

**United States Department of Agriculture
Center for Veterinary Biologics**

Testing Protocol

SAM 633

**Supplemental Assay Method for Potency Testing of
Salmonella dublin Bacterins**

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Supplemental Assay Method for Potency Testing of *Salmonella dublin* Bacterins

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Supplemental Assay Method for Potency Testing of *Salmonella dublin* Bacterins

1. Introduction

This Supplemental Assay Method (SAM) describes procedures for potency testing biological products containing *Salmonella dublin*, as prescribed in title 9, *Code of Federal Regulations* (9 CFR), part 113.123. Mice are vaccinated twice, 14 days apart, and challenged with a standard dose of virulent *S. dublin* 7 to 10 days after the second vaccination.

2. Materials

2.1 Equipment/instrumentation

Equivalent equipment or instrumentation may be substituted for any brand name listed below.

- 2.1.1 Spectrophotometer, Spectronic 20D+ (Spectronic Instruments)
- 2.1.2 Sterile inoculating loop
- 2.1.3 Bunsen burner or Bacti-Cinerator[®] (if nonsterile, wire loop used)
- 2.1.4 Incubator, 35°- 37°C
- 2.1.5 Micropipettors, 20- to 1000-μL
- 2.1.6 Crimper for aluminum seals on serum vials
- 2.1.7 Test tube mixer, vortex-type
- 2.1.8 Rotary shaker
- 2.1.9 Biological safety cabinet

2.2 Reagents/supplies

Equivalent reagents or supplies may be substituted for any brand name listed below.

- 2.2.1 Appropriately-qualified *S. dublin* challenge culture, available from the biologics manufacturer. This reagent is supplied to the Center for Veterinary Biologics (CVB), upon request, with a reagent information sheet indicating handling and test information.
- 2.2.2 Test bacterin(s) containing *S. dublin*

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2.2.3 Appropriately-qualified *S. dublin* reference bacterin, available from the biologics manufacturer. This reagent is supplied to the CVB, upon request, with a reagent information sheet indicating handling and test information.

2.2.4 Syringes, 1 mL Luer-lock Tuberculin

2.2.5 Needles, 26-gauge, 3/8-inch

2.2.6 Glass serum bottles, 10- to 100-mL

2.2.7 Rubber stoppers, 13 x 20-mm, and aluminum cap for serum bottle

2.2.8 Screw-cap tubes, 13 x 100-mm and 15 x 125-mm

2.2.9 Screw-cap flasks, 500-mL and 1-L

2.2.10 Pipettes, 5-mL, 10-mL, 25-mL

2.2.11 Micropipette tips, up to 1000- μ L capacity

2.2.12 Growth/Dilution media, as specified by the biologics manufacturer

2.3 Animals

2.3.1 Mice, 16-22 g. Although the 9 CFR does not specify a specific mouse type or source, some colonies of mice may be relatively resistant to salmonellosis and therefore less suitable for this assay.

2.3.2 Sixty mice are required for each bacterin to be tested (20 mice/dilution; 3 dilutions/bacterin). Sixty additional mice are required for the reference bacterin. Thirty mice are required to determine the LD₅₀ of the challenge inoculum. All mice must be from the same source colony and of similar weight and/or age.

3. Preparation for the Test

3.1 Personnel qualifications/training

Technical personnel need a working knowledge of the use of general laboratory chemicals, equipment, and glassware and have specific training and experience in sterile technique, the handling of live bacterial cultures, and the handling of mice.

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3.2 Selection and handling of test mice

3.2.1 Mice of either sex may be used, but females are recommended.

3.2.2 All mice must be housed and fed in a similar manner.

3.2.3 Identify each cage of mice by treatment group.

3.2.4 If any mice die after vaccination, but prior to challenge with live *S. dublin*, necropsy these mice to determine cause of death if the cause of death is not outwardly apparent. If the cause of death is unrelated to vaccination, file the necropsy report with the test records, and no additional action is needed. If death is attributable to the test bacterin, report the death immediately to CVB-Inspection and Compliance, which may request further safety testing of the bacterin.

3.2.5 When the test is concluded, instruct the animal caretakers to euthanize and incinerate the mice and to sanitize the contaminated rooms.

3.3 Preparation of supplies/equipment

3.3.1 Use only sterile bacteriological supplies.

3.3.2 Operate and maintain all equipment according to manufacturers' recommendations and applicable standard operating procedures.

3.4 Preparation of reagents

3.4.1 *S. dublin* reference bacterin, available from the biologics manufacturer. Refer to the current reagent information sheet for details.

3.4.2 *S. dublin* challenge culture, available from the biologics manufacturer. Refer to the current reagent information sheet for details.

4. Performance of the Test

4.1 Vaccination of test animals

4.1.1 Check the label on each product and Part VI of the current Outline of Production to confirm identity and dose volume.

4.1.2 Test each test bacterin and the reference bacterin at 3 tenfold dilutions. Typically, test the bacterins undiluted and at 1:10 and 1:100 dilutions. Refer to the current reagent information sheet for any starting dilutions of the reference bacterin. It is permissible to make tenfold dilutions other than those described as

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long as the reference and test bacterins are tested at the same dilutions. For viscous bacterins, it is advisable to start at 1:2 or 1:3, and make tenfold dilutions from this starting point, to increase injectability of the product at the low dilution.

4.1.3 Thoroughly mix product by inverting end-to-end at least 10 times. Make the appropriate tenfold dilutions of the reference bacterin as specified on the reagent information sheet. Make identical tenfold dilutions of the test bacterin(s) in the diluent approved in the specific Outline of Production for that product. (Some oil-adjuvanted products require oil-based diluents.) Place each dilution in a separate sterile injection vial. Prepare dilutions immediately prior to use; do not store in diluted form.

4.1.4 Vaccinate separate groups of 20 mice with each of the test bacterin dilutions and reference bacterin dilutions. For reference bacterin groups, inject each mouse intraperitoneally with the dose supplied on the reagent information sheet. Inject test bacterins intraperitoneally at a dose volume that corresponds to 1/20 of the least dose recommended on the product label or Part VI of the current Outline of Production. This volume must not be < 0.1 mL.

Note: It is permissible to vaccinate a few extra mice in each group to compensate for any potential deaths that may occur prior to challenge and are not related to vaccination. However, if extra mice are vaccinated, all surviving at the time of challenge must be challenged with live *S. dublin* and included in data calculations.

4.1.5 Revaccinate the mice in a similar manner 14 days after the first vaccination.

4.1.6 Retain 30 nonvaccinated mice to determine LD₅₀ of the challenge.

4.2 Preparation of challenge in a biological safety cabinet

4.2.1 Prepare the challenge and LD₅₀ determination dilutions according to the firm-supplied information.

4.2.2 Place the vial(s) of challenge inoculum and additional dilution tubes on ice. Keep on ice throughout the challenge procedure.

4.3 Timing and administration of challenge

4.3.1 Challenge all vaccinates 7 to 10 days after the second vaccination.

4.3.2 Challenge nonvaccinated LD₅₀ controls at the same time as the vaccinates.

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4.3.3 Inoculate each vaccinated mouse with 0.25 mL of challenge inoculum (standardized culture, see **Section 4.2.6**) intraperitoneally, using a 1-mL Tuberculin syringe and 26-gauge, 3/8-inch needle.

4.3.4 Inoculate separate groups of 10 nonvaccinated control mice intraperitoneally with 0.25 mL of each of the LD₅₀ dilutions.

4.4 Observation of mice after challenge

4.4.1 Observe the mice up to twice daily for 14 days after challenge. Record deaths and euthanize any moribund mice as recommended by the Institutional Animal Care and Use Committee.

4.4.2 If deaths occurring after challenge are suspected to be due to causes other than salmonellosis, necropsy such mice to determine the cause of death. If cause of death is unrelated to vaccination and/or challenge, do not include data from these mice in the total deaths for the test.

5. Interpretation of the Test Results

Interpret the test as prescribed in 9 CFR 113.123.

5.1 Calculate the LD₅₀ (theoretical dose/dilution at which the challenge would be lethal to 50% of the control mice) of the challenge inoculum using the Reed-Muench or Spearman-Kärber method of estimation. A valid test must have an LD₅₀ between 1,000 and 100,000.

5.2 Calculate the PD₅₀ of the reference bacterin and each test bacterin (theoretical dose/dilution at which the bacterin would protect 50% of the mice) using the Reed-Muench or Spearman-Kärber method of estimation.

5.3 At least 2 dilutions of the reference must protect > 0% and < 100% of the mice for a valid test. The lowest dilution of reference shall protect > 50% of the mice. The highest dilution of the reference shall protect < 50% of the mice.

5.4 If the PD₅₀ of the reference cannot be calculated because the lowest dilution tested protects < 50% of the mice, the bacterin may be retested, ***provided the following:***

5.4.1 If the bacterin is not retested, it is unsatisfactory.

5.4.2 If the protection provided by the lowest dilution of the reference bacterin exceeds that provided by the lowest dilution of the test bacterin by at least 6 mice, the test bacterin is unsatisfactory without additional testing.

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5.4.3 If the total number of mice protected by the reference bacterin (sum of survivors in all dilution groups) exceeds the total number protected by the test bacterin by 8 mice or more, the test bacterin is unsatisfactory without additional testing.

5.5 If the PD₅₀ of the test bacterin in a valid test cannot be calculated because the highest dilution protected more than 50% of the mice, the bacterin is satisfactory without further testing.

5.6 Divide the PD₅₀ of each test bacterin by the PD₅₀ of the reference to calculate the relative potency (RP) for each test bacterin.

5.7 If the RP of the test bacterin(s) is ≥ 0.30 , the test bacterin is satisfactory.

5.8 If the RP of the test bacterin(s) is < 0.30 , the test bacterin is unsatisfactory.

5.9 A test bacterin with an RP < 0.30 may be retested by conducting 2 independent replicate tests in a manner identical to the initial test. Calculate the results of the retests in the following manner:

5.9.1 Average the RP values of the retests.

5.9.2 If the average RP of the retests is < 0.30 , the bacterin is unsatisfactory.

5.9.3 If the average RP of the retests is ≥ 0.30 **AND** the RP obtained in the original test is $\leq 1/3$ the average (RP) of the retests, the test bacterin is satisfactory. Consider the initial test to be the result of test system error.

5.9.4 If the average RP of the retests is ≥ 0.30 **BUT** the RP of the original test is $> 1/3$ of the average RP of the retests, calculate a new average RP using the RP values obtained in all tests (original plus retests). If the new average RP is ≥ 0.30 , the test bacterin is satisfactory. If the new average RP is < 0.30 , the test bacterin is unsatisfactory.

6. Report of Test Results

Report results of the test(s) as described by standard operating procedures.

7. References

7.1 Title 9, *Code of Federal Regulations*, part 113.123, U.S. Government Printing Office, Washington, DC.

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7.2 Reed LJ, Muench H, 1938. A simple method of estimating 50% endpoints. *Am J Hygiene*, 27: 493-497.

7.3 Cottral G.E., (Ed.), 1978. *Manual of standardized methods for veterinary microbiology*. Comstock Publishing Associates, Ithaca, NY. pg. 731.

7.4 Finney, D.J. 1978. *Statistical methods in biological assay*. Griffin, London. 3rd edition, pp. 394-401.

8. Summary of Revisions

Version .07

- Updated coversheet and contact information.

Version .06

- The Section Leader and Director information has been updated.
- The CVB no longer provides the challenge reagent. The SAM was updated to reflect this change.

Version .05

- The CVB no longer provides the qualified reference bacterin. The SAM was updated to reflect this change.

Version .04

- The Contact information has been updated.
- **2.1.3/4.5.1:** These sections have been updated to reflect current practices.

Version .03

- **5.1.7, 5.1.8, and 5.1.9** Increased relative potency criteria to two decimal places to coincide with 9 CFR, Part 113.123.
- 7. Additional references have been added.

Version .02

Supplemental Assay Method for Potency Testing of *Salmonella dublin* Bacterins

This document was revised to clarify practices currently in use at the Center for Veterinary Biologics and to provide additional detail. While no significant changes were made that impact the outcome of the test, the following changes were made to the document:

- **2.1** A sterile inoculating loop and biological safety cabinet have been added.
- **2.2.8** An additional tube size has been added.
- **2.2.9** An additional flask size has been added.
- **2.2.14** Bovine blood agar has been added as an additional media option for plate counts.
- **3.4.6** A recipe for 5% bovine blood agar plates has been added.
- **4.2.6** The second gram stain done on the challenge material has been removed.
- **5.1.1** and **5.1.2** The Spearman-Kärber method has been added with the Reed-Muench method of estimation.
- References to the current reagent data sheet have been added throughout the document.
- The use of a biological safety cabinet has been added throughout the document.
- References to internal CVB documents have been replaced with summary information.
- References to the spectrophotometer that is currently used have been updated.
- The contact has been changed to Janet Wilson.