Health of the population and the demographic situation in Ukraine

**INCREASE THE LEVEL OF SECURITY OF THE PRINTING PRODUCTS**

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The printing products are a significant part in the life of modern person. Salts of lead and other heavy metals have not been used as the base material to manufacture the printing inks more than 30 years. At the same time, the black printing inks for newspapers are made of soot and printing varnish. Moreover, soot is obtained by burning the petroleum products. They contain the impurities of lead, cadmium and other heavy metals. A mixture of hemp and flax oils, resin oil, resin soap, resins and terpenes is used to obtain the printing varnish. This mixture has the impurities of the heavy metal too.

The content of lead impurities can be from 10 to 50 mg/kg, cadmium impurities – 0,5-4,0 mg/kg in the printing ink [1, P.10-15; 2, P. 5-15]. The content of lead has not to exceed 29 mg/kg and cadmium one – 3,0 mg/kg according to the methodical instructions for sanitary assessment of the printing inks. The requirements MU №1838-86 and SanPiN 41-123-4240-06 are intended to manufacture the printing inks. The lead and cadmium can get to human body after reading newspapers if a person does not wash his hands before eating. There is also information about getting salts of lead into the human body through the skin pores [3, P. 210-242; 4, P. 57-69; 5, P. 78-85; 6, P.123-131, 7; P.147-167].

Standard procedure for determination of lead and cadmium in printing products consists of many steps. At first, a newspaper should be dried, grinded to the pulverized state. Then, the printing ink is extracted by ethanol or 0,2% solution of potassium hydroxide. The sample is dried for 1 hour at 400 ° C, ash is dissolved by hydrochloric acid and determine the elements by spectrophotometric analysis for 1,5 hours [8, P. 489-493]. Analysis of the printing inks for determine the impurities of lead and cadmium contains dry ashing for 1 hour at 400 ° C, the dissolution of the ash in hydrochloric acid and determination the elements by spectrophotometric analysis for 1,2 hours. The relative standard deviation of the results of the analysis is S>0,11.The existing methods of the analysis of the printing inks and printing products for heavy metals do not correspond to the modern safety requirements of quality control in terms of rapidity and reliability.

We propose the several ways to intensify of sample preparation for the determination of lead and cadmium in printing inks and products. It is necessary to use the ultrasound, carry out the incomplete mineralization the inks – carbonization. The obtained carbonizate likes a suspension is entered into electrothermal atomiser of atomic absorption spectrometer. The chemical modifier (ChM) are used to improve the metrological characteristics of electrothermal atomic absorption determination of lead and cadmium in printing inks and products. ChM permit to stabilize sample, to remove interfering organic and inorganic matrix components, to lower a limit of detection and improve the reproducibility of the results. So we investigated the performance of the most common chemical modifiers – the salts of Pd (II). They can prove their effectiveness in atomic absorption analysis [9, P. 706-710; 10, P. 201-224;11, P. 1254-1279].

A sorption of the ChM with lead (II) and cadmium (II) on a sorbent-concentrate is the best way to use the ChM. It was established that the degree of sorption of palladium (II) in static conditions at pH = 8,10 is 99.9%. It was established that the degree of sorption of palladium (II) in static conditions at pH = 8.10 is 99,9%. It allows to use the common sorption of ChM with determined elements on the sorbent for further investigation of the effect of the ChM on a pyrolysis temperature and sensitivity of the determination (Table 1).

Conclusions. We have developed the methods for determination of lead and cadmium in the printing inks and products. Correctness of the methods is checked by the comparison of the obtained results with standard techniques results (atomic absorption spectrometry after dry mineralization). The rapidity of proposed methods of analysis is more in 5-20 times than rapidity of standard techniques. In this case the metrological characteristics of the obtained results are improved.

Table 1. The results of the determination of lead (II) and cadmium in printing inks and papers (n = 6; P = 0,95)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Element | Introduced,  mg/kg | Proposed technique | | Standart technique | |
| Х, mg/kg | Sr | Х, mg/kg | Sr |
| The paper «Sobitiy» | | | | | |
| Pb | 0 | 43,2±1,8 | 0,084 | 41,5±1,6 | 0,113 |
| 10,0 | 52,1±2,1 | 0,082 | 49,0±2,0 | 0,114 |
| Cd | 0 | 0,54±0,05 | 0,072 | 0,49±0,04 | 0,109 |
| 0,50 | 0,97±0,08 | 0,083 | 0,84±0,07 | 0,101 |
| The paper «Vpered» | | | | | |
| Pb | 0 | 10,5±0,8 | 0,082 | 11,0±0,9 | 0,114 |
| 10,0 | 19,7±1,2 | 0,083 | 18,4±1,3 | 0,111 |
| Cd | 0 | 0,10±0,01 | 0,079 | 0,17±0,01 | 0,108 |
| 0,20 | 0,28±0,02 | 0,085 | 0,23±0,02 | 0,105 |
| The ink of type «Diva» by production France | | | | | |
| Pb | 0 | 10,5±0,7 | 0,084 | 9,8±0,6 | 0,110 |
| 10,0 | 19,3±1,2 | 0,082 | 18,2±1,2 | 0,111 |
| Cd | 0 | 0,54±0,04 | 0,077 | 0,43±0,04 | 0,101 |
| 0,20 | 0,60±0,05 | 0,080 | 0,49±0,05 | 0,104 |
| The ink of type «Lotus» by production France | | | | | |
| Pb | 0 | 14,7±1,1 | 0,083 | 13,8±1,2 | 0,111 |
| 10,0 | 23,4±1,9 | 0,080 | 21,3±2,0 | 0,112 |
| Cd | 0 | 0,67±0,05 | 0,078 | 0,61±0,05 | 0,101 |
| 0,20 | 0,84±0,07 | 0,081 | 0,76±0,06 | 0,100 |
| The ink of type «Manum» by production France | | | | | |
| Pb | 0 | 12,5±1,0 | 0,084 | 11,8±1,1 | 0,110 |
| 10,0 | 21,8±1,8 | 0,082 | 19,8±1,9 | 0,110 |
| Cd | 0 | 0,73±0,06 | 0,079 | 0,70±0,07 | 0,101 |
| 0,20 | 0,90±0,08 | 0,083 | 0,85±0,08 | 0,102 |
|  | | | | | |
| Table continuation | | | | | |
| The ink of type «Optima» by production France | | | | | |
| Pb | 0 | 11,6±0,9 | 0,080 | 11,2±1,0 | 0,110 |
| 10,0 | 20,9±1,8 | 0,081 | 18,3±1,8 | 0,111 |
| Cd | 0 | 0,84±0,07 | 0,079 | 0,80±0,08 | 0,100 |
| 0,20 | 1,02±0,08 | 0,081 | 0,91±0,09 | 0,102 |
| The ink of type «NT» by production France | | | | | |
| Pb | 0 | 22,5±2,0 | 0,084 | 21,2±2,2 | 0,1120 |
| 10,0 | 31,6±2,8 | 0,082 | 30,3±3,0 | 0,111 |
| Cd | 0 | 2,64±0,22 | 0,082 | 2,43±0,02 | 0,100 |
| 1,00 | 3,53±0,04 | 0,083 | 3,19±0,03 | 0,102 |

The papers and inks are obtained from local printing house in Artemivsk , Donetsk region (2014).

References

1. Методичні вказівки до токсикологічної оцінки друкарських СанПін 1838-2006 / Під. ред. Петренко  В.А.- К.: вид-во Медліт, 2006. – 34 с.
2. Санитарно-гигиенические правила и норми СанПин 41-123-4240-86. – М.: изд-во стандартов, 1986.­ – 75 с.
3. Коломнин П.Н. Краткие сведения по типографскому делу / Коломнин П.Н. - Издательство: Студия Артемия Лебедева,  2008. – 712с.
4. Елдред Н.Р.Типографские краски / Елдред Н.Р. – Издательство: ПРИНТ-МЕДИА центр . – 2009. – 432 с.
5. Наумов В. А. Начала полиграфического материаловедения / Наумов В.А. – М.: Печатник,  2002. – 121 с.
6. Наумов В. А. Полиграфическое материаловедение/ Наумов В.А. – М.: Печатник,  2011. – 320 с.
7. Березин Б.И. Материаловедение полиграфического производства /Березин Б.И.  – М.: изд-во «Книга», 2009. – 259 с.
8. Бакланов А.Н. Анализ пищевых продуктов с применением техники карбонизации и ультразвука / А.Н. Бакланов, Ю.В. Бохан, Ф.А.Чмиленко // Журн. аналит. химии. – 2003. – Т. 58, № 5  . – С. 489-493.
9. Dragan Milenkovic  Analysis of Regression Models of MaximalAbsorption on High-Porosity Absorbents without Ultrasound Application / DraganMilenkovic, Predrag Dasic, Valentin Nedeff, Emilian Mosnegutu // Revista de  chimie (Bucuresti).  – 2009. – Vol.60, №7. – P. 706-710.
10. Алемасова А.С. Высокотемпературные процессы превращения комплексообразователей и комплексов металлов в атомно-абсорбционном анализе. / А.С. Алемасова - Донецк: Изд-во ДонГУ. – 1997. – 297 с.
11. Применение модификаторов матрицы в сложных объектах методом электротермической атомно–абсорбционной спектрометрии / Н.Ф. Бейзель, Ф.И. Дааман, Г.Р. Фукс–Поль, И.Г. Юделевич // Журн. аналит.химии. – 1993. –Т.48, № 8. – С. 1254–1279.