ASSESSMENT OF TOXIC HAZARD OF INDUSTRIAL WASTE AND SOCIETY'S WASTE PRODUCTS BY THE INFLUENCE ON BULL SPERMATOZOA SUSPENSION

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INTRODUCTION

Assessment of toxic hazard of waste products is one of the most important tasks of the sanitary service. Waste products toxicity level by impact on human health is determined through sanitary and toxicological tests on mammals. The scope of necessary toxicity studies is being constantly under the growth of risk of waste products impact on human health and environment. Taking into account both the testing time and economic and ethical aspects of animal testing, it has become necessary to work up procedures for assessing waste toxicity and identifying hazard classes using simple biological models. In this context, mammal cell cultures are available because the correlation factor of toxicometry parameters of acute systemic toxicity both on the mammal and mammal cell cultures approaches 0.86.

METHOD

To determine toxic hazard of waste products, bull spermatozoa suspension has been used. The method is based on the influence of waste extracts on the motility of spermatozoa suspension. Toxicity index I_t as the endpoint is equal to the ratio of the weighted average time of spermatozoa suspension motility in the extract to that of spermatozoa suspension motility in the control sample. To determine IC_{50} (concentration that causes 50% decrease of the weighted average time of spermatozoa suspension motility in the test sample in comparison with the one in the control sample and corresponds to I_t=50%), we have used five different concentrations of the extract. Toxicity index I_t has been determined on toxicity analyzer AT-05, Fig.1

Fig.1. Toxicity analyzer AT-05

TABLE 1.

TOXICITY PARAMETERS OF CHEMICAL COMPOUNDS/ELEMENTS AS DETERMINED ON SPERMATOZOA SUSPENSION AND ANIMAL

№	Compounds/elements	IC_{50}, mg/L	DL_{50}, mg/kg
1	Formaldehyde	1,3	600
2	Ethyleneimine	44	15
3	Epihlorohydrin	550	260
4	Acrylic acid	530	1250
5	Phenol	890	510
6	Cyclohexanone	1200	1800
7	Ethylene dichloride	1390	770
8	Methyl methacrylate	3350	8700
9	Acrylamide	5500	200
10	Tetrahydrofuran	5710	3000
11	Vinyl pyrrolidone	12210	1370
12	Ethanol	25760	9000
13	Methanol	26890	10000
14	Acetone	29580	9750
15	Caprolactam	30510	2400
16	Bischofite German	8200	4875
17	Bischofite Turkmen	9200	4444
18	Calcium chloride (Nordix)	8600	2889
19	Calcium chloride (Volgogradski)	12000	1600
20	Calcium chloride modified (Finnish)	11300	1175
21	Mercury	0,14	35
22	Cadmium	0,15	50
23	Lead	16	300

RESULTS

We have determined IC50 for 27 compounds with known Ld50, Table 1. According to the obtained statistical dependence IgIC50=1,33IgLD50-0,97, (r=0,78), Fig.2 and criteria for identifying hazard classes of wastes by LD50, it has become possible to determine the corresponding criteria for classifying hazardous wastes by IC50. When IC50<50mg/L, it is Hazard Class 1; when IC50=(50-1050) mg/L, it is Hazard Class 2. Hazard Class 3 is for IC50=(1050-22400) mg/L, Hazard Class 4 is for IC50>22400 mg/L. The experimental procedure is useful to identify hazard class of galvanic and foundry production wastes, sewage sludge and ash-slag wastes as a result of thermal and chemical destruction of pharmacological agents. The findings have been compared with the data of environmental and hygienic assessment using the traditional values for identifying hazard classes experimentally. No substantial discrepancy has been found between them.

CONCLUSION

The above method is easy-to-use, quick-operated and cheap. Experimental data processing is automated. The results have demonstrated that bull spermatozoa suspension is available for preliminary determination of hazard class for industrial and domestic wastes, and it is advisable to use the method along with the standard set of biological tests.

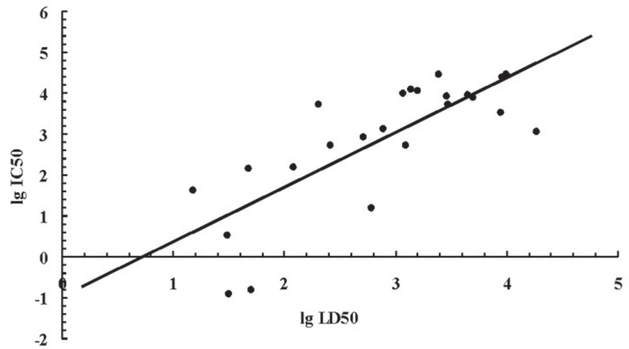

Fig.2 Regression $lgIC_{50}$ to $lgLD_{50}$