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**HANUS, Jozef, Technical Problems in  
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**HANUS, Jozef, Problemi tecnici nella  
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*I documenti archivistici del XX secolo rappresen-  
ta la parte maggiore delle consistenze archivistiche  
in tutti gli archivi. Tuttavia, si può dire molto spes-  
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Tale minor qualità concerne il materiale fisico, non  
quello contenutistico. I maggiori problemi nella con-  
servazione di archivi e biblioteche sono causati -  
paradossalmente - dalla carta moderna prodotta  
tra la seconda metà del XIX secolo e gli anni più  
recenti. La nuova tecnologia di produzione della  
carta introdotta attorno al 1850 comprendeva la  
formazione della carta in ambiente acido e prevede-*

## Technical Problems in Preservation of Archives from the 20th Century

### INTRODUCTION

Archival institutions all over the world contain a rich and irreplaceable source of information. They also represent a unique part of the cultural heritage of human society. The preservation and management of those precious resources and accessibility to them by public are principal responsibilities of all public archives. Archival documents are an inseparable part not only of a national cultural heritage of each country but they create also a part of the whole human civilisation. Therefore preservation, conservation and restoration of documents are of a crucial importance among the main tasks of archives.

Preservation of archives is a summary of processes and proceedings ensuring stability and preservation of documents against damage or destruction, treatments of damaged documents by conservation and restoration processes as well treatments of all documents during processing, making accessible, using, exhibition, etc. Preservation of enormous quantities of different types of documents can be solved only by a thorough research as an interdisciplinary complex problem in which the role of paper scientists and their co-operation with experts from other fields of science and technology and practical end-users, conservators and restorers, is an inevitable and the only solution. As these problems are very common for archives, libraries and museums, many activities in the field of preservation are carried out in very close co-operation between these institutions on a national and international level.

The biggest problems in preservation of archives and libraries are caused - paradoxically - by modern papers produced from the 2<sup>nd</sup> half of the 19<sup>th</sup> up to the recent years. The new technology of paper-making introduced in 1850, involved paper formation in an acidic environment and wood as the raw material. This was a crucial milestone from the point of permanence and durability of paper, its degradation and preservation in archives and libraries. The self-degradative effect of acidic papers causes the limited lifetime of machine-made paper from wood pulp with acidic rosin sizing with addition of alum. These problems are well known to the experts from the field of preservation of archives and library paper materials. It seems that - because of large quantities of these materials - only mass deacidification can help to solve these problems.

A large scale research into the field for many years has brought an extensive knowledge in paper degradation causes, mechanisms and also in different techniques and processes in order to improve its permanence, durability and life-span<sup>1, 2, 3</sup>. Many deacidification processes have been introduced and several treatments are commercially used in a large scale<sup>4, 5, 6</sup>.

However, despite all these achievements it seems that still some problems have to be solved. Among the most serious are ranked the following ones: which of the chemical processes offered is most effective; which collection materials should be subjected to such a mass treatment; which analytical methods should be used for evaluation of deacidification processes and life prediction after the treatment; which standards should be developed, which quality standards should be defined, etc.<sup>7, 8</sup>.

Serious research has been devoted to this problem within the European project PaperTreat<sup>9</sup>. PaperTreat was an EC co-funded research project within the Specific Support to Policy programme. The aim of the project is to propose the best solutions for preservation of a variety of paper materials and thus enable their long-term safekeeping. In order to prolong the usable time of the vast quantities of original materials, paper collections may be deacidified and/or stored at appropriate conditions. While preservation options are known, lack of the competent comparative studies still leaves collection keepers hesitant of their use. The aim of PaperTreat project was develop the most cost-effective solutions for preservations of a variety of paper materials and thus enable their long-term safekeeping. The project supports EU policies which stress the importance of preserving and enhancing cultural heritage. Through evaluating the environmental and health aspects of traditional and new deacidification techniques, the project contributes to healthier environment.<sup>9</sup>

## SITUATION IN THE SLOVAK REPUBLIC

47 state archives in the Slovak Republic keep altogether more than 22.000 archival fonds and collections representing total scope of about 185.000 running meters of material<sup>10</sup>. It is estimated that about 80 - 85 % of total holdings are documents created on paper from the period 1850 - 1970, i.e. on acidic paper with very low ageing resistance and thus potentially liable to self-degradation processes<sup>11</sup>.

Situation in Slovak libraries can be illustrated by the example of the Slovak National Library in Martin. The total number of book volumes until year 1900 is 1,2 million, of which 684.000 are on acidic paper. Of 900.000 volumes produced on hand-made paper 470.000 ones are acidic – 117.500 volumes of them are in acute jeopardy. 300.000 volumes are produced on wooden paper; 214.000 volumes are on acidic paper – 107.000 volumes are in acute jeopardy. Much worse is situation concerning books after year 1900. The Slovak National Library keeps 2,4 millions of book titles of which 2.280.000 are made of acidic paper. 1.140.000 book volumes are in acute jeopardy<sup>12</sup>.

*va il legno come materiale grezzo. Questa fu una pietra miliare cruciale dal punto di vista della permanenza e durabilità della carta, del suo degrado e della conservazione in archivi e biblioteche. L'effetto di auto degrado della carta acida causa la vita limitata della carta realizzata industrialmente da pasta di legno con colofonia e allume. Tali problemi sono ben noti agli esperti del settore della conservazione del materiale cartaceo di archivi e biblioteche. Sembra che - a causa della gran quantità di tali materiali - solo una deacidificazione su vasta scala può aiutare a risolvere tali problemi. Una ricerca nel campo ad ampio raggio per molti anni ha portato ad profonda conoscenza della cause del degrado della carta, dei meccanismi e pure a differenti tecniche e processi volti a migliorarne la durabilità. Molti processi di deacidificazione sono stati introdotti e commercializzati su vasta scala. L'articolo dà conto*

1. Williams, J., C. ed.: *Preservation of Paper and Textiles of Historic and Artistic Value II*. American Chemical Society 193, Washington, DC, 1981.

2. Hendriks, K., B.: *Permanence of Paper in the Light of six centuries of Papermaking in Europe. Actes des Deuxièmes Journées Internationales d'Études de l'ARS.AG*. Paris 1994, pp. 131-137.

3. *Ageing and Stabilisation of Paper*. Eds. M. Strlič, J. Kolar. National and Univeristy Library. Ljubljana, 2005, 211 p.

4. Henk, J. Porck: *Mass Deacidification-An Update of Possibilities and Limitations*. European Commission on Preservation and Access, Amsterdam and Commission on Preservation and Access, Washington, September 1996, 54 p.

5. Hanus, J.: *Trendy v oblasti masového konzervovania archívnych a knižničných fondov* in «Slovenská archivistika», 2000, n. 1, s. 18-29.

6. Blüher, A.: *Experience in Paper Deacidification - Three Years of Operation in the Swiss National Library*. in «Papierrestaurierung» 4(2003), pp. 21-28.

7. Banik, G.: *Mass Technology in Germany and its Quality Control* in «Restaurator», 2005, pp. 63-75.

8. Banik, G., Doering, T., Kolbe, D., Hähner, U.: *Quality Control of mass deacidification of library and archival holdings*. ICOM-CC 14th Triennial Meeting, The Hague 14-16 September 2005, Preprints (Volume I), ed. Isabelle Verger, James & James Earthscan, London, pp. 157-165.

9. <http://www.infosrvr.nuk.uni-lj.si/jana/papertreat/index.htm>

10. Informatívny sprievodca štátnych archívov Slovenskej republiky I. Ministerstvo vnútra SR, OA SS, Bratislava (2000). (Informative guide to the State Slovak archives I. Ministry of Interior of the Slovak Republic, Department of Archives and Registries, Bratislava 2000 – in Slovak).

11. J. Hanus, J. Mináriková, E. Hanusová, *Deacidification without equipment and money - dream or reality?* ICOM-CC 15th Triennial Meeting, Rio de Janeiro 22-28 September 2002, Preprints (Volume II), ed. Roy Vontobel, James & James London, pp. 603-608.

12. Bukovský V., *Nevyhnutnosť masovej deacidifikácie papiera vo fondoch knižníc a archívov, Buničina a papier - technológie, vlastnosti, životné prostredie*. Zborník z medzinárodnej konferencie. Bratislava (2001) pp. 183-188.

*sia dei diversi approcci alla soluzione di tale situazione, così come delle problematiche in alcuni archivi e biblioteche.*

**HANUS, Jozef, Tehnični problemi in varovanje arhivskega gradiva v XX. stoletju. Atlanti, Zv. 19, Trst 2009, str. 57-65.**

*Arhivski dokumenti iz XX. stoletja predstavljajo največji del arhivov verjetno kar v vseh arhivih po svetu. Kakovost teh dokumentov pa je verjetno vprašljiva, saj pravimo, da kadar je večja količina, je zato manjša kakovost. Po drugi strani pa vemo, da ti dokumenti, ki so manjše kakovosti, so zato potrebni večje fizične zaščite. Tako se zdi, da morajo imeti večjo zaščito novejši dokumenti, t.j. tisti, ki so nastali od druge polovice 19. stol. Vse do danes. Papir, ki so ga pričeli proizvajati po letu*

In other Slovak libraries - scientific, public, special and academic - is kept about 43,6 millions of library units. On the basis of statistical data it can be stated that the situation in these libraries is even worse because most of their collections are books, journals, newspaper and other units produced after 1850 and 1900 on wooden and acidic paper<sup>12, 13</sup>.

The systematic effort of the archives libraries, museums, galleries and other cultural institutions have raised public awareness of the seriousness of cultural heritage endanger and necessity of its preservation; the National Council of the Slovak Republic has passed the Declaration on Preservation of Cultural Heritage<sup>14</sup>.

## THE APPROACH TO CULTURAL HERITAGE PRESERVATION IN ARCHIVES AND LIBRARIES

The effort of the Slovak National Archives and the Slovak National Library for preservation of archives and library paper cultural heritage together with activities and long-term co-operation with the Department of Chemical Technology of Wood, Pulp and Paper and Department of Graphic Arts and Applied Photochemistry, Faculty of Chemical and Food Technology, STU Bratislava and the Slovak Academy of Science, Polymer Institute resulted in the State programme of research and development "Preservation, stabilisation and conservation of traditional information carriers in the Slovak Republic - KNIHA SK"<sup>15, 16, 17, 18</sup>. The programme was financed by the Ministry of Education of the Slovak Republic within the framework of the State programme "Current problems of the society development". Its first phase was realized from 10/2003 until 12/2005, the second in the period 1/2006 - 12/2008.

The basic aims, structure and some results of the program can be summarized as follows:

### Coordination of the program

- the scientific and technological potential of the key institutions in the field of cultural heritage preservation - Slovak University of Technology / Faculty of Chemical and Food Technology, Slovak National Archives, Slovak National Library and Polymer Institute, Slovak Academy of Science - has joined into a consistent research-educational system and association "Consortium KNIHA SK";
- concentration of scientific capacity in the field of technology of preservation, stabilization and conservation of ligno-cellulosic (LC) macromolecular materials in the SR.

### Shared specialized national library of the SR for the field of cultural heritage preservation

- there has been created a specialised national library for the field of technologies of cultural heritage protection and preservation, shared knowledge space of world and new own pieces of knowledge, intranet communication system and investigating working space for program participants;

13. Hanus, J.: *Integration of paper education, research and industry for cultural heritage preservation*. in: Baudin G., Fellegi J., Gellerstedt G., Katuscak S., Pikulik I., and Paris J. (Editors): *WPP - Chemical Technology of Wood, Pulp and Paper*. 490 pages. ISBN 80-227.1942-0. STU Bratislava 2003, pp. 91-95.

14. Deklarácia Národnej rady SR o ochrane kultúrneho dedičstva. Uznesenie NRSR z 28.2.2001, č. 1292.

15. Katusčák S.: *Chemical Technology of Wood, Pulp and Paper in Culture, Education and Industry*. in: Baudin G., Fellegi J., Gellerstedt G., Katuscak S., Pikulik I., and Paris J. (Editors): *WPP - Chemical Technology of Wood, Pulp and Paper*. 490 pages. ISBN 80-227.1942-0. STU Bratislava 2003.

16. Bukovský V., Katusčák D., Hanus J., *Program ochrany papierových nosičov informácií v SR, Buničina a papier - technológia, vlastnosti, životné prostredie. Zborník z medzinárodnej konferencie*. Bratislava (2001) p. 179-182.

17. Hanus, J., Katusčák, S., Katusčák, D., Bukovský, V., Rychlý, J.: *Integrated effort for paper cultural heritage preservation in the Slovak Republic. International Conference Durability of paper and writings*, Papyrus, InkCor, MIP, 16. - 20. 11. 2004 Ljubljana. Proceedings of the conference, pp. 86-87.

18. Hanus, J., Katusčák, S., Čeppan, M., Bukovský, V., Rychlý, J., Hanusová, E., Mináriková, J., Szabóová, Z.: *Research on paper deacidification in Slovakia (The approach to cultural heritage preservation in archives and libraries)*. in: Agnes Blüher, Gabriela Grossenbacher - editors: *Save Paper! Mass Deacidification, Today's Experience - Tomorrow's Perspectives. Papers given at the International Conference 15-17 February 2006*, Swiss National Library, Berne, Switzerland. ISBN 3-9523188-1-7, pp. 75 - 91.

- database of relevant literature information in the field; search in patent databases (e.g. present database contains relevant American, European and Canadian patents from 1968 up to now);
- digitization of relevant hard copies information from the field and full-text information retrieval, etc. - all information are available for all participants of the program.

### National shared potential of instruments and devices for education and research of cultural heritage preservation

- it enables all partners to use all laboratory devices and equipments in each institution for the purposes of the project free of charge;
- creation of central testing laboratory at the Faculty of Chemical and Food Technology for the purposes of the project;
- it is supposed to be converted to the Technological centre for cultural heritage protection and preservation having a character of applied research laboratories in the 2nd stage of the project.

### Methods of classification and assessment of library and archival documents according to historical-cultural and technical criteria

- Document classification from the point of view of preservation priority and from the point of view of possible individual technological processes. Cultural heritage of the SR, stored on paper carriers of historical books, is partially classified not only from the cultural-historical point of view, but also according to technological criteria.

One of the examples - the classification of books based on acidity measurements, mechanical properties (holding endurance) and lignin content - enabled their categorization into four groups and is illustrated on the following pictures<sup>19</sup>.

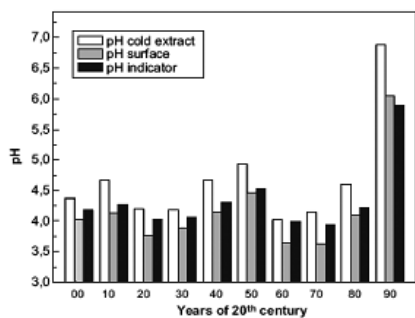


Figure 1: Average of pH of 20th century books sorted by their age. Standard deviation was  $\pm 0,1$  for cold extraction and surface pH method and  $\pm 0,2$  for pH indicator method

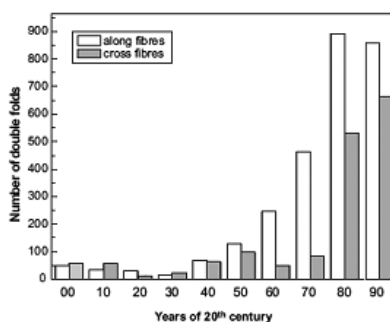


Figure 2: Average of fold endurance of 20th century books sorted by their age

1850, je kisel in ni tako obstojen, zato tudi izdelki kot so knjige in arhivski dokumenti niso obstojni. O tem vedo strokovnjaki, ki se bavijo z ohranitvijo dokumentov. Zdi se, da bi lahko le masovni postopki raziskovanja rešili problem obranitve dokumentov. O tem so bile napravljene obširne raziskave in so bile uvedene različne tehnike reševanja dokumentacije, saj je raziskovanje postalo predmet številnih obravnav. V prispevku razpravljam o mnogih poteh, ki imajo za cilj reševanje teh vprašanj in problemov, s katerimi se srečujejo tako arhivi kot knjižnice.

### SUMMARY

Archival documents from the 20th century represent the major part of archival holdings nearly in all archives. However, very often it can be said - the bigger quantity the lower quality. The mentioned lower quality concerns their material and physical not content quality. The biggest problems in preservation of archives and libraries are caused - paradoxically - by modern papers produced from the 2nd half of the 19th up to the recent years. The new technology of paper-making introduced in 1850, involved paper formation in an acidic environment and brought wood as the raw material. This was a crucial milestone from the point of permanence and durability of paper, its degradation and preservation in archives and libraries. The self-degradative effect of acidic papers causes the limited lifetime of machine-made paper from wood pulp with acidic rosin sizing with addition of alum. These problems are well known to the experts from the field of preservation of archives and library paper materials. It seems that - because of large quantities of these materials - only mass deacidification can help to solve

19. M. Reháková et al: Preselection of historical books in the process of their stabilization. Durability of paper and Writing, Ljubljana 2004.

these problems. A large scale research into the field for many years has brought an extensive knowledge in paper degradation causes, mechanisms and also in different techniques and processes in order to improve its permanence, durability and life-span. Many deacidification processes have been introduced and several treatments are commercially used in a large scale. The paper inform about different approaches to solution of this situation and problems in Slovakia. The solution of the state task of the Ministry of Education of the Slovak Republic - "Preservation, stabilisation and conservation of traditional information carriers in the Slovak Republic - KNIHLASK" - was completed on December 31, 2008. A system of objective testing and evaluation of deacidification systems and technologies have been developed and introduced into a practical realization and requirements for selection of the best available technology (BAT) for Slovakia have been established. As the BAT for books and archives in closed archival boxes the Paper-save - Unisaver technology has been selected and recommended. As economically low-cost and environmentally cleanest technology air - water (SoBu/Liberte) system has been recommended. As BAT for single sheet documents Neschen Bücheburg system has been evaluated and recommended. Some other important material and intellectual realization outputs for practical education, culture and preservation industry have been achieved. The sustainability of development of Integrated Conservation Centre in Slovakia has been proposed and proved as the proper development in the field of cultural heritage preservation. The results also proved that Slovakia owns sufficient intellectual and technical capacity for solution of the problems and for international cooperation in this field.

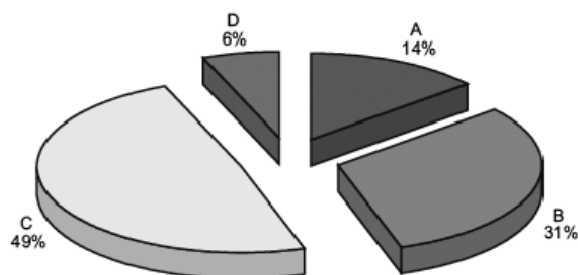


Figure 3: Classification of books required protection: A - intercession of restaurators, B - deacidification and strengthening, C - deacidification only, D - without protection

### Evaluation of present commercial deacidification systems, research in strengthening of ligno-cellulosic (LC) materials and development of own modification systems<sup>20</sup>

This is the core and the most important part of the program towards the end-users - archives and libraries. The improvement/stabilization of permanence of mechanical strength of treated paper in the course of time ageing has been set up as the primary criterion for the evaluation of treatment (deacidification, modification) effectiveness in the first step of evaluation process.

In practical evaluation it means the comparison of treated/modified ( $T_{t,m}$ ) and non-treated/non-modified ( $T_{t,n}$ ) samples after the same period and conditions of ageing

$$S_t = T_{t,m} / T_{t,n}$$

where  $S_t$  is permanence coefficient by given treatment/modification (deacidification, strengthening, etc.),  $t$  - ageing period.

If  $S_t > 1$ , the permanence is increased; if  $S_t = 1$ , it is not changed; if  $S_t < 1$ , it is decreased.

Paper samples were sent for treatment to all companies providing commercial mass deacidification and we would like to thank them for their kind service. After the treatment they were tested and changes of some mechanical, chemical and optical properties were evaluated.

In the case that some other and more information is needed the whole range of methods which are available in laboratories of all participating institutions can be used, e.g. scanning electron microscopy, FTIR, LC- MS, etc.

All other observations - as visual evaluation of mechanical changes (any kind of deformation of paper or bookbinding - e.g. cockling, distortion), undesirable deposit of deacidification agent on treated materials, inks bleeding, etc. - were made as well and create very important part of the overall evaluation process.

Degradation of cellulose and loss of its use properties is caused by two main processes, particularly by acid-catalyzed hydrolysis and oxidation. The first reaction is direct cleavage of 1,4  $\beta$  glycosidic bond which takes place after its interaction with hydrogen ions and leads to semiacetal chain-end groups ( $pH < 7$ ). On the other hand,

20. Hanus, J., Bakoš, D., Vrška, M., Jablonský, M., Katusčák, S., Holubková, S., Bajzíkova, M., Bukovský, V., Rychlý, J.: *The Kniha Project in Slovakia. Durability of Paper and Writing, 2nd International Symposium and Workshops*. National and University Library and University of Ljubljana, Faculty of Chemistry and Chemical Technology, Ljubljana, Slovenia, July 7-10, 2008, pp. 17-19.

oxidation by oxygen is much more complex process occurring via oxidation of hydroxyl groups on glucopyranosyl structural units into carbonyl and carboxyl groups. The latter facilitate scission of the cellulose backbone as well. Both, production of chain-end semiacetal groups and oxidation of hydroxyl groups are accompanied by weak light emission (chemiluminescence - CL)<sup>21,22,23</sup>.

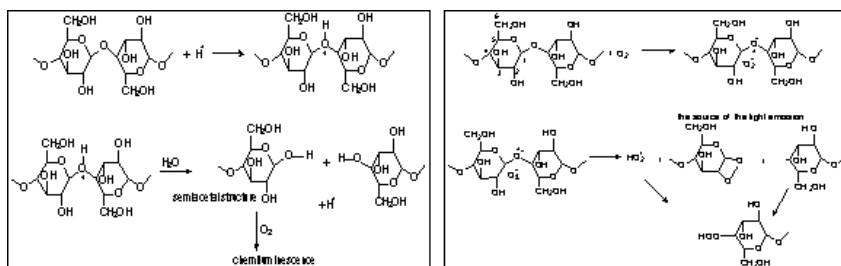


Figure 4, 5: Degradation of cellulose by acid hydrolysis and oxidation

Measurements of CL were used in EU project Papyrus<sup>24</sup> and extensively used also in KNIHASK. The present equipment for CL measurement - chemiluminometer Lumipol 3 - as well as its previous versions have been developed and made at the Polymer Institute, Slovak Academy of Science, Bratislava. The following pictures represent some examples of the equipment and measured results.

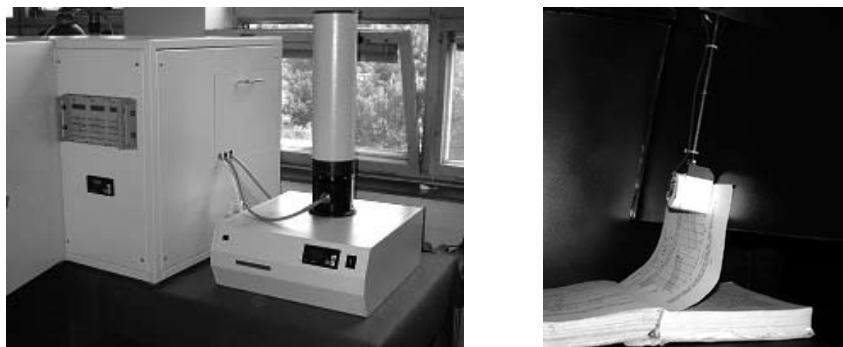


Figure 6, 7: Lumipol 3 - CL measurement at the Polymer Institute, Slovak Academy of Science

21. J. Rychlý, M. Strlič, L. Matisová-Rychlá, J. Kolar, *Chemiluminescence from paper. 1. Kinetic analysis of thermal oxidation of cellulose*, *Polym. Degrad. Stab.* 78, 357-367, 2002.

22. Hanus, J., Rychlý, J., Mináriková, J., Matisová-Rychlá, L.: *Estimation of the progress of oxidative ageing of various papers by chemiluminescence method and estimation of papers properties by other standard tests*. *International Conference Durability of paper and writings*, Papyrus, InkCor, MIP, 16.-20. 11. 2004 Ljubljana. Proceedings of the conference, pp. 22-23.

23. Hanus, J., Rychlý, J., Mináriková, J., Matisová-Rychlá, L., Szabóová, Z.: *Estimation of paper degradation progress by chemiluminometry and folding endurance changes*. *Proceedings of the International workshop „Practical applications of chemiluminescence at the oxidation of chemical systems“*. Smolenice, October 9 - 13, 2005, pp. 10 - 12.

24. <http://www.science4heritage.org/papyrus/>

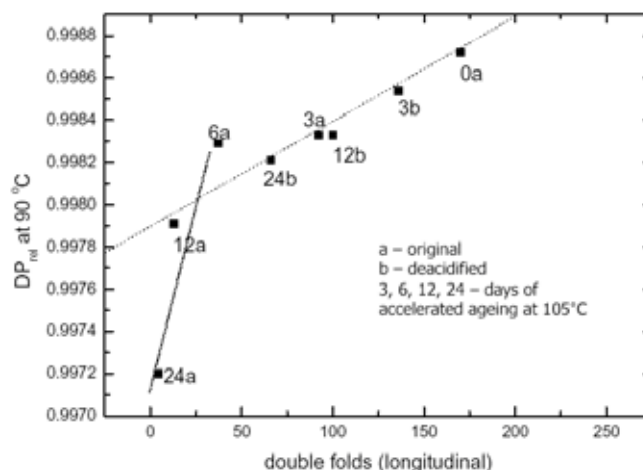


Figure 8: Number of double folds (machine direction) for bank paper vs relative degree of polymerization determined from the surface below the chemiluminescence intensity - temperature runs in oxygen atmosphere at 90°C

### New information on indoor quality environment for long-term storage of library & archives materials

It is well known that the indoor quality environment is a decisive factor in life-span from the point of long-term storage of library & archives materials. This is the reason why program KNIHA SK involves also monitoring and evaluation of air quality (air pollution) in selected Slovak archives and libraries, analysis of volatile compounds from archives and library materials, behaviour of acidic paper in alkaline boxes during a long-term storage, etc.

### Education

As a consequence of the project KNIHA SK in 2004-2008 the interest of young generation, scientists and teachers considerably increased also in the field of technical education for cultural heritage preservation. Conditions for academic education, bachelor projects, diploma works and dissertation theses are being improved<sup>25</sup>.

The interest of young generation is of key importance for qualified preservation of its own cultural heritage in the SR. The social importance of project KNIHA SK is strongly felt also in the field of intensification of education in chemistry and technology of preservation of traditional carriers of cultural heritage.

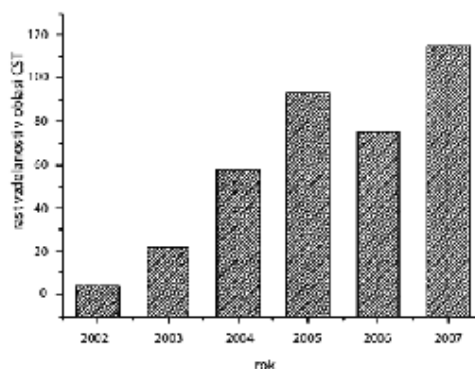


Figure 9: Impact of KNIHA<sup>SK</sup> on motivation and education of university students in the field of chemistry and technology of preservation of cultural heritage in the Slovak Republic in period of 2002 (before starting the project) to 2007<sup>24</sup>

25. Vizárová, K., Katuščák, S., Reháková, M., Katuščák, D.: *Rast kvalifikácie a potenciál rastu zamestnanosti v oblasti rozvoja konzervačnej vedy, vzdelávania, výskumu a priemyslu na Slovensku po roku 2003 podporovaný konzorciom KNIHA<sup>SK</sup>*. Knižnica, roč. 9, č. 6-7 (2008), pp. 9-13.

A new conception of education in conservation science on university level has been elaborated and is getting to be ready and effective in very near future<sup>26, 27</sup>.

### **The main results of the project KNIHA<sup>SK</sup>**

The solution of the state task of the Ministry of Education of the Slovak Republic - project KNIHA<sup>SK</sup> - was completed on December 31, 2008. A system of objective testing and evaluation of deacidification systems and technologies have been developed and introduced into a practical realization and requirements for selection of the best available technology (BAT) for Slovakia have been established. As the BAT for books and archives in closed archival boxes the Papersave® (ZFB Leipzig) - Unisaver® (KNIHA<sup>SK</sup>) technology has been selected and recommended. As economically low-cost and environmentally cleanest technology air -water (SoBu/Libertec) system has been recommended. As BAT for single sheet documents Neschen Bückeberg system has been evaluated and recommended<sup>28</sup>.

Some other important material and intellectual realization outputs for practical education, culture and preservation industry have been achieved. The sustainability of development of Integrated Conservation Centre in Slovakia has been proposed and proved as the proper development in the field of cultural heritage preservation. The results also proved that Slovakia owns sufficient intellectual and technical capacity for solution of the problems and for international cooperation in this field.

## **CONCLUSION**

The problems of acidic paper degradation and their solution have brought very positive synergic effect into the field of cultural heritage preservation in general in the Slovak Republic. It is mainly connected with increasing of educational background in the field, coordination of research activities involving inter-disciplinary scientists and different institutions, but also increased number of Bc., MSc. and PhD. works, in which deacidification, stabilisation and strengthening of endangered archives and library materials plays the key role.

On the basis of results achieved in programme KNIHA<sup>SK</sup> a new Integrated Conservation Centre is proposed and planned to be built at the Slovak National Library in Martin - Vrútky. Within the framework of this centre also the mass deacidification for library and archives materials will be in operation. The sustainability of development of Integrated Conservation Centre in Slovakia has been proposed and proved as the proper development in the field of cultural heritage preservation. The results also proved that Slovakia owns sufficient intellectual and technical capacity for solution of the problems and for international cooperation in this field.

26. Katuščák, S., Katuščák, D., Bakoš, D., Šíma, J., Urandová, A.: *Koncepcia rozvoja konzervačnej vedy, vzdelávania, technológie a priemyslu na Slovensku*. Knižnica, roč. 9, č. 6-7 (2008), pp. 4-9.

27. Bakoš, D., Katuščák, S., Hudec, I., Čeppan, M., Reháková, M.: *Nový študijný program STU: Ochrana materiálov a objektov dedičstva. I. Etapa rozvoja VŠ európskeho vzdelávania Conservation Science na Slovensku*. Knižnica, roč. 9, č. 6-7 (2008), pp. 14-15.

28. <http://www.knihask.eu/>

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