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21. MEĐUNARODNA KONFERENCIJA
TISKARSTVA, DIZAJNA I GRAFIČKIH KOMUNIKACIJA

ZBORNIK RADOVA
PROCEEDINGS

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Senj, 13. - 16. rujna 2017. godine, Hrvatska
Senj, 13th - 16th September 2017, Croatia


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doc. dr. sc. Miroslav Mikota

GRAFIČKA UREDNICA / GRAPHIC ART DIRECTOR

Nika Svilar, univ. bacc. ing. techn. graph.

DIZAJN KORICA / COVER DESIGN

Jelena Kajganović, dipl. graf. ing.

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dobro došli na 21. međunarodnu konferenciju tiskarstva, dizajna i grafičkih komunikacija Blaž Baromić!

Pred Vama je Zbornik sažetaka Konferencije koji sadrži sažetke znanstvenih radova kroz koje su pokrivene teme Konferencije: povijest tiskarstva, knjige i pisma, grafičke komunikacije i mediji, grafički dizajn, fotografija, izdavaštvo, priprema za tisak, tisak, dorada, ambalaža, sustav upravljanja bojom i kolorimetrija, materijali, postojanost papira i otisaka, kontrola kvalitete, marketing, ekologija i ostale teme vezane uz tiskarstvo, dizajn i grafičke komunikacije.

Radove, čije sažetke možete pronaći u ovom zborniku, recenzirali su članovi Međunarodnog znanstvenog i recenzijskog odbora Konferencije, no za sadržaj radova, podatke iznesene u njima i njihovu prezentaciju odgovaraju sami autori pojedinog rada.

Radovi čiji su sažetci objavljeni u ovom zborniku će na Konferenciji biti predstavljeni kroz pozvana predavanja, predavanja i postersku sekciju te se nadam da će Vam Zbornik pomoći u aktivnom sudjelovanju na Konferenciji.

Svim autorima, sudionicima Konferencije, organizatorima Konferencije, članovima Organizacijskog i Znanstvenog i recenzijskog odbora, sponzorima i donatorima zahvaljujem na doprinosu Konferenciji te želim ugodan boravak u Senju i uspješan rad na Konferenciji!

Urednik

Introduction Words

Dear Colleagues,

Welcome to the 21st International Conference on Printing, Design and Graphic Communications Blaž Baromić!

The Book of Abstracts of the 21st International Conference on Printing, Design and Graphic Communications Blaž Baromić is in front of you. It contents abstracts of scientific papers covering Conference topics: History of printing, book and script, Graphic communications and media, Graphic design, Photography, Publishing, Prepress, Press, Postpress, Packaging, Color management, Materials, Paper and print durability, Quality control, Marketing, Ecology and other topics related to printing, design and graphic communications.

The book contains abstracts of the papers, which will be presented on the Conference. All papers are reviewed by members of the International scientific and review committee, however the contents and date of the papers and presentations are the sole responsibility of the authors.

Papers whose abstracts are published in the Book will be presented as invited lectures, oral presentations and posters and I hope that the Book of Abstracts will help you in active participation on the Conference.

I wish pleasant time in Senj and successful participation on the Conference to all authors, Conference participants, Conference organizers, members of Organizing and Scientific and Review Committees, sponsors and donators!

Editor

OPTICAL STABILITY OF PAPERS EXPOSED TO ELECTROMAGNETIC RADIATION ACCORDING TO USED FLOTATION DEINKING METHOD

OPTIČKA STABILNOST PAPIRA IZLOŽENIH ELEKTROMAGNETSKOM ZRAČENJU UVJETOVANIH NAČINOM RECIKLIRANJA

Dorela Dujmušić, Vesna Džimbeg-Malčić, Željka Barbarić-Mikočević, Ivana Plazonić, Irena Bates
Grafički fakultet, Getaldićeva 2, Zagreb, Hrvatska
E-mail: dorela.dujmusic@gmail.com; vesna.dzimbeg.malcic@grf.hr; zeljka.barbaric.mikocevic@grf.hr; ivana.plazonic@grf.hr; irena.bates@grf.hr

SAŽETAK

U radu je promatrana optička stabilnost recikliranih hrvatskih dnevnih novina Eco-lužinom na tri različita načina. Ubrzano starenje pripremljenih laboratorijskih listova provedeno je u Solarbox-u 1500e pri temperaturi od 60°C u različitim vremenskim intervalima: 24, 48 i 72 sata. Optička stabilnost svih laboratorijskih listova analizirana je kroz promjene refleksijskih spektara u odnosu na listove dobivene metodom reciklacije INGEDE 11. Rezultati ispitivanja na svim uzorcima pokazuju izjednačenje refleksijskih spektara iznad 600 nm i njihovo znatno snižavanje ispod 600 nm uzrokovano plavim intervalom bijele svjetlosti.

Ključne riječi: ubrzano starenje, flotacijsko obezbojenje, reciklirani papir, reflektancija

ABSTRACT

This study observes optical stability of deinked Croatian daily newspaper with novel type of alkali media called Eco-alkali after exposing to electromagnetic radiation. Three deinking methods with Eco-alkali were carried out under different experimental conditions. Gained laboratory papers were submitted to accelerate ageing at 60°C for 24, 48 and 72h provided by Solarbox 1500e. Experimental results were compared to accelerate aged laboratory

papers made of pulp deinked with frequently used INGEDE Method 11. The results have shown that the reflectance of samples is almost equalled to reflectance of non aged paper for wavelength higher than 600 nm and that consequential reduction of the reflective spectra for wavelength lower than 600 nm of accelerated aged papers treated with Xenon lamp and indoor filter was caused by blue part of visible light.

Key words: accelerated ageing, flotation deinking, recycled paper, reflectance

1 INTRODUCTION

Apart from increasing the temperature, acceleration of degradation can be achieved by irradiation with light. Heat and light, beside oxygen, ozone and moisture, are environmental factors that can influence on papers stability [1]. Every oxidation mechanism involves photochemical and thermal activation. Photochemical activation under polycromatic light and thermal activation, even at room temperatures, cannot be examined separately. The absorbed light intensity and the temperature of the exposed surface are two types of activation that should be controlled simultaneously during artificial accelerated tests in order to ensure the reliability of results [1]. Exposure to light is harmful to paper because it tends to shorten the time required to reach the maximum possible rate of oxidation at a given temperature [2].

The energy of photons in the infrared range is rarely sufficiently great to induce the chemical reactions that are generally encountered in photochemical deterioration, but as the wavelength of radiation gets shorter, through the blue and violet region of the visible and into the ultraviolet, the photons possess an increasing amount of energy and are capable of inducing significant photochemical changes that causes irreversible damage of polymer [2]. Photolysis is light-induced degradation that can occur when the energy of an absorbed photon is high enough to induce direct dissociation of a bond. Indoors, where sunlight is filtered by windows made of glass, the light spectrum contains wavelengths higher than 340 nm. Under such conditions, direct photolysis of cellulose does not take place. In the process called photosensitised degradation the energy from electronically excited states is transferred to initiators, or oxygen, resulting in the formation of reactive species and subsequent photooxidative decay of cellulose. [1]. Photooxidation reduces the degree of polymerization and the strength of paper and cellulose, deteriorates their optical properties, especially those of lignin containing paper and introduces carbonyls and carboxyls on the cellulose backbone (Patfiled, 1965). Light exposure can also cause bleaching to paper, presumably because it oxidizes the chromophores produced by lignin degradation, or for non-lignin containing paper, converting the carbonyls to carboxyls (Bos, 1972) [1].

The intention of this research is to measure reflectance in visible part of electromagnetic spectrum of accelerated aged newspaper handsheets made at different process parameters in chemical deinking flotation.

2 EXPERIMENTAL PART

Experimental samples for optical stability analysis were recycled paper made of daily Croatian newspaper in four chemical flotations deinking trials, where chemicals and process parameters were changed (Table 1.) [3]. Efficiently removing ink particles from recycled newspaper through flotation deinking demands mildly alkali media. In Trial 1 (T1) standard chemical deinking, INGEDE Method 11 (International Association of the Deinking Industry) was done and alkali media was achieved by sodium hydroxide as a control method for defining deinking efficiency of new alkali flotation deinking approach. Novel alcali, called Eco-alkali were applied on other three samples. In Trial 2 (T2) alkali media was accomplished by Eco-alkali, chemicals and surfactant processed at 45°C. The environmental impact of chemicals for conventional flotation deinking was minimized in Trial 3 (T3) which was done at 45°C by applying only Eco-alkali without any additional chemical except surfactant, which is necessary for flotation. Cold flotation was done at 24°C in Trial 4 (T4) with Eco-alkali, chemical and surfactant. Handsheets, after flotation, were prepared from pulp gained from these trials according to INGEDE Method 1 and was kept in a room away from sunlight and high moisture for a year.

Table 1 Flotation deinking trials

	Trial 1 (T1)	Trial 2 (T2)	Trial 3 (T3)	Trial 4 (T4)
Alkali	0.6% sodium hydroxide	33.5% Eco-alkali		
Sodium silicate	1.8%	1.8%	-	1.8%
Hydrogen peroxide	0.7%	0.7%	-	0.7%
Oleic acid	0.8%	0.8%	0.8%	0.8%
Temperature	45°C	45°C	45°C	24°C

Already prepared experimental samples were exposed to accelerated ageing provided by Xenon Lamp of Cofomegra's Solarbox 1500e. Simulation of indoor environment was achived using indor filter which admits infrared radiation and absorbes ultraviolet light. All handsheets were exposured to radiant energy in Solarbox 1500e for one, two and three days.

Reflectance spectra values (R) were measured for all samples before ageing ($R_{non\ aged}$) and after accelerated ageing (R_{aged}) and gained results are presented as ΔR according to Equation (1):

$$\Delta R = R_{non\ aged} - R_{aged} \quad (1)$$

Handsheets reflectance measurements were processed using X-rite SpectroEye spectrophotometer in the interval of the wavelengths from 380 nm to 730 nm for every 10 nm, with standard illuminant D65 and 2 degree of observer. These measurements were analysed by Technical Graphic Origin 6.0 Professional.

3 RESULTS AND DISCUSSION

The spectrum differences (ΔR) results of accelerated aged handsheets, prepared by different process conditions during flotation deinking method, are presented at Figure 1.

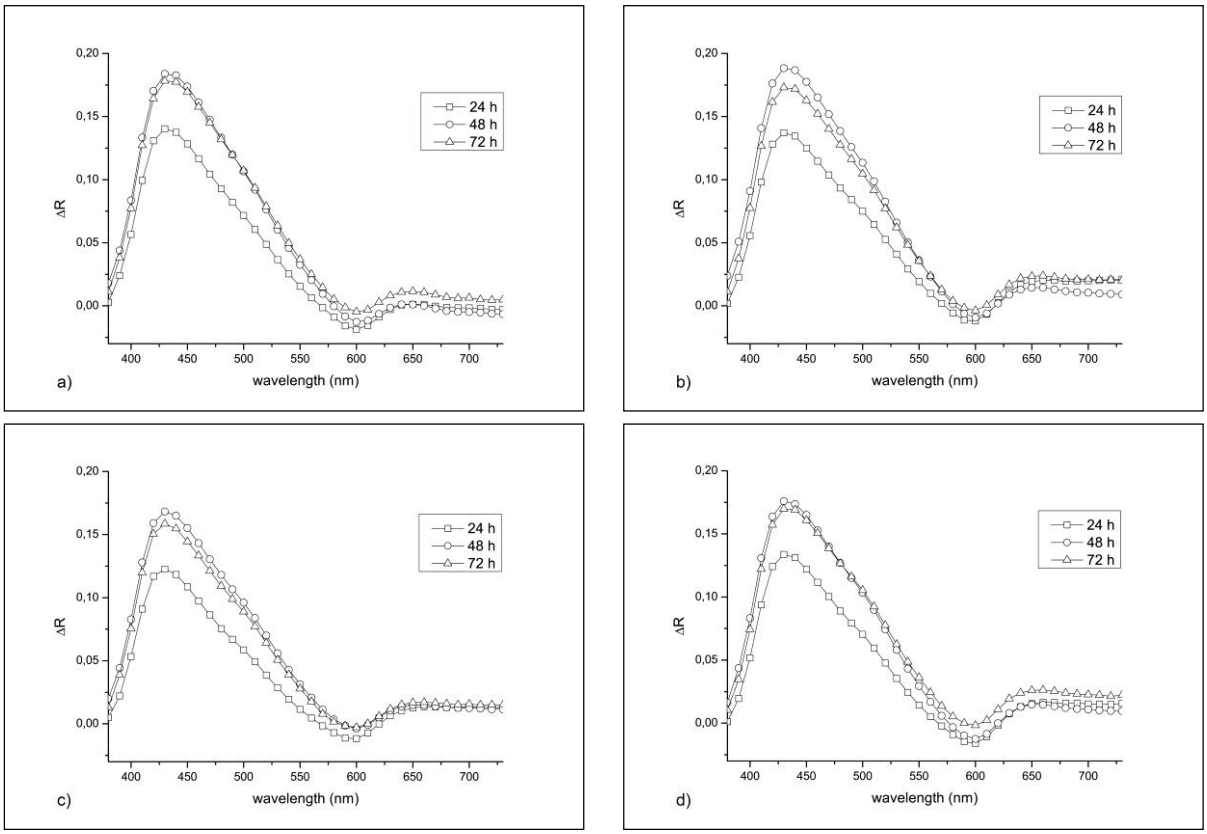

Figure 1. The influence of ageing time on handsheet spectrum differences reflectance according to process conditions: a) Trial 1, b) Trial 2, c) Trial 3 and d) Trial 4

For better understanding the experimental results reflectance spectrum of non aged and accelerated aged handsheets, prepared by different process conditions during flotation deinking method, are presented at Figure 2.

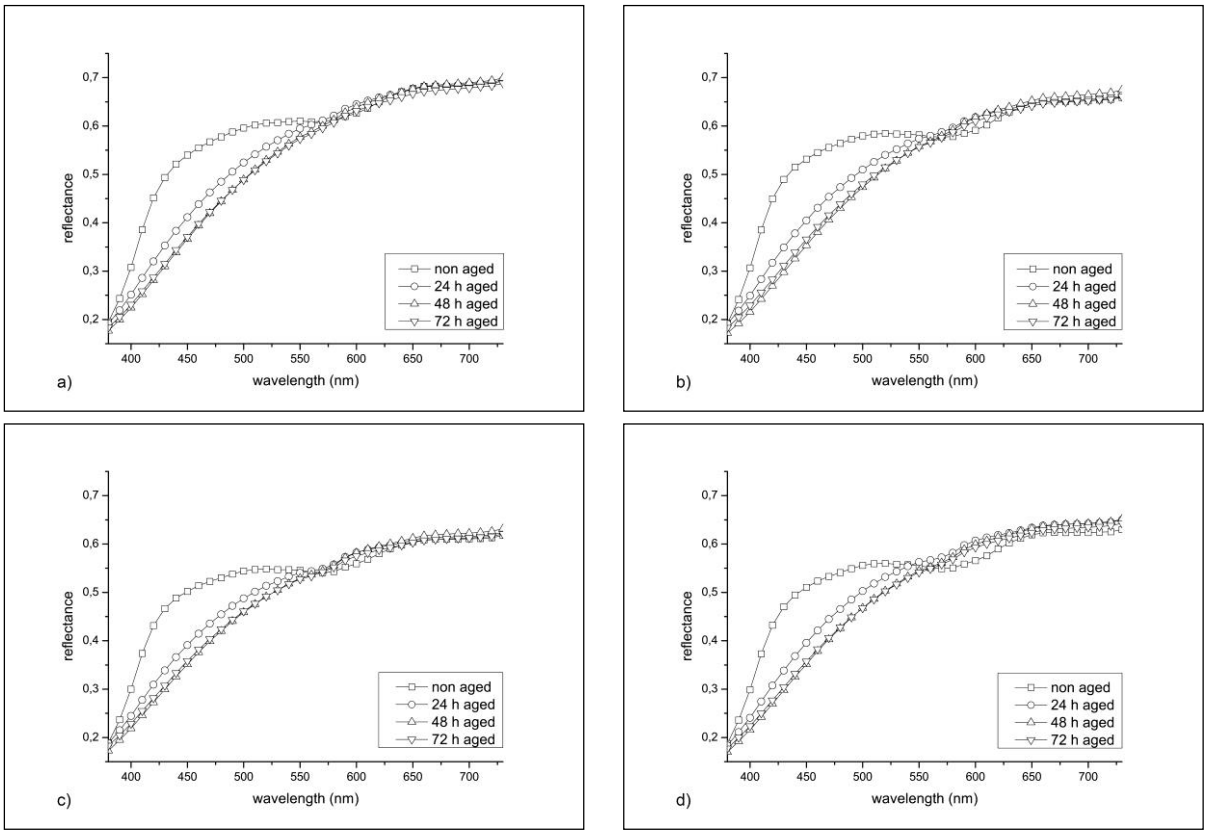

Figure 2. The influence of ageing time on handsheet reflectance spectrum according to process conditions: a) Trial 1, b) Trial 2, c) Trial 3 and d) Trial 4

Negative values of ΔR in the visible part of spectrum around 600 nm indicate the technical foul for all trials.

The results of all trials have shown major reduction of reflective spectra for wavelength lower than 600 nm when we compare accelerated aged with non aged paper and that reflectance spectrum of these samples for wavelength higher than 600 nm are almost balanced. ΔR values are significantly reduced after exposing for 48 hours to accelerated ageing. The results of trials 2 and 3 show sensibly lower ΔR values after exposing for 72 hours to accelerated ageing.

Handsheets made in trials 1, 2 and 4 gives almost similar or equal ΔR values after exposing to accelerated ageing from 24 to 72 hours, while handsheets made in trial 3 (Figure 1c) give

lower ΔR values. Since those handsheets made in trial 3 are made from pulp suspension without presence of hydrogen peroxide and sodium silicate those results show influence of hydrogen peroxide and sodium silicate on ΔR values.

4 CONCLUSION

This research has brought about several conclusions:

- consequential reduction of the reflective spectra for wavelength lower than 600 nm of accelerated aged papers treated with Xenon lamp and indoor filter was caused by blue part of visible light

- the results have shown that the reflectance of samples is almost equalled to reflectance of non aged paper for wavelength higher than 600 nm

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