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Standard Guide for Characterization and Testing of Porcine Fibrinogen as a Starting Material for Use in Biomedical and Tissue- Engineered Medical Product Applications¹

This standard is issued under the fixed designation F3515; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide covers the evaluation of porcine fibrinogen suitable for use in biomedical or pharmaceutical applications including, but not limited to, tissue-engineered medical products (TEMPs).

1.2 This guide addresses key parameters relevant for functionality, characterization, and purity of porcine fibrinogen.

1.3 As with any material, some characteristics of porcine fibrinogen may be altered by processing techniques, such as electrospinning (1)² and sterilization, required for the production of a specific formulation or device. Therefore, properties of fabricated forms of this protein should be evaluated using test methods that are appropriate to ensure safety and efficacy and are not addressed in this guide.

1.4 The primary focus of this document is fibrinogen derived from porcine blood, which is similar to human fibrinogen. The biggest advantage that pigs have over other species (such as cattle, sheep, goats, elk, and deer) is that they are less likely to transmit transmissible spongiform encephalitis (TSE) (ISO 22442-1 Annex D; WHO Guidelines, 2003; WHO Guidelines, 2006; WHO Guidelines, 2010). The document may also discuss fibrinogen from other sources when useful information is available. Fibrin is also discussed in some sections.

1.5 *Units*—The values stated in SI units are to be regarded as the standard. No other units of measurement are included in this standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 ASTM Standards:³

E1298 Guide for Determination of Purity, Impurities, and Contaminants in Biological Drug Products (Withdrawn 2014)⁴

F981 Practice for Assessment of Compatibility of Biomaterials for Surgical Implants with Respect to Effect of Materials on Muscle and Insertion into Bone

F1983 Practice for Assessment of Selected Tissue Effects of Absorbable Biomaterials for Implant Applications

F2212 Guide for Characterization of Type I Collagen as Starting Material for Surgical Implants and Substrates for Tissue Engineered Medical Products (TEMPs)

F3163 Guide for Classification of Cellular and/or Tissue-Based Products (CTPs) for Skin Wounds

2.2 ISO Standards:⁵

ISO 10993-1 Biological evaluation of medical devices—Part 1: Evaluation and testing with a risk management process

ISO 11137-1:2006 Sterilization of health care products—Radiation—Part 1: Requirements for validation and routine control of a sterilization process for medical devices

ISO 11737-1:2006 Sterilization of health care products—Microbiological methods—Part 1: Determination of a population of microorganisms on products

ISO 11737-2:1998 Sterilization of health care products—

¹ This guide is under the jurisdiction of ASTM Committee F04 on Medical and Surgical Materials and Devices and is the direct responsibility of Subcommittee F04.42 on Biomaterials and Biomolecules for TEMP.

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² The boldface numbers in parentheses refer to a list of references at the end of this standard.

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

⁴ The last approved version of this historical standard is referenced on www.astm.org.

⁵ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

- Microbiological methods—Part 2: Tests of sterility performed in the definition, validation and maintenance of a sterilization process
- ISO 13485 Medical devices—Quality management systems—Requirements for regulatory purposes
- ISO 14160:2020 Sterilization of health care products—Liquid chemical sterilizing agents for single-use medical devices utilizing animal tissues and their derivatives—Requirements for characterization, development, validation and routine control of a sterilization process for medical devices
- ISO 14644-1 Cleanrooms and associated controlled environments—Part 1: Classification of air cleanliness by particle concentration
- ISO 14644-2 Cleanrooms and associated controlled environments—Part 2: Monitoring to provide evidence of cleanroom performance related to air cleanliness by particle concentration
- ISO 14644-3 Cleanrooms and associated controlled environments—Part 3: Test methods
- ISO 14644-4 Cleanrooms and associated controlled environments—Part 4: Design, construction and start-up
- ISO 14644-5 Cleanrooms and associated controlled environments—Part 5: Operations
- ISO 14644-7 Cleanrooms and associated controlled environments—Part 7: Separative devices (clean air hoods, gloveboxes, isolators and mini-environments)
- ISO 14644-8 Cleanrooms and associated controlled environments—Part 8: Classification of air cleanliness by chemical concentration (ACC)
- ISO 14644-9 Cleanrooms and associated controlled environments—Part 9: Cleaning of surfaces to achieve defined levels of cleanliness in terms of particle and chemical classifications
- ISO 14644-10 Cleanrooms and associated controlled environments—Part 10: Classification of surface cleanliness by chemical concentration
- ISO 14644-13 Cleanrooms and associated controlled environments—Part 13: Cleaning of surfaces to achieve defined levels of cleanliness in terms of particle and chemical classifications
- ISO 14644-14 Cleanrooms and associated controlled environments—Part 14: Assessment of suitability for use of equipment by airborne particle concentration
- ISO 14644-15 Cleanrooms and associated controlled environments—Part 15: Assessment of suitability for use of equipment and materials by airborne chemical concentration
- ISO 14698-1 Cleanrooms and associated controlled environments—Biocontamination control—Part 1: General principles and methods
- ISO 14698-2 Cleanrooms and associated controlled environments—Biocontamination control—Part 2: Evaluation and interpretation of biocontamination data
- ISO 14971 Medical devices—Application of risk management to medical devices
- ISO 22442-1 Medical devices utilizing animal tissues and their derivatives—Part 1: Application of risk management
- ISO 22442-2 Medical devices utilizing animal tissues and their derivatives—Part 2: Controls on sourcing, collection and handling
- ISO 22442-3 Medical devices utilizing animal tissues and their derivatives—Part 3: Validation of the elimination and/or inactivation of viruses and transmissible spongiform encephalopathy (TSE) agents
- 2.3 *Other Documents:*
- AAMI TIR 19:1998 Guidance for ANSI/AAMI/ISO 10993-7:1995, Biological evaluation of medical devices—Part 7: Ethylene oxide sterilization residuals⁶
- 21 CFR 211 Current Good Manufacturing Practice for Finished Pharmaceuticals⁷
- 21 CFR 820 Quality System Regulation⁷
- European Commission, OJ L 2011/C 73/01 Note for guidance on minimizing the risk of transmitting animal spongiform encephalopathy agents via human and veterinary medicinal products (EMA/410/01 rev.3)⁸
- European Pharmacopoeia 9.0, 2017 Fibrin Sealant Kit⁹
- European Pharmacopoeia 9.0, 2017, Chapter 2.2.3 Potentiometric Determination of pH⁹
- European Pharmacopoeia 9.0, 2017, Chapter 2.2.40 Near-Infrared Spectroscopy⁹
- European Pharmacopoeia 9.0, 2017, Chapter 2.4.8 Heavy Metals⁹
- European Pharmacopoeia 9.0, 2017, Chapter 2.5.9 Determination of Nitrogen by Sulphuric Acid Digestion⁹
- European Pharmacopoeia 9.0, 2017, Chapter 2.5.12 Water: Semi-micro Determination⁹
- European Pharmacopoeia 9.0, 2017, Chapter 2.5.32 Loss on Drying⁹
- European Pharmacopoeia 9.0, 2017, Chapter 2.6.1 Sterility⁹
- European Pharmacopoeia 9.0, 2017, Chapter 2.6.12 Total Viable Aerobic Count⁹
- European Pharmacopoeia 9.0, 2017, Chapter 2.6.13 Test for Specified Microorganisms⁹
- European Pharmacopoeia 9.0, 2017, Chapter 2.6.14 Bacterial Endotoxins⁹
- European Pharmacopoeia 10.0, Supplement 10.3, 2020, Chapter 2.6.32 Test for Bacterial Endotoxins Using Recombinant Factor C⁹
- European Pharmacopoeia 9.0, 2017, Chapter 5.1.6 Alternative Methods for Control of Microbiological Quality⁹
- FDA Guidance Document, 1991 Shelf Life of Medical Devices¹⁰
- FDA Guidance Document, 2008 Guidance for Industry: Container and Closure System Integrity Testing in Lieu of

⁶ Available from Association for the Advancement of Medical Instrumentation (AAMI), 4301 N. Fairfax Dr., Suite 301, Arlington, VA 22203-1633, <http://www.aami.org>.

⁷ Available from U.S. Government Printing Office, Superintendent of Documents, 732 N. Capitol St., NW, Washington, DC 20401-0001, <http://www.access.gpo.gov>.

⁸ Available from the European Medicines Agency (EMA), Domenico Scarlatti-laan 6 1083 HS Amsterdam, The Netherlands, <https://www.ema.europa.eu>.

⁹ Available from the EDQM Council of Europe, 7 allée Kastner, CS 30026, F-67081 Strasbourg, France, <https://pharmeuropa.edqm.eu>.

¹⁰ Available from U.S. Food and Drug Administration (FDA), 10903 New Hampshire Ave., Silver Spring, MD 20993, <http://www.fda.gov>.