FRANZ CELL BARRIER INTEGRITY TESTING USING A CONDENSER-CHAMBER TEWL INSTRUMENT

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The aim of the present study was to assess the performance of a condenser-chamber TEWL instrument for barrier integrity testing. OECD Test Guideline 428 stipulates barrier integrity testing before permeation experiments are carried out[1]. TEWL, electrical resistance and tritiated water procedures are recognised for such tests[2].

In a comprehensive study using an open-chamber TewaMeter, Netzlaff et al[3] found that TEWL measurements appear to be of limited use for barrier integrity testing, being able to detect only severe damage in the samples they examined. Particular problems they identified included topically adhering water and the permeation of condensed water via capillary action through deliberately made pinholes in artificial membranes.

The condenser-chamber AquaFlux instrument (Biox Systems Ltd, UK) offers the following advantages for in-vitro membrane integrity testing:-

1. The design of the AquaFlux measurement head facilitates vapour-tight coupling with Franz cell donor chambers without the need to touch the membrane under test.

2. The controlled microclimate within the condenser-chamber provides consistent evaporation conditions irrespective of ambient humidity.

3. The low humidity within the condenser chamber causes topically adhering water to dry off quickly during measurements. You therefore do not need to include a drying phase into such test protocols.

4. The measured water vapour flux curves clearly show the drying progress and therefore give quality control information for the tests. The software can be set to terminate the test automatically when the quality criteria are met, thus ensuring that the tests are neither prematurely terminated nor are run for longer than necessary.

We will report experimental measurements using both artificial membranes (Sil-Tec and PTFE) and bio-membranes (excised human epidermis, excised human stratum corneum & snake sheddings) to illustrate the capabilities and limitations of this approach.

Initial experiments used Sil-Tec membranes, whose well controlled properties could be relied upon to verify the measurements. Four membranes in the thickness range 0.13mm -1.06mm were used. The receptor chamber was filled with clean water, making sure that there was no air trapped below the membranes. Membrane diffusion resistance was found to correlate linearly with membrane thickness, with a Pierce Correlation Coefficient of R^2=0.9998 ($P<0.0001$).

1. *Skin absorption: In-vitro method*. OECD Test Guideline 428, 2004.

2. Guidance document for the conduct of skin absorption studies. In: OECD Series on Testing and Assessment, No. 28, 2004.

3. F Netzlaff, KH Kostka, CM Lehr and UF Schaefer: TEWL measurements as a routine method for evaluating the integrity of epidermis sheets in static Franz type diffusion cells in vitro. Limitations shown by transport data testing. European Journal of Pharmaceutics and Biopharmaceutics, **63**, 44-50, 2006.