ASSESSMENT OF IRRITANT CONTACT DERMATITIS RISK FOR HEALTHCARE WORKERS USING MEDICAL GLOVES

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INTRODUCTION

The risk of irritant contact dermatitis (ICD) when using medical gloves is proportional to the quantity of hazardous processing chemical residues. Newly developed cleaning processes of gloves reduce concentrations of chemical residues and latex proteins to an immeasurable minimum, virtually minimizing all risks of ICD. To predict residual risk of ICD for high-quality gloves, cytotoxicity of extracts containing an unknown number of chemicals in very low concentrations capable to strengthen or weaken each other's effect should be evaluated.

METHOD AND MATERIALS

The least cytotoxic and thereby the cleanest gloves were selected based on the results of the preliminary test of surgical gloves of 73 well-known commercial brands. Treated with MPXX™ – a special batch cleaning technology, natural rubber latex surgical gloves were tested.

Among different test methods for assessing cytotoxicity, the Bull Spermatozoa Video Image Cytotoxicity Test is the most suitable for verification of finished gloves at the factory. Test method has high sensitivity, 3 hours duration of the measurement and evaluates non-sterile extracts. The bull spermatozoa video image cytotoxicity test work flow is presented in Table 1. Spermatozoa suspension motility measurement and toxicity index calculation were performed using Videoimage Cytoxicity Analyzer (Fig. 1.). The extraction was performed under the conditions prescribed by ISO 10993-12: 37°C within 24 hours. Cytotoxicity was evaluated for different ratios of glove surface (S) to distilled water volume (V): 20cm²:1ml, 10cm²:1ml, 5cm²:1ml, 2,5cm²:1ml, 1cm²:1ml.

The HPLC reverse-phase technique was used to separate, identify and quantify the residual chemicals present in aqueous extracts. 10 accelerators and 2 antioxidants were quantified (Table 2).

RESULTS

Quantification of a few chemicals used in manufacturing process in all extracts showed that they were either not present in extracts or the concentration was below the detectable limit (Table 2). Cytotoxicity test results are presented in Table 3. In fact, cytotoxicity of extracts appeared to be proportional to the used ratios. Ratio 20cm²:1ml is most suitable for quality controls and forecast risk of ICD.

CONCLUSIONS

Thus the cytotoxicity evaluation allows assessing the risk of ICD for high-quality gloves and monitoring the effectiveness of cleaning. The technology can also be applied for risk assessment of ICD using other materials and products. Quantification of chemicals in extracts in this situation is practically worthless. The Bull Spermatozoa Video Image Cytotoxicity Test is low cost, robust, proven and can be easily implemented on location.

Table 1. Bull spermatozoa video image cytotoxicity test work flow

Time, h:min	Procedure
00:00	Thaw one dose of bull spermatozoa suspension in glucose-citrate medium, 40 °C ↓
00:10	Prepare test-tubes containing 0,4 ml either of test sample or blank (glucose-citrate medium), 37 °C Per test-tube, add 0,1 ml of bull spermatozoa suspension, 37 °C Place samples into capillaries, 37 °C ↓
00:20	Measure bull spermatozoa suspension motility in 9,5 min interval, 37 °C ↓
02:50	Evaluate toxicity index, and variation coefficients

Fig. 1. Videoimage cytotoxicity analyzer

Table 2. Analytical results

№	Type of Chemical Residue	Detection Limit (µg/g)	Result
1	Zinc pentamethylenedithiocarbamate (ZPMC)	10	not detectable
2	Buthylated hydroxytoluene (BHT)	10	not detectable
3	Diphenyl Guanidine (DPG)	10	not detectable
4	Diphenyl Thiourea (DPT)	10	not detectable
5	Mercaptobenzothiazole (MBT)	10	not detectable
6	Tetramethylthiuram disulphide (TMTD)	10	not detectable
7	Zinc dibutyldithiocarbamate (ZDBC)	10	not detectable
8	Zinc diethyldithiocarbamate (ZDEC)	2	not detectable
9	Zinc dimethyldithiocarbamate (ZDMC)	10	not detectable
10	Zinc mercaptobenzimidazole (ZMBI)	10	not detectable
11	Zinc mercaptobenzothiazole (ZMBT)	10	not detectable
12	Zinc pentamethylenedithiocarbamate (ZPMC)	10	not detectable

Table 3. Cytotoxicity test results

S/V, cm²/ml	I_t,%
20	33,5
10	57,3
5	62,8
2,5	77,8
1	89,9