Prediction of acute lung toxicity of impregnation products using an *in vitro* method based on lung surfactant inhibition

Jorid B. Sørli, Yishi Huang, Emilie Da Silva, Jitka S. Hansen, Søren T. Larsen and Karin S. Hougaard
The National Research Centre for the Working Environment, Copenhagen, Denmark

Background

Impregnation products (IPs) are used to make surfaces water- and dirt-repellent. Accidental inhalation of IPs causes acute inhalation toxicity yearly. Lung surfactant (LS) is an important target.

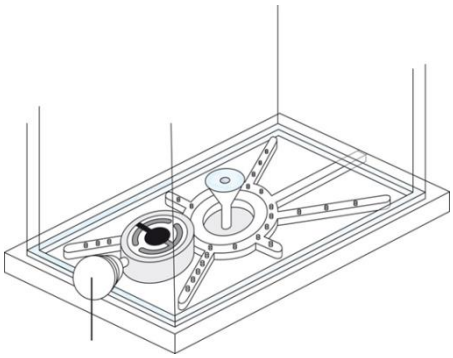
Twenty-one IPs, of which 6 have been involved in human acute lung toxicity, were tested *in vitro* and *in vivo* and the results compared.

A robust *in vitro* test will reduce the need for animal experimentation.

In vitro lung surfactant function

Lung surfactant function was assessed in an "artificial lung", the constant flow through set-up of the Constrained Drop Surfactometer (CDS).

A "breathing" drop of LS was continuously exposed to the IP, mimicking the physiological conditions in the lungs. The LS function was continuously monitored.

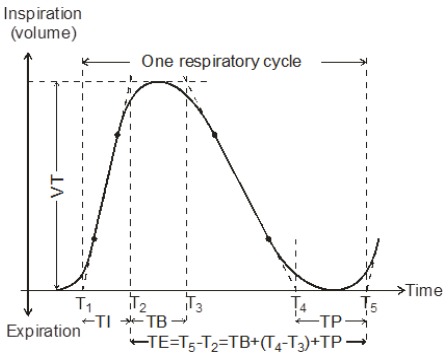


Sørli *et al*, 2015

Product	*In vitro*	*In vivo*	Correlation	Human toxicity
"Wood impregnation"	Yes	Yes	Yes	Yes
"Stain repellent super"	Yes	Yes	Yes	Yes
"Liquid stain protection"	Yes	Yes	Yes	Yes
"Faceal oleo MG"	Yes	Yes	Yes	Yes
"HG textile"	Yes	Yes	Yes	Yes
"HG leather "	Yes	Yes	Yes	Yes
"Antismuds"	Yes	Yes	Yes	-
"Footwear protector"	Yes	Yes	Yes	-
"Nakano impregnation"	Yes	Yes	Yes	-
"Non-absorbing floor materials"	Yes	Yes	Yes	-
"Rim sealer"	Yes	Yes	Yes	-
"Stain repellent nano"	Yes	Yes	Yes	-
"Stain repellent"	Yes	Yes	Yes	-
"Bath and tiles"	No	No	Yes	-
"Faceal oleo HD"	No	No	Yes	-
"Special textile coating"	No	No	Yes	-
"Textiles and leather concentrate"	No	No	Yes	-
"Textiles and leather"	No	No	Yes	-
"Car glass"	Yes	No	No, false +	-
"Footwear repel"	Yes	No	No, false +	-
"Performance repel"	Yes	No	No, false +	-

In vivo acute toxicity

The breathing patterns of mice exposed to IPs were monitored. Acute toxicity was observed as a sudden and irreversible drop in tidal volume (VT).



Nielsen *et al*, 2005

Conclusion

The *in vitro* method can identify all the products that cause acute toxicity *in vivo*.

In vitro inhibition of LS function is useful for evaluation of the inhalation toxicity of IPs and can therefore reduce the need for testing on animals.

Funded by the Danish 3R center and SmartNanoTox EU project