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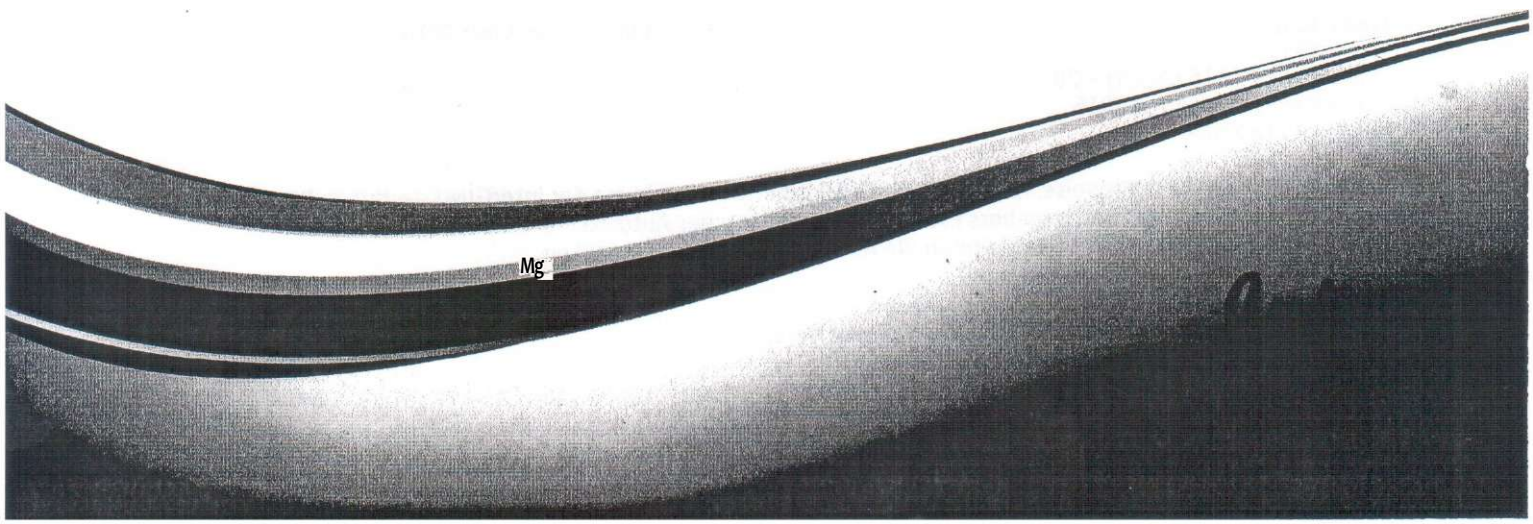
German Science Herald



ISBN 978-3-946407-01-0 GEKL
3-946407-01-3

Deutscher Wissenschaftsherold
German Science Herald

№ 1/2016

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Impressum
Deutscher Wissenschaftsherold - German Science Herald
Wissenschaftliche Zeitschrift

Herausgeber:
InterGING
Sonnenbrink 20
31789 Hameln, Germany
Inhaber: Marina Kisiliuk
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Internet: www.dwherold.de
Chefredakeur/Editor-in-chief:
Pierre-Guillaume Ribas
Korrektur:
O. Champello
Gestaltung:
N. Gavrilets
Auflage: № 1 2016 (April)-20
Redaktionsschluss April 2016
Erscheint vierteljährlich

Editorial office: InterGING
Sonnenbrink 20
31789 Hameln, Germany
Tel.:+49 51519191533
Email: info@dwherold.de

Deutscher Wissenschaftsherold - German Science Herald is an international, German/ English language, peer-reviewed journal and is published quarterly.

Druck: WIRmachenDRUCK GmbH
Mühlbachstr. 7
71522 Backnang
Deutschland

№ 1 2016-20
Passed in press in April 2016

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U DC 661.848

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PROSPECTS OF SOLVING ENVIRONMENTAL PROBLEMS WHILE USING CADMIUM COMPOUNDS (literature review)

Abstract. We have studied common trends in using cadmium compounds in the world and, according to our findings, there is not any decrease in their use. It was established that household nickel-cadmium batteries are the most significant group of products containing cadmium. It is shown that the main problem of recycling technologies is the problem of collecting used power sources.
Key words: cadmium compounds, used power supply, recycling, organization of collection.

Humanity as a part of the Earth's ecosystem is increasingly feeling the effects of various xenobiotics that pollute the atmosphere and disturb the ecological balance. Therefore, more efforts are taken to solve the problems of ecological safety of new technologies and recycling accumulated waste, but these efforts, despite their magnitude, are not systemic, and therefore do not lead to significant results in a particular direction.

For instance, there are more than 20 metals in the UN list of the most dangerous pollutants. Three of them - mercury, lead and cadmium are attributed to global pollutants and are among the most common engineering materials. Moreover, the latter two metals do not have much prospects to be reduced in their use, as both lead and cadmium are indispensable electrotechnical materials. Furthermore, the use of cadmium, as a material for secondary power sources has not decreased, and the world amount of cadmium production has varied during the last decade at the level of 20 thousand tons per year [1].

An analysis of the industrial consumption of cadmium shows (Table. 1) that most of the cadmium is used for the production of secondary power sources. According to the forecasts of the International Association of cadmium (International Cadmium Association) the need for nickel-cadmium batteries in the world will grow, especially with the positive resolution of electric cars problems [2].

Cadmium from the chemical point of view, as well as zinc and mercury are the last representatives of the d-transition elements in the periodic table by D. Mendeleev with a completely filled d-orbital. That is why they are similar in properties both to their predecessors and to the elements of the main subgroup - namely, they are easily fusible and volatile. Their oxides, whose volatility is even higher, can be obtained directly in their interaction with oxygen.

Table
Cadmium consumption structure (in% of the total in terms of metal)

Years	2000	2003	2007	2011
Power sources	75.1	77.9	83.0	85.0
Cover	8.0	8.1	8.0	7.4
Pigments	12.0	12.1	7.0	6.5
Plastic	3.7	1.5	1.2	1.1
Other	0.9	0.6	0.8	0.8

It is considered [3], that the effect of toxic metals that causes severe consequences in the body occurs mainly in the following areas:

- ions Pb, Hg, Cd form strong complexes with amino acids and other biomolecules containing mercapto- (HS-) or alkylthio groups (RS). There is a so-called effect of mimicry when a false complex becomes similar to a conventional substrate, metabolism of major classes of nutrients gets disturbed;

- ions - pollutants replace biometal in metal containing enzymes, causing loss of their biological activity. For instance, as a result of replacing Zn by Pb, or Cd deactivation of

enzymes responsible for the synthesis of heme occurs, resulting in anemia;

- toxic effects of heavy metals is also related to a disturbed synthesis of cytochrome P-450 responsible for biodégradation of xenobiotics and endogenous biologically active substances that can cause profound metabolic disorders;

- In the presence of heavy metals ions the activation of peroxide and free radical oxidation occurs. As a result, some proteins, lipids and biomembranes are damaged.

But to fully evaluate the toxicity of a particular metal we should also take into account the form and the way the metal gets in the body. Because of their high capacity for hydrolysis, cadmium salts are poorly absorbed in the gastrointestinal tract. Cadmium poisoning is most frequently due to air pollution. Accumulating in landfills, which often burn, metals-pollutants get into the atmosphere already as toxic oxides. Thus, the main way of getting cadmium in the body is through the lungs, causing bronchitis, emphysema, anemia, kidney failure. It is also confirmed by the data [4], according to which health problems in smokers are caused by cadmium content in the cigarette smoke.

Considering the negative effect of cadmium compounds on the environment, a number of countries adopted regulations that reduce their harmful effects due to an increased content of cadmium, derived from processing cadmium-containing products, in the end products. Today, the following programs for the collection and recycling of waste batteries are known: RBRC - US and Canada, Battery Association - Japan and Collect NiCad - in the EU. Ukraine does not have such programs. But still, according to approximate estimates in Kharkiv, for example, each year up to 1 ton of nickel-cadmium batteries are thrown in landfills while replacing batteries in toys, mobile phones and various medical and household devices.

Thus, as the use of nickel-cadmium batteries threatens our environment but it cannot be stopped right now, it is especially important to suggest a system of storage and disposal of waste AA and AAA NiCd batteries.

From a technological point of view the utilization of waste nickel-cadmium batteries is not too difficult. An analysis of patent sources and known modern methods of processing raw materials containing cadmium and nickel, has shown that they are mainly hydro- and pyro-metallurgical techniques [5]. Moreover, for industrial power sources the recycling is supposed after the expiration date because of their large size. As for the household batteries, the problem is not only in processing technology but in recycling due to a large number of users.

This very fact becomes an obstacle to the introduction of technologies of recycling small (but numerous!) AA and AAA NiCd batteries.

Creating a state system for recycling a large quantity of a variety of waste industrial and household devices containing heavy, mostly toxic metals is an insistent need of our society. In Ukraine, such a program can operate in a system of environmentally sound recycling of domestic waste and can in the long run actually increase the ecological safety of our environment.

References:

1. Наумов А. В. Обзор мирового рынка кадмия [Текст] / А. В. Наумов. Известия вузов. Цветная металлургия.-М: Книга, 2006.-С. 18 -23.

2.Cadmium. Environmental Health Criteria 134 [Text] / World Health Organisation, International Programme on Chemical Safety (IPCS). - Geneva, Switzerland, 1992. - 250 p.

3. Зеленин К.Н. Химия общая и биоорганическая: учеб. для преподавания химии в мед. вузах [Текст] / К.Н. Зеленин, В.В. Алексеев. - Санкт-Петербург: Элби-СПб, 2003. -711с.

4. Козуб С. Н. Токсичность кадмия и методы воздействия его на окружающую среду [Текст] / С. Н. Козуб, А. А. Лавренко, П. А. Козуб, г. и. гринь, и дрУ// вісник НТУ «ХПІ». -2008.-№41.-С. 65-71.

5. Козуб С. Н. Экспериментальные исследования процесса осаждения соединений кадмия, никеля и железа из азотнокислых растворов [Текст] / С. Н. Козуб, П. А. Козуб, Г. И. Гринь, А. А. Лавренко, Н. М. Ткачук, А. М. Панчева // Восточно-Европейский журнал передовых технологий. - Харьков, 2009. - № 5/5 (41). - С. 14-16.