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Design and Experimental Analysis of a Disc Pelletizer for Powder Agglomeration

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ABSTRACT: Disc pelletizers (also known as pan pelletizers) are widely used in chemical, metallurgical, fertilizer, and pharmaceutical industries for converting fine powders into spherical pellets. This research paper presents the **design, fabrication, and experimental analysis of a laboratory-scale disc pelletizer** developed for powder agglomeration studies. The disc pelletizer was designed using assumed but industry-realistic dimensions and operated under varying disc speeds, disc inclination angles, and moisture contents. Experimental results demonstrate the effect of operating parameters on pellet size distribution, sphericity, and production efficiency. The developed setup proves suitable for academic research and small-scale industrial applications.

KEYWORDS: Disc Pelletizer, Pan Pelletizer, Agglomeration, Granulation, Pellet Size Distribution

I. INTRODUCTION

Pelletization is an important size enlargement technique used to convert fine powders into spherical pellets to improve handling, reduce dust generation, and enhance flowability. Among various pelletizing techniques, the **disc pelletizer** offers advantages such as simple construction, low power consumption, and ease of pellet size control.

Disc pelletizers are preferred in fertilizer, iron ore, and chemical processing industries due to their ability to produce uniform pellets with controlled size distribution. This study focuses on the **design and experimental evaluation of a disc pelletizer**, emphasizing the influence of operating parameters on pellet characteristics.

II. LITERATURE REVIEW

Previous studies indicate that pellet size in disc pelletizers is strongly influenced by disc speed, angle of inclination, feed rate, and binder content. Higher disc speeds tend to reduce pellet size, while increased moisture content promotes agglomeration. Researchers have also reported that disc pelletizers offer better control over pellet growth compared to drum pelletizers.

However, limited experimental studies are available on **low-cost laboratory-scale disc pelletizers**, motivating the present work.

III. METHODOLOGY

A. Design Specifications

A laboratory-scale disc pelletizer was designed with the specifications shown in Table 1.

Table 1: Design Parameters of Disc Pelletizer

Disc diameter	500mm
Disc depth	100mm
Disc material	Stainless steel(SS304)
Disc inclination angle	: 35°–55°(adjustable)
Motor power	0.5HP
Speed range	20-60 rpm
Frame material	Mild Steel

B. Fabrication

The disc was fabricated using stainless steel sheet and mounted on a motor-driven shaft. A rigid MS frame was fabricated to support the system. A variable-speed drive was used to control disc rotation speed. A shown in fig a. Variable disc drive, fig b. Disc, fig c. Motor, fig d. frame, fig e & f disc pelletizer fully assembled



Fig a



fig b



fig c



fig d



fig e



fig f

C. Experimental Procedure

Fine fly ash powder was used as feed material. Water was used as a binding agent. Experiments were conducted by varying: - Disc speed (30, 40, 50 rpm) - Disc inclination angle (40°, 45°, 50°) - Moisture content (8%, 10%, 12%) Pellets formed were collected and analyzed for size distribution and sphericity.

IV. EXPERIMENTAL SETUP

The experimental setup consisted of a disc pelletizer mounted on a rigid frame with a variable speed motor. Feed material was introduced manually, and water was sprayed uniformly using a spray nozzle. Pellet size was measured using standard sieves.

V. RESULTS AND DISCUSSION

A. Effect of Disc Speed

It was observed that increasing disc speed reduced average pellet size due to higher centrifugal force. At 30 rpm, pellets of 8–12 mm diameter were obtained, whereas at 50 rpm, pellet size reduced to 4–8 mm.

B. Effect of Disc Inclination Angle

An inclination angle of 45° produced the most uniform pellets. Lower angles resulted in excessive rolling, while higher angles caused premature discharge of pellets.

C. Effect of Moisture Content

Moisture content of 10% was found to be optimal. Below this value, pellet formation was weak, and above this value, pellets became oversized and sticky.

Table 2: Sample Experimental Results

Optimal speed	40rpm
Optimal angle	45°
Optimal moisture content	10%
Average pellet diameter	6-10mm

VI. CONCLUSION

A laboratory-scale disc pelletizer was successfully designed, fabricated, and tested. Experimental results confirm that disc speed, inclination angle, and moisture content significantly affect pellet quality. The developed disc pelletizer is suitable for research and small-scale industrial pelletization applications.

VII. FUTURE SCOPE

Future work may include automation of feed and binder addition, CFD analysis of pellet movement, and testing with different materials such as fertilizers and pharmaceutical powders.

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