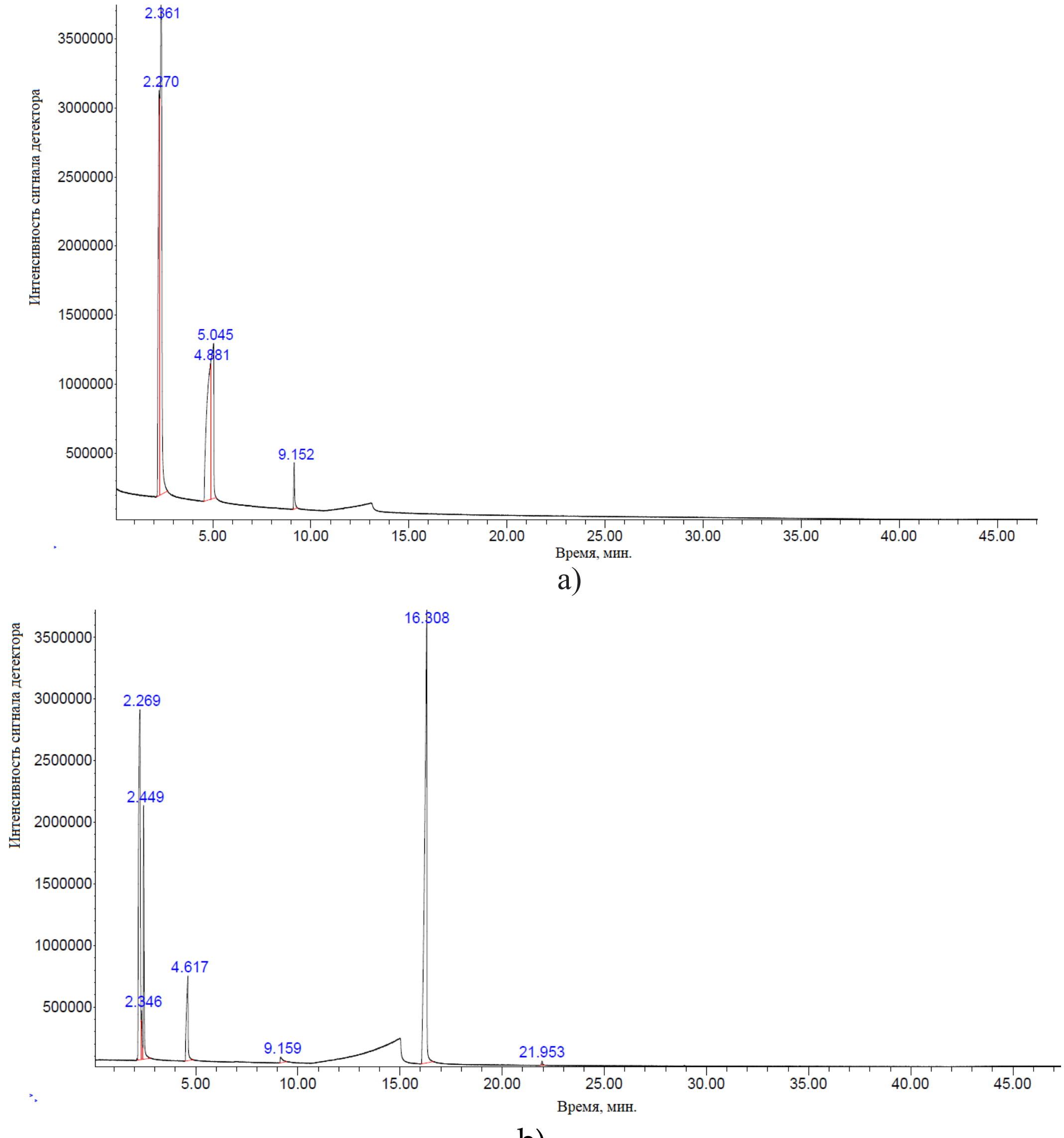

Figure 2. Differential chromatogram of solutions: a-Printchem Sun Fountain 300, b-Chembyo Fountain Solution SF.

Table 1. Components of the concentrate of the fountain solution.

Name of chemical elements	Percentage amount in concentrate	
	Printchem Sun Fount 300	Chembyo
Ammonia	35.22	30.74
Carbon dioxide	25.07	-
Propylene glikol	20.60	7.17
Isopropyl alcohol	-	10.12
Ethanol	-	2.45
Ethanol,2-(2-butoxyethoxy)	-	48.61
4-Pyridinemethano, acetat	-	0.22
Furan	-	0.70
2H-Puran-2-one	1.67	-

As can be seen from the table 1, universal and economical (2-4%) Printchem Sun Fountain 300 concentrate, used for water with carbonate hardness (up to 300 mg/l), contains ammonia, carbon dioxide, propylene glycol. Chembyo Fountain Solution SF 2015 the concentrate of the moisturizing solution used for soft and medium hardness water contains ethyl and isopropyl alcohols. The concentration of hydrogen ions in tap water can be determined by the pH value from 0 to 14, depending on the acidity or alkalinity. Acidic medium has a pH from 0 to 7, neutral medium-7, alkaline medium-7. For high-quality printing, a range of 4.8 to 5.5 pH is required. Deviations from optimal values negatively affect the printing process, for example, poor setting of the paint layer, the shadow of the blanks appears due to the emulsification of the paint at a pH above 6.

The constant hardness, measured in German degrees, does not change even after boiling and is denoted as dH. Carbonate hardness is considered temporary and is expressed in dKH.

In laboratory conditions, using special indicator sticks and an electronic device, the hardness and pH of tap water were measured in two samples from different regions: Tashkent and Namangan (Uzbekistan), the results of which are presented in table 2.

Table 2. Physico-chemical properties of water.

The name of the indicator	The first sample	The second sample	by GOST
Water hardness,^{0} dH (ГОСТ 4151)	2.2	3.9	from 6.0 to 11
pH level (O'zDSt 3277-2015)	7.9	7.6	from 4,8 to 5,5
Electrical conductivity	220	245	from 800 to 1500

As can be seen from the table.2, of the two regions describing calcium and magnesium salts, water hardness values are up to 4 DH, which according to the standard classification can be classified as "soft", while those above 8 DH are considered solid [13]. The use of soft desalinated water from two areas with a hardness index of less than 5 leads to the fact that the paint layer fits snugly to the surface of the impression, since during the printing process water interacts with calcium and magnesium salts of paper and printing ink.

Discussion. According to the parameters of the hydrogen indicator (pH), it was found that the concentration of hydrogen ions in water is above the optimal range for high-quality printing, that is, the medium is slightly alkaline. Calcium and magnesium salts with fatty acids of printing inks create a gray shade, because on the rollers the paint is part of the water, and water should be part of the paints, that is, the printing ink is "lathered". At the same time, the oil layer settles in the printed form, on the wrapper and moisturizing rollers, which leads to the formation of a shadow and a gray shade on the impression. It also worsens the maintenance of the purity of hollow elements (wetting the mold with water), the printing elements of the mold are destroyed, which leads to a decrease in its reproducibility and the need for replacement in the process of printing replication. Depending on the water quality, certain special additives are added to the wetting solution together with alcohol to regulate and stabilize the pH, improve the hydration of printed hollow elements and accelerate the process of their hydrophilization. At the same time, additives should not negatively affect the fixation of printing ink, cause corrosion of printed metals.

Conclusion. Thus, the gas chromatography method used made it possible to quickly and accurately obtain information about the chemical composition of the fountain solution concentrate for offset printing. The obtained chromatography parameters allow determining the amount of additives depending on the type of solution, the properties of water, sealing material and ink, as well as adjusting the percentage of isopropyl alcohol to ensure a balance of "ink – fountain solution".

REFERENCES

1. Stefanov S.I. Face and moisturizing mask in offset printing//Computer. No. 1. 2003.
2. M.A.Bozoyan The effect of the supply of a moisturizing solution on the quality of prints in flat offset sheet printing: abstract Candidate of Technical Sciences Moscow. 2015. 24 p.
3. E.Orlova The influence of the parameters of the moisturizing solution on the distribution of the layers of the solution on the rollers: diss. Candidate of Technical Sciences ... 2007. Moscow. 175 p .
4. A.K.Bulanov, I.A.Bulanov, R.K.Imamov, D.Usmanov Study of the supply of a moisturizing solution by a feeding group of a moisturizing apparatus // The universe. Technical sciences. 2022. №4 (97).
5. L.G.Varepo, A.Yu.Brazhnikov Evaluation of temperature deviations of a humidifying solution in the humidification system of an offset printing machine // Omsk Bulletin. Mechanical engineering and machine science. 2016 No.1 (145). pp.8-12.
6. G.I.Turchinova, D.I.Vlasenko, S.G.Vlasenko Factors influencing the process of fixing ink when printing by offset method // Eastern European Journal of Advanced Technologies. 2009. No. 2. pp. 41-43.
7. S.Gulyaev, V.Tikhonov Principles of finding the balance of paint – moisturizing solution // Polygraphy. Moscow. 2007.
8. Khromchenko L.Ya., Rudenko B.A. Determination of trace amounts of organic pollutants in drinking, natural and wastewater by gas chromatography // Chemistry and technology of water. - 1981. - Vol. 3. - 1.
9. Handbook of physico-chemical methods of environmental objects research. - L.: Shipbuilding, 1979.
10. Unified methods of water quality research. - M.: COMECON, 1987.
11. Water Analysis. Soniassy R., Sandra P., Schlett C. Eds. - Waldbronn: Hewlett-Packard Company, 1994.
12. https://unichem.com.ua/article/zhestkost_vodi
13. https://www.meta-chrom.ru/company/articles/chromatographic-analysis/

CONTENTS

ADVANCED PEDAGOGICAL TECHNOLOGIES IN EDUCATION

ECONOMICAL SCIENCES