

Developing a system to predict the results of alternatives to animal eye irritation tests using the Hansen Solubility Parameter (HSP) method: Achievement of a rapid and highly accurate safety assessment for cosmetics

Milbon Co., Ltd. (headquarters: Chuo-ku, Tokyo, Japan; Ryuji Sato, Representative Director, President and CEO), a manufacturer of hair cosmetics for beauty salons, in collaboration with Professor Hideki Yamamoto of Kansai University, has developed a novel computing system using the Hansen Solubility Parameters method (the HSP method¹) for the prediction of the results of alternatives to animal testing for eye irritation, which is one of the safety criteria for cosmetics. We intend to use the findings from this system to easily predict eye irritation in order to develop highly safe products more quickly. The results of this study were published in the journal mentioned below.

Academic journal

Len I. et al., Predictive Study of Eye Irritation Results Obtained from the STE Method Using Hansen Solubility Parameters, *J. Soc. Cosmet. Chem. Jpn*, 56(1): 53-59

Overview of the study

From the perspective of animal protection, the worldwide trend in the development of cosmetics is to ban animal experiments. Milbon Co., Ltd. is in agreement with this view. It has become standard practice to perform alternatives to animal testing (*in vitro**²) using artificially cultured cells instead of animals when testing the safety of cosmetics (Fig. 1A).

In addition, the “2019 Guidelines for the Development of *in silico* Assessment” prepared by the Ministry of Economy, Trade, and Industry (METI), state that “There are problems with animal testing (*in vivo**³) and alternatives to animal testing (*in vitro*) from all viewpoints, including technological, ethical, and economic perspectives, leading to a halt in development. However, if these experiments (*in vivo* and *in vitro*) and predictive calculations using computers (*in silico**⁴) can be mutually complementary, development will be accelerated” (Fig. 1B).

2019 Guidelines for the Development of *in silico* Assessment (Guide) released by METI/Japan Agency for Medical Research and Development (AMED)
<https://db.bioip-lab.org/uploads/attachment/file/16/fca3a326-8dea-40ad-bb8a-98d34c6b1d00.pdf>
 were modified (Figure 1A, B)

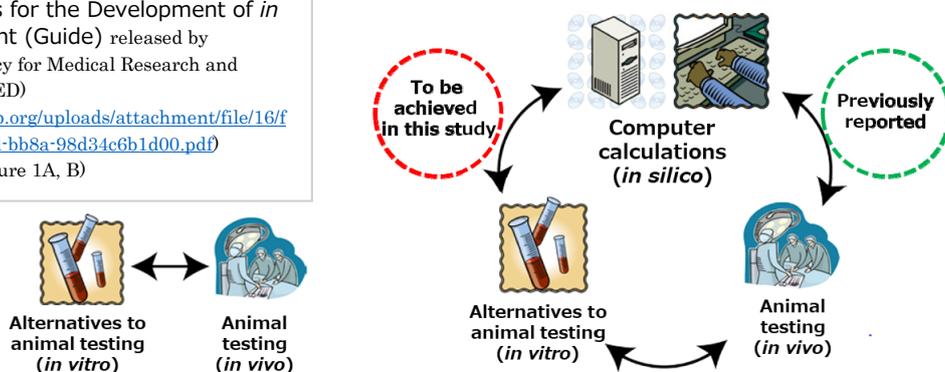


Fig 1A

Fig 1B

Figures 1A & 1B: Mutually complementary relationships among alternatives to animal testing (*in vitro*), animal testing (*in vivo*), and computer calculations (*in silico*)

Based on this concept, Milbon has been conducting research with Professor Hideki Yamamoto of Kansai University to develop a system that predicts the safety of cosmetics based on computer

calculations using the HSP method. We previously reported that a system for predicting the results of animal eye irritation tests using computer calculations was established as a part of this initiative (see the green circle in Figure 1B).

https://www.milbon.co.jp/files/pdf/news/2021/01/20210125143504_1.pdf

If we can apply computer calculations not only to animal experiments but also to alternatives to animal experiments, we will have advanced in our research to the point where we can apply this knowledge to the development of a system that can predict eye irritation with a higher degree of accuracy (see the red circle in Figure 1B). In the present research, we have attempted to develop a predictive calculation system using the HSP method for the “STE test,”⁵ a widely used alternative to animal testing.

We have developed a computing system that can predict eye irritation caused by various substances, including the ingredients in cosmetics, with an accuracy of 91.7%. Milbon’s predictive computer calculation system based on the HSP method has an accuracy comparable to animal tests and alternatives to animal testing for assessing eye irritation.

The results of this study indicate that our system can be used to complement alternatives to animal testing, which we believe will lead to the rapid development of safe products.

Future prospects

In order to develop safe cosmetics, it is important to conduct various tests, focusing not only on eye irritation but also on skin irritation and the risk of allergies. Milbon will continue to engage in research on a computer predictive system to complement various safety tests with high accuracy in order to develop safe products more quickly.

Terminology

*1 Hansen Solubility Parameters method (HSP method): A method of assessing substances based on the fact that substances dissolving together have similar properties and substances not dissolving together have different properties.

*2 *in vitro*: “Test tube evaluation.” Here, it refers to experiments utilizing cells and tissues derived from organisms.

*3 *in vivo*: “Assessment within a living body.” Here, it refers to experiments in living organisms.

*4 *in silico*: Assessments using computer calculations.

*5 STE test (Short Time Exposure test): It refers to an alternative to animal testing for eye irritation. The test measures the cell viability of chemical substances in rabbit cornea cells cultured *in vitro*.

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