INTERNATIONAL STANDARD

ISO 23381

First edition
2020-09

Determination of salt out (crystallization) temperature of liquid fertilizers

Détermination de la température de désolubilisation (cristallisation) des engrais liquides

iTeh Standards
(https://standards.iteh.ai)
Document Preview

ISO 23381:2020
https://standards.iteh.ai/catalog/standards/iso/eac8fc3f-8bac-487c-bb49-519e96019a2a/iso-23381-2020

Reference number
ISO 23381:2020(E)

© ISO 2020

iTeh Standards
(https://standards.iteh.ai)
Document Preview

ISO 23381:2020
https://standards.iteh.ai/catalog/standards/iso/eac8fc3f-8bac-487c-bb49-519e96019a2a/iso-23381-2020

COPYRIGHT PROTECTED DOCUMENT

© ISO 2020

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

 © ISO 2020 – All rights reserved

Contents

Page

iTeh Standards
(https://standards.iteh.ai)
Document Preview

ISO 23381:2020
https://standards.iteh.ai/catalog/standards/iso/eac8fc3f-8bac-487c-bb49-519e96019a2a/iso-23381-2020

© ISO 2020 – All rights reserved

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

iTeh Standards
(https://standards.iteh.ai)
Document Preview

This document was prepared by Technical Committee ISO/TC 134, *Fertilizers, soil conditioners and beneficial substances*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

https://standards.iteh.ai/catalog/standards/iso/eac8fc3f-8bac-487c-bb49-519e96019a2a/iso-23381-2020

 © ISO 2020 – All rights reserved

Introduction

The global liquid fertilizers market size is estimated to account for a value of USD 2,5 billion in 2019 and is projected to grow at a CAGR of 3,7 % from 2019, to reach a value of USD 3,1 billion by 2025. North America is the leading consumer of the liquid fertilizers with 32 % of the market, followed by Europe (25 %), Asia Pacific (21 %), Latin America (13 %), and the rest of the world at 9 %[7]. Liquid fertilizers cover inorganic nitrogen, phosphorus, potash, and micronutrients as well as organic, and synthetic fertilizers applied to soil, as foliar, in fertigation, and as starter solutions and aerial applications and in crops such as cereals, grains, fruits, vegetable, oilseeds, pulses, turf, ornamentals, forage, and plantation crops. Liquid fertilizers are the most efficient way of delivering the required nutrients to the plants at the correct time and in optimal concentration.

Urea ammonium nitrate (UAN 28-32) is an example of a widely used liquid fertilizer. Ammonium polyphosphate (APP, 10-34-0, and 11-37-0), Ammonium thiosulfate (ATS, 12-0-0-26S), potassium thiosulfate (KTS, 0-0-25-17S), magnesium thiosulfate (0-0-0-10S-4Mg), calcium ammonium nitrate (CAN 17), and solutions of water soluble fertilizers such as potassium nitrate (13-0-46), and ammonium chloride solution (6-0-0-16Cl) are few examples of liquid fertilizers.

Limitations of liquid fertilizers

Liquid fertilizers, although easier to use, and are versatile in application, they have the disadvantage of salting out (crystalize) at cold climate. This phenomenon creates limitation for transportation, storage, and handling during the cold season and proper steps is recommended to avoid crystallization.

Accurate crystallization data and an accurate, easy to use, and a universal method for the determination of salt out temperature (SOT) of liquid fertilizers is a helpful reference for stakeholders to avoid or prevent crystallization of these popular fertilizers during the cold season[8].

Currently, there is no uniform and standard method for the determination of SOTs of liquid (fluid) fertilizers. There are quite a few methods used internally by several manufacturing companies. ASTM D6660 for the freezing point determination of aqueous ethylene glycol base engine coolants by atomic phase transition method, ASTM D1177-17 for the determination of freezing point of aqueous engine coolants, and the ASTM D97 (pour point) have also been cited in the literature for SOT measurements of liquid (fluid) fertilizers. Pour point of a liquid is defined as the temperature below which the liquid loses its flow characteristic. [4]to[6]

In addition to these cited methods, there are ISO documents that provide methods to determine the melting/freezing temperature of chemicals. ISO 1392 provides a method for the determination of the crystallization point of chemicals, and ISO 3016 provides a method for petroleum oils for the determination of pour points. [1],[2]

Differential scanning calorimetry is a thermoanalytical technique in which the difference in the amount of heat required to increase the temperature of a sample and reference is measured as a function of temperature. Both the sample and reference are maintained at nearly the same temperature throughout the experiment. The temperature increase as a function of time linearly and heat flow curve vs. the temperature increase is the instrument output. These instruments are expensive and the price tag is over $50,000 (USD).

Moreover, OECD Guidelines refers to the term “melting range” for the transition of solid to liquid.

The proposed method is based on cooling/thawing of the liquid fertilizer. The liquid (fluid) fertilizer is cooled in a dry ice/methanol bath until the liquid is crystallized. It then warms at the ambient temperature. Normally, the SOT is the temperature at which the last crystal dissolves.

iTeh Standards
(https://standards.iteh.ai)
Document Preview

© ISO 2020 – All rights reserved

iTeh Standards
(https://standards.iteh.ai)
Document Preview

ISO 23381:2020
https://standards.iteh.ai/catalog/standards/iso/eac8fc3f-8bac-487c-bb49-519e96019a2a/iso-23381-2020