MEOGRT: A Practical Experience

SMITHERS

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ABSTRACT

The Medaka Extended One Generation Reproduction Test (MEOGRT) is a standard OECD Test Guideline (No. 240) using multiple generations of fish to generate data relevant to ecological hazard and risk assessment of chemicals. The test evaluates population relevant parameters, such as survival, gross development, and growth and reproduction, but also includes endpoints which may provide evidence of endocrine disrupting properties of a chemical, such as measuring vitellogenin (Vtg), phenotypic secondary sex characteristics (SSC) and histopathology. The test is highly complex with several highly stringent control validity criteria. The test requires the use of nearly 2000 fish and is one of the most extensive and expensive ecotoxicology studies, therefore the risk of having to repeat studies due to a failure to achieve the control validity criteria has significant financial and animal welfare implications.

Two of the hardest control validity criteria to achieve for the MEOGRT study are fecundity for the first (F_0) and second (F_1) generations and hatching success of the F_1 and third (F_2) generations. As experience is gained with this study type, it is possible to implement small modifications to the conduct of the test to both improve the ability to achieve the validity criteria but also to improve animal welfare.

RESULTS

A summary of some of the modifications made between the conduct of two MEOGRT studies, and how these were considered to improve both control validity criteria achievement and animal welfare, are presented in Table 1. A comparison of the results for the relevant control validity criteria from Study 1 (conducted before modifications were considered) and Study 2 (conducted implementing the modifications) are presented in Table 2.

Small modifications to the conduct of the MEORGT can help to achieve the validity criteria and improve animal welfare

Table 1: Summary of modifications

Modification	Improves achievement of validity criteria	Improves animal welfare
Establishing breeding pairs prior to fin clipping for PCR for F_0 and F_1 generation	Allows for an initial assessment of fecundity for both generations	Reduces the number of fish undergoing fin clipping (F_0) and prevents stress due to individually housing of fish following fin clipping for genetic sex determination (F_1)
Modified egg chamber design	Reduces the potential for contamination	-
Shifting light cycle such that the 'dawn' period occurs at the start of the working day	Allows eggs to be collected when produced. Reduces the potential for eggs to be dropped and eaten	Can reduce requirement for handling of the fish as eggs can be collected immediately on release from the fish

Table 2: Test validity comparison between the two studies.

OECD 240 Test Validity Criteria	Study 1		Study 2	
Mean fecundity of controls in each of the generations (F_0 and F_1) should be ≥ 20 eggs per pair per day.	F_0	24	F_0	24
	F_1	20	F_1	23
16 of the 24 control breeding pairs (> 65%) should produce greater than 20 eggs per pair per day	27% (73% ≥ 19 eggs/female/day)		87%	
Hatchability of eggs should be ≥ 80% (average) in the controls (in each of the F_1 and F_2 generations)	F_1	81%	F_1	92%
	F_2	87%	F_2	81%

CONCLUSIONS

Small modifications made to the conduct of a MEOGRT study, in general, helped achieve the control validity criteria and improve animal welfare. This can provide reduced chance of study failure / increased chance of study success due to better husbandry practices and tighter control of study variables.

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