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**PROJECT: ‘Degradation effects of different types of pneumatic wood pellet delivery trucks’**

Wood pellets are a renewable fuel for domestic heating applications. However, before they are thermally converted, wood pellets are subjected to various mechanical processes and loads, e.g. various transport and storage steps, during pneumatic delivery by blowing trucks or domestic storage procedures, which lead to abrasion, pellet breakage and an increase of fines. The accrued fines can cause operational problems and system failures during storage, storage charging and discharging. Additionally, they may increase the risk of dust explosions and can lead to higher pollutant emissions during combustion.

The details of the degradation mechanisms inside delivery trucks are currently unknown and are the topic of the present project. The equipment on the transport and delivery trucks can mainly be divided into pressurized and unpressurized systems, with pressurized silo trucks being the most common in Germany. Depending on manufacturer and system, different discharging mechanisms from the truck’s silo into the conveying line are combined (e.g. screw conveyers, rotary valves, manual or automatic flaps, pinch valves, etc.). This inevitably results in different mechanical loads acting on the pellets inside the trucks, which lead to progressive pellet breakage and fines formation.

Four different vehicles (varying manufacturers, systems, and components) covering the range of commonly used discharging systems will be assessed. The trucks will be equipped with required measurement devices for pressure, force, volume and mass flows (air and pellets), temperature and other relevant operating characteristics which allow for time-resolved data acquisition during the discharging process. A cellular data interface is planned, allowing an immediate upload of each automatically measured data package during truck operation to a central database.

The project will commence with the development of a sampling device for the gentle separation of pellet bulk after leaving the vehicle’s internal pipe system. This device is essential for the subsequent quantification of the trucks’ size reduction effects by determination of resulting pellet length distribution and fines.

Initial measurements with each individual truck will be performed at Bochum University. These tests are expected to provide well-controlled and repeatable conditions to analyse the comminution behaviour of the individual truck system under different operating conditions, and to identify the critical pipe components which are mainly responsible for fines formation. These components of the discharging systems, such as screw conveyors, rotary valves, flaps, etc., will be examined separately as individual components by DEM-CFD simulations, giving a detailed insight into the mechanisms causing degradation.

In subsequent field tests, the entire process chain from truck loading to final delivery into domestic storage will be examined. Since wood pellets are regional products, a variance of material quality has to be considered. This material-specific influence will be determined in terms of the mechanical Durability (DU) according to DIN EN ISO 17831-1, enabling comparability between the results of different pellet types. The data obtained, especially during the field tests, will be collected in a database enabling conclusions to be drawn and suggestions made for guidelines for operation and design of delivery trucks guaranteeing gentle pellet delivery with low fines formation.

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**Research Station:** Ruhr-University Bochum
Department of Energy Plant Technology (LEAT)
Prof. Dr.-Ing. V. Scherer
Universitätsstraße 150, 44780 Bochum

**Contact:** B.Sc. Phil Spatz
Universitätsstraße 150, IC 2/93
44780 Bochum
+49 234 32 26333
spatz@leat.rub.de