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English version

Fertilizers - Determination of dust content

Engrais - Détermination de la teneur en poussière

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Foreword

This CEN Report has been prepared by Technical Committee CEN/TC 260 "Fertilizers and liming materials", the secretariat of which is held by DIN.

This CEN Report is published by the European Committee for Standardization. It is published for information only and does not have the status of a European Standard.

The annexes A and B are informative.

Introduction

In production and handling of fertilisers dust generation is of great concern by both producers and users of the fertiliser products. For health and environmental reasons it is of great interest to control and reduce the amount of dust generation. In the fertiliser industries there exist a wide variety of apparatus for dust determination, most being used as "in-house" methods in plants and laboratories.

In order to develop a standard dust test CEN TC260 put the work item WI 00260007 on the agenda of WG2 who has worked in this field since November 1991. A spouting bed apparatus was designed for gravimetric determination of dust, and after two preliminary ringtests a conclusive ringtest involving six laboratories was carried out. Not being able to develop a statistical significant method for the determination of dust TC 260 decided by resolution 105/1997 to change the deliverable of this work item into a CEN Report. The change of deliverable has been approved by CEN/BT with its resolution BT C172/1999.

1 General

When handling fertiliser grains, dust is at every moment generated on the surface. The fertiliser thus contains more or less free dust, and has a potential for generating more dust (abrasion dust) when subject to subsequent handling.

In all existing gravitational test methods dust will be generated during the testing time, and the two types of dust will be measured simultaneously. The scope of the method is expressed in annex A and the aim is to:

*"...specify a method for the determination of the **dust potential** of solid fertilisers and is applicable to granular and prilled fertilisers.*

Dust particles which cause reduced visibility in air are too small to be determined by this method."

2 Background for choice of method

Fluidized particle powders are generally divided into four characterising groups (A,B,C,D) [1]. Group C particles are small, cohesive and are difficult to fluidize. Aeratable powders belong to group A, and many fluidized bed catalysts

characterise this group. Sand typifies group B, in which inter-particle forces are negligible, in contrast with group A powders. Large and/or dense particles in general belong to group D, and fertiliser particles (2 mm to 4 mm) in air are in this group. A flow diagram can be used to broadly identify flow regimes appropriate to combinations of gas velocity and particle properties. It can be shown that the fertiliser system is in the lower part of the spouted bed regime.

A criterion that can be used to distinguish between group B and D is the numerical inequality that classifies a powder as spoutable if:

$$(\rho_p - \rho_g) . d_p^{1,24} > 0,23$$

For a typical fertiliser this value will be about 1,4 and about 0,5 for an urea prill.

From previous experiments with other methods based on a fluidized bed and the above calculations, it was decided to base the method upon the spouted bed principle.

3 Symbols and abbreviated terms

3.1 Technical Symbols

C_D	- drag coefficient
d_p	- particle diameter, expressed in metres (m)
d_s	- average spout diameter, expressed in metres (m)
D_p	- average particle diameter, expressed in metres (m)
D	- diameter of spouting section, expressed in metres (m)
D_i	- inner orifice diameter, expressed in metres (m)
g	- gravity, expressed in kilograms per metres per square seconds (kg/m $s^{2)}$
H	- bed height, expressed in metres (m)
Re	- Reynolds number
v_t	- terminal velocity, expressed in metres per seconds (m/s)
v_{ms}	- minimum spouting height
ρ_p	- particle density, expressed in kilograms per metres to the third power (kg/m^3)
ρ_f	- fluid density, expressed in kilograms per metres to the third power (kg/m^3)
μ	- viscosity, expressed in Newton seconds per square metres (Ns/m^2)

3.2 Statistical symbols and abbreviations

df	- degrees of freedom
F	- mean square between groups/mean square within groups
F_{crit}	- tabulated value form the F-distribution for a significance level of 0.05 confidence interval
MS	- mean square
P-value	- significance level corresponding to a given F (should be less than 0,05 to reject the null-hypothesis)
SS	- sum of squares