

Particle Size Distribution in Domestic House Dust Samples-

A comparison of the Characteristics of ISO Fine Test Dust versus Real House Dust (#868)

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Introduction

Test Dust:

- ❖ Domestic products, such as vacuum cleaners are often tested with inert particle mixtures called 'test dust'.
- ❖ Test dusts are usually defined mixtures consisting of silicon dioxide, aluminum, iron and sodium oxides and other components such as talcum powder, wood flour and potassium chloride (ASTM. 2007, CEI IEC. 2004, ASTM. 2004).
- ❖ Test dusts are graded according to their particle size range. ISO 12103-1 A2 Fine Test Dust (or ISO Fine Dust) is a test dust with a particle size range from 1-80µm.
- ❖ ISO Fine Dust is used in ASTM standard F2608-07 (ASTM. 2007) for determining the change in room air particulate counts as a result of test dust removal from floor coverings with the vacuum cleaner under test.

House Dust:

- ❖ In contrast to Test Dust, Household dust is composed of a heterogeneous mixture of fibers and irregularly shaped particles of varying particle sizes and composition.
- ❖ Particle sources include skin, hair, mites, plant pollen, fibers, soil, road dust, cooking emissions, heating emissions and cigarette smoke (Edwards et al. 1998; Molhave et al. 2000).
- ❖ A comparison of the particle size distribution of ISO Fine Dust and of household dust is necessary to determine if the ISO Fine resembles 'real' dust encountered by a vacuum cleaner in the home.

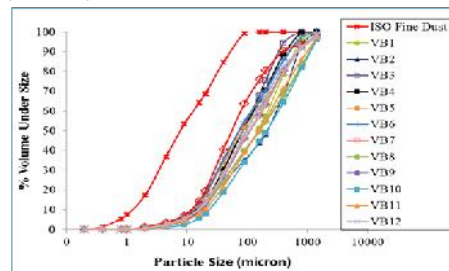
Study Aim:

- ❖ Compare the particle size distribution of ISO Fine Dust to that of House Dust by Laser Diffraction.
- ❖ Determine if a test dust, more representative of household dust, should be produced and standardized for domestic appliance testing.

Materials/Methods

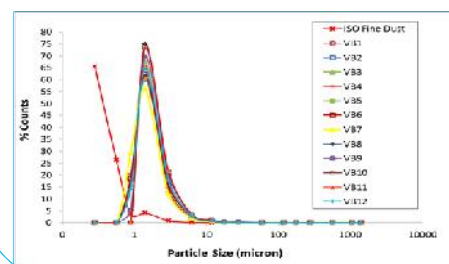
- Household dust was collected from vacuum bags taken from different homes (VB1-VB12). The dust was hand-sieved to remove large fibers and debris, and then sieved through a 500 µm sieve.
- Particle size determination was performed on the sieved dust samples (VB1-VB12) and on ISO Fine Dust (Powder Technology Inc., MN, USA) using a Malvern Mastersizer 2000 (Range of Detection 0.02-2000µm) at the Pharmacy Dept., Trinity College Dublin, Ireland.
- Results for VB1-VB12 household dust are reported as % Volume Under Size and Particle Count Distribution and compared to ISO Fine Dust.

Results: Figure 1: Comparison of ISO Fine Dust and House Dust (VB1-12) Particle Size Distributions as % Volume Under Size.



In ISO Fine Dust: 99% of the particles were <90µm with 53% <9µm and 18% <2 µm.
In household dust, 46% of particles were <90 µm and 1.0% were <2 µm.

Figure 2: Comparison of ISO Fine Dust and House Dust (VB1-12) Particle Size Distributions as % Counts.



Of the particles counted in household dust, 99% were <10µm with 65% ≤1.5µm, whereas in ISO Fine Dust, most were <1.0µm, with 65% ≤0.3µm

Conclusion:

- Although house dust is heterogeneous, the particle size distributions were remarkably similar for the 12 house dust samples tested in this study.
- In contrast, the particle distributions show that ISO Fine Test Dust is much finer than house dust and therefore markedly different to the dust encountered by a vacuum cleaner in the home.
- There is a possibility that vacuum bag dust under-represents the quantity of finer particles present in house dust as shown by Hunt et al. (2008) with vinyl flooring. In this study, coarser particles of house dust were preferentially removed from vinyl flooring during vacuum cleaning and 73% of finer particles (<10µm) remained on the floor due to particle-surface adhesion forces. However, these adhesion forces may also occur with the finer test dusts currently used in vacuum cleaner testing.
- With standardisation and some modifications, 'real' test dust more closely resembling house dust, could be used in domestic appliance testing in conjunction with the current test dusts, to provide important additional information.

