

IMPROVEMENT OF THE PROPERTIES OF BLEACHED OFFSET PAPERS USED FOR BOOK COVERS AND THEIR BEHAVIOUR DURING PRINTING

T. Bozhkova

University of Chemical Technology and Metallurgy
8 Kl. Ohridski, 1756 Sofia, Bulgaria
E-mail: mila.2005@abv.bg

Received 15 December 2009
Accepted 10 April 2010

ABSTRACT

One of the recent tendencies in packing paper production, including book covers, is the improvement of their physical-mechanical and barrier properties, recycling and secondary usage.

Different kinds of papers, cardboards and a vast range of surfacing materials on paper base with various properties are used during the production of book covers. They have no analogue regarding the good outlook and functionality. They offer respectable possibilities for multicolour printing and may be processed in different text types. Excellent qualities are exhibited and are suitable for usage in different cases; their overall strength and hardness are also excellent.

Keywords: paper base, improved paper, surface overlaying, physical-mechanical and barrier properties.

INTRODUCTION

As follows from the main purpose of book covers, namely protection of the book body from damaging during usage, the covering materials must possess high mechanical, tearing, bursting and wearing resistance have to accept well the printing materials, to possess low water permeability, as well as good printability. These materials are dedicated to impart a beautiful and attractive outlook of the production, corresponding to its content.

The surface improved papers are a good choice for elaboration of wrappers and it is sufficient for them to have single side overlaying [1, 2].

What is understood under good printability?

Under good printability of the paper are understood all properties which influence the printing result - they differ mainly in function of the printing method [3].

During the present investigations experiments are carried out aiming at improvement of the physical-mechanical and some barrier properties of offset papers used for book covers by surface improvement

and their behavior during printing is observed (i.e. their printability).

EXPERIMENTAL

Used materials

For surface improvement we have used a product of the company "Schill + Seilacher" and as a paper base - offset bleached paper, produced in the EU.

In Table 1 are shown some of the basic indices of the paper base and in Tables 2 and 3 show, accordingly, the way of use and the range of implementation of the products, as well as their characteristics [4, 5].

The paper and the cardboard covered with UKADUR/UKAPHOV are:

- recyclables;
- biodegradable;
- in compliance with the requirements for nutritive products.

They also ameliorate the quality of packing paper without loss at tearing and have easy application of the covering even at paper machines.

Methods of analysis

The following methods have been used for carrying out the experiments for determination of the physical-mechanical and barrier properties of the paper base and the obtained improved offset paper:

- Water absorption acc. to Cobb - g/m²;
- Tearing strength at stretching, kN/m with dynamometer “FP-30”;
- Relative elongation, % with dynamometer “FP-30”;
- Bursting strength, kPa with apparatus “Frank”;
- Resistance to treading mN with apparatus “Elmendorf”;
- Hardness acc. to Gurley, mg;
- pH of water extracted from the used paper.

RESULTS AND DISCUSSION

Preliminary laboratory studies were carried out for improvement of the physical and mechanical indices and some barrier properties of papers produced in the EU with the goal to establish the most appropriate product.

The tests were done with three types of “Schill + Seilacher” GmbH products, namely: UKAPHOBL496, UKAPHOB 5100 and UKADUR 9533. The laying of the products on the paper was done in laboratory conditions on a special table with a laying bar. From the preliminary tests was established, that all the three products improve the physical and mechanical, as well as the barrier properties of the paper base, but the most

easy to lay product is the one with the highest viscosity, namely UKAPHOB 5100. That is why we have used it in the semi-industrial trials. The paper improved with this product is easy for recirculation and biodegradable [6, 7].

The product application on the paper base was carried out on an installation with working width of 50 cm and speed of 60 m/min, the coating mass was 10 g/m².

Of the obtained surface-improved offset paper the physical-mechanical and some barrier properties were determined and afterwards the indices were compared to those of the paper base, shown on Figs. 1, 2, 3 and 4.

From Fig. 1 it is clearly seen that the water absorption of the surface-improved offset paper for book covers has diminished with about 30 % in comparison to the water absorption of the paper base.

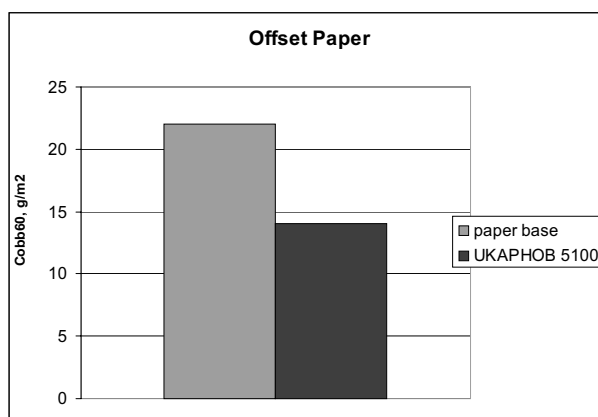


Fig. 1. Alteration of the indices Cobb₆₀ of offset paper for book covers with surface improved with UKAPHOB 5100.

Table 1. Main indices of bleached offset paper for book covers, produced in the EU.

| Indices | methods | value |
|---|---------------------|-------|
| Mass, g/m ² | BDS EN 536 | 120 |
| Tearing strength at stretching, kN/m | BDS EN ISO 1924 - 2 | |
| - longitudinal | | 5.80 |
| - transversal | | 3.76 |
| Relative elongation, % | BDS EN ISO 1924-2 | |
| - longitudinal | | 2.27 |
| - transversal | | 5.58 |
| Bursting strength, kPa | BDS EN 20235 | 316 |
| Water absorption, Cobb ₆₀ g/m ² | BDS EN 20235 | 22 |
| Hardness, acc. to GURLEY, mg | BDS EN ISO 186 | |
| - longitudinal | | 289 |
| - transversal | | 151 |

Table 2. Way of use and application range of the products of “Schill+Sleicher” GmbH.

| Product | Way of use | Application range |
|---------------|--|---|
| UKAPHOB L 496 | Foreseen to be laid as covering, individually or in combination with other anion additives, on a sizing press or by the usual for the paper industry aggregates for laying of coverings. | Neutral sizing of papers and boards with the use of: water solution of special polymers, film formatting, barrier means against solvents, greases and oils. Covering products with possibility for recycling, against water vapor penetration and hydrofobilizing. Substitute of plastic coverings on packings, which can not be recycled (PE, PVDC) |
| UKAPHOB 5100 | Foreseen to be laid as covering without additive or dilution with water | |
| UKADUR 9533 | Foreseen to be laid as covering, individually (straight or diluted with water) or in combination with starch, KMC or alginates. | |

Table 3. Characteristics of the products of “Schill+Sleicher” GmbH .

| Product Indices | UKAPHOB L 496 | UKAPHOB 5100 | UKADUR 9533 |
|--------------------------------|------------------------------------|--|------------------------------------|
| Appearance | Thin (liquid) white dispersion | Thin white dispersion | Thin white to yellow dispersion |
| Chemical composition | Water solution of special polymers | Mixture of special copolymers with waxes | Water solution of special polymers |
| Ionogenity | Anion | Anion | Anion |
| Content of active substance, % | 43 - 46 | 41 - 44 | 43 - 46 |
| pH | 7 - 9 | 7 - 9 | 7 - 9 |
| Viscosity (20°C), mPa.s | About 100 | Max 600 | About 100 |

Comparing the tearing strength at stretching and the relative elongation of the improved paper and the paper base, shown on Fig. 2, depicts that for both indices there is an increase with about 10 % in favor of the improved paper.

The indices bursting strength, as can be seen on Fig. 3, is doubled for the paper improved with the product UKAFOB 5100.

The indices hardness, as seen from Fig. 4, in longitudinal direction increases significantly, while in transversal direction the increase is minimal, which imposes the exigency for monitoring the fiber direction when cutting and creasing. The harder the paper is, the tighter fold is obtained.

The insufficient ink fixing may be caused by the unconformity between the ink and paper properties, high quantity of hydrating solvent, increased air humidity, as well as an increase of the paper pH.

The paper for offset printing must be with appropriate acidity, so papers with $\text{pH} > 9.5$ or $\text{pH} < 4.5$

are not suitable for printing. Additionally, the paper must be acclimatized towards the temperature and the humidity in the printing shop. The paper humidity must be in the limits of 7 ± 1 %. When the paper is dry, static electricity occurs leading to sticking of the paper sheets and braking of the paper in the direction to the printing apparatus. After the test carried out for pH determination of water extracts from the improved offset paper was established, that the pH value for both extractions is 5. Consequently, the covering does not alter the paper acidity and no technological problems are to be expected during the printing process due to these indices.

The influence of the coating in multicolour offset printing was monitored in production conditions. The imprints were done on HEIDELBERG Speedmaster. The prints on improved and non improved paper were compared visually. As a result from the visual observation was established, that both imprints are nearly identical and no apparent defects on the imprint, as poor ink fixing, fiber pickling and others were observed, thus the

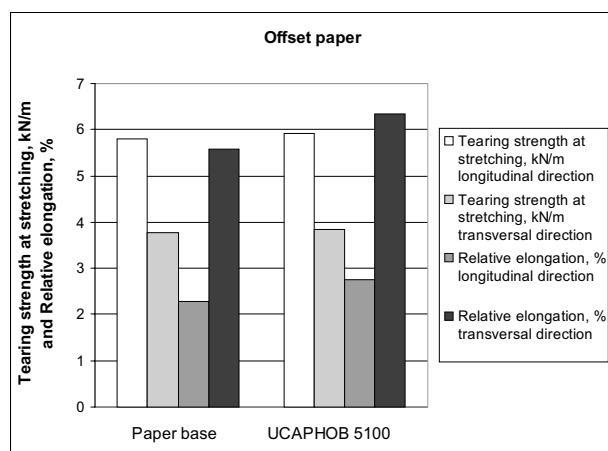


Fig. 2. Alteration of the indices “tearing strength at stretching, kN/m” and “relative elongation, %” of offset paper for book covers with surface improved with UCAPHOB 5100, compared to base paper.

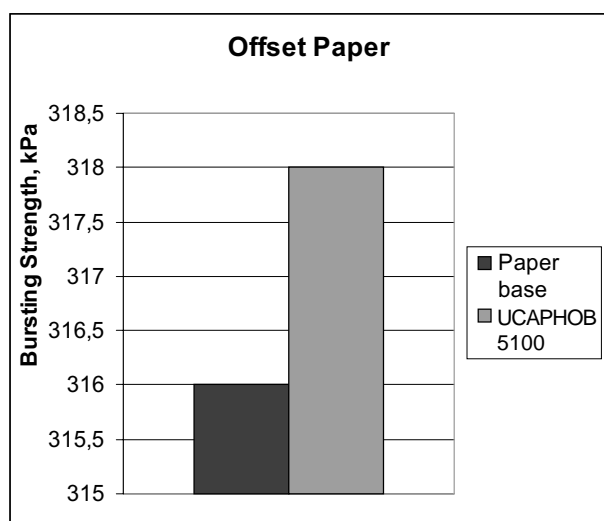


Fig. 3. Alteration of the index “bursting strength, kPa”, of offset paper for book covers with surface improved with UCAPHOB 5100.

covering caused no problems during the printing process. Regarding the overall influence of the covering during the printing process, it is necessary to be carried out a complete test on the suitability of the printing machine, which will be the topic of our future studies.

CONCLUSIONS

It may be stated, that the thus treated offset paper used for book covers:

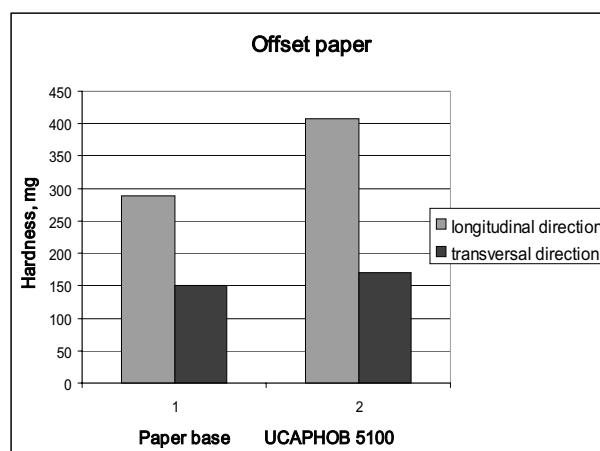


Fig. 4. Alteration of the barrier index “hardness” of offset paper for book covers with surface improved with UCAPHOB 5100, compared to base paper.

- is with higher physical-mechanical and barrier properties;
- the coating has no influence on the paper printability;
- the paper is easy for recirculation and biodegradation.

REFERENCES

1. St. Nedeva, Trends bei der Herstellung und Nutzung von Papieren für Wellenkarton, Zellulose und Papier, **3**, 2006, 5-10, (in Bulgarian).
2. R. C. Grenz, H. Hofer, Die Systematische Eingangskontrolle von Rohstoffen und chemischen Additiven der Papiererzeugung, Wochenblatt für Papierfabrikation, **8**, 2000, 524-534.
3. R. Paetow, Wochenblatt für papierfabrikation, 3-4, 2008, 149-152.
4. Schill Seilacher Firmeninformation, Zellulose und Papier, 1, 2003, 8-11, (in Bulgarian).
5. K. Ivanov, Barrierebeschichtungen von CIBA Seminar, Papierchemikalien von Ciba Specialty Chemicals, 2006, vorgetragener Beitrag, Bansko, 2006, 18-19, (in Bulgarian).
6. N. Kinnunen, Firmeninformation von Clariant Ltd., UK, Packaging Technology, 2003.
7. T. Bozhkova, D. Rozalinov, P. Todorova, Wochenblatt für Papierfabrikation, 2010, (in press).