ISMA* Technical Conference

Wiesbaden, Germany
11-15 September 1961

**In 1982, the name of the International Superphosphate Manufacturers' Associations (ISMA) was changed to International Fertilizer Industry Association (IFA).*

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THE INTERNATIONAL
ISMA
SUPERPHOSPHATE
MANUFACTURERS' ASSOCIATION
TECHNICAL COMMITTEE · COMITE DES TECHNICIENS

CONFIDENTIAL

LE/61/58
Received : 26th June, 1961.

TECHNICAL MEETINGS - WIESBADEN

This paper will be presented at the Technical Meetings in Wiesbaden from September 11th to 15th, 1961. It must not be published prior to that date, and, in any case, it must not be published without the permission of the author.

TESTING GRANULAR FERTILIZERS FOR HARDNESS

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It is important that fertilizer granules should be of a correct hardness. They must be sufficiently hard to avoid being crushed by their own weight in the stock pile and they should give off no dust through mechanical friction during transport or during application.

Older Methods

In the past, hardness was determined objectively by testing only one granule or a few granules at a time. In the method evolved by Chemische Fabrik Kalk , granules of the same diameter are placed on a sheet of glass in such a manner as to form a triangle, with another sheet of glass on top. The latter carries a vessel into which lead pellets are poured. The pressure required for crushing a granule is then measured.

With the "Stodiek" method a single granule is loaded in a similar manner, and the commencement of disintegration is indicated by the breaking of an electric current. With this method a very large number of granules had to be tested, one after the other, so as to obtain a fairly reliable average. Even then the shape of the granule could vitiate the result. Hence, tests took a considerable amount of time and the average values obtained were not reliable even with a large number of single tests.

In view of this, the laboratory of the Verein Deutscher Dünger-Fabrikanten (German fertiliser manufacturers' association) limited their tests to the so-called "finger-test". A granule which could be crushed between the thumb and forefinger was classified as "soft". If it could be crushed with the forefinger on a hard surface it was regarded as being of "medium hardness". If it remained intact when subjected to pressure by the forefinger against a hard surface, it was classified as "hard". According to this subjective method thousands of

samples were tested by the "Verein". The method was indeed both rapid and simple, but results were not reliable, as the shape of the granule and, with a prolonged series of tests, the fatigue of the fingers, were bound to influence results.

Knowing that an objective test is reliable only when a large number of granules are tested simultaneously, an apparatus has been constructed by the laboratory of the Verein Deutscher Dünger-Fabrikanten whereby thousands of granules of the same size are simultaneously subjected to pressure by means of a hydraulic press. The pressure which granules are able to withstand during an increasing range of pressure is measured by means of an oil pressure manometer. Experiments showed that in this way reliable and reproducible values were obtained which made it possible to establish a pressure scale covering a wide range of pressures.

Description of the New Apparatus

A simple hydraulic press, i.e. an ordinary jack, is fixed into a rectangular, vertical frame, 40 cm high, made of square piping. The ram of the press carries above it a flat steel disc 12 cm in diameter. The oil pressure chamber is connected to a manometer, the scale of which extends to 250 atmospheres. Next to the manometer there is a second dial, the pointer of which is moved by a cog-rail and cog-wheel. The cog-rail is attached to the disc, thus transmitting its upward movement on a magnified scale to the pointer.

Apart from these integral parts, there are also the following sections:-

a pressure vessel consisting of a cylinder made of V2A steel with a clear height of 65 mm and a clear width of 70 mm, open at the top and bottom;

a shallow steel dish in which the pressure vessel is placed;

a strong piston made of plexiglass which is introduced at the top of the cylinder.

Method of working

Take a fraction of granules 3 - 4 mm in diameter from the fertilizer granules to be tested. After slight shaking in a graduated cylinder measure off 200 ml, and transfer to the pressure vessel standing on the small steel dish. The height of the granules in the vessel should be 52 mm. Insert the plexiglass piston into the cylinder and place on the disc of the hydraulic press. Now apply slow pressure at intervals, until the pointer indicates a depth of intrusion amounting to 10 mm. Wait for 10 seconds and then read from the manometer the pressure which the granules can still withstand.

Advantages of this Method

200 ml of fertilizer granules of 3 mm diameter correspond to 6000 - 7000 granules, the resistance of which can be measured in one operation. Therefore, the value obtained is very exact and can be reproduced each time.

This method offers an extensive pressure range from 0 - 150 atmospheres, or even more. Thus, it is possible to express the hardness of granules in a wide range of pressure values.

Measurement can be carried out within a very short time and requires not more than 3 minutes per sample, including preparation and cleaning.

Other Points to be observed

Dried granules of compound fertilizers can be so hard that a pressure of 150 atmospheres does not suffice. In the case of these granules, it is not advisable to go the whole length of the pressure scale, i.e. 10 mm, as the manometer may be damaged. For fertilizers of this type, it would be preferable to limit the pressure to 5 mm.

Owing to the pressure, all granules get stuck in the pressure chamber, but can be removed without difficulty by means of a hammer. For this reason, the pressure vessel is open at both ends. When measuring is completed, the inside walls of the cylinder have to be cleaned.

Findings established by usage

Even after drying, superphosphate provides the softest granules.

Granules of compound fertilizers are, as a rule, harder, and are extremely hard after having been dried.

In the majority of cases the hardness of granules of any one type of fertilizer is a function of moisture content.

Manufacturer

The above apparatus is manufactured by the firm of Walter Hansen, Heidag-Waagen-und Gerätebau, Hamburg-Altona, Holstentwiete 52, and is priced at £44.

Druck-Prüfgerät
für Düngergranalien

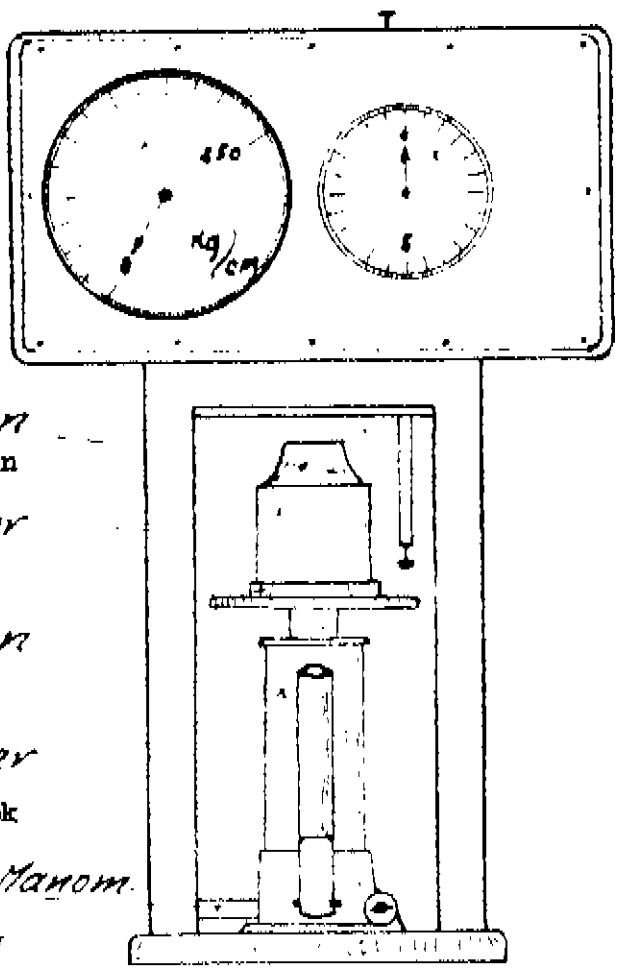
UDDF

APPARATUS FOR TESTING FERTILISER GRANULES BY PRESSURE

Regulator screw for "0" position
Stellschraube für 0-Stlg

Oeldruck-Manometer
Oil pressure manometer

Tiefenanzeiger
Depth indicator



Plexiglaskolben
Plexiglass piston

V2A-Zylinder
V2A Cylinder

Zylinderboden
Cylinder base

Oeldruckheber
Oil pressure jack

Zuleitung z. Manom.
Manometer inflow

HEIDAG - Waagen- u. Gerätebau - W. Hansen
Hamburg-Altona - Holstenstraße 52

den 25.2.1960