

Proceedings

Pressure Agglomeration Process of Bakery Industry Waste †

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Abstract: The research aim of this study was to assess the suitability for pellet production of bakery industry waste in the form of “sponge flour” in a mix with peanut postproduction sweepings (20%, 30%, 40%, 50%). An increase in the content of peanuts (from 20% to 50%) in the mix was shown to increase the power demand of the pelleting system and the physical density of the obtained granules but caused a decrease in their kinetic durability.

Keywords: food waste; pressure agglomeration; pellet quality

1. Introduction

According to the Central Statistical Office of Poland (2016) [1], the agriculture and agri-food industries in Poland collectively generate over 27 million tonnes of waste annually, thus leading to increasing interest in finding solutions for these industries to address this problem [2]. However, according to Daniel et al. [3], the problem of improper waste management is becoming increasingly common. Pelleting and briquetting (agglomeration) of waste plant materials enables their reuse as solid fuels, animal feed and fodder, fertilizers, etc. The quality of the obtained granules depends on a number of parameters, which can be divided into chemical-biological factors (e.g., chemical composition of the material, biological structure of compacted particles), material factors (e.g., material moisture and temperature, its granulometric composition), process factors (e.g., thickening pressures, flow rate of compacted material, compaction speed, process temperature, material conditioning), and apparatus and construction parameters (e.g., die diameter; number and diameter of compacting rolls; diameter, length, and condition of die holes; the gap size between the die and the roll).

2. Aim of the Research

The research aim of this study was to assess the suitability for pellet production of bakery industry waste in the form of “sponge flour” in a mix with peanut postproduction sweepings (20%, 30%, 40%, 50%). The specific purpose of the study was to determine the effect of peanut content in the mixture on the power demand of a granulating device and on the quality of the granules.

3. Materials and Methods

Peanut sweepings are a waste product obtained during the production of rodent food. Peanut sweepings are characterized by high fat content of approx. 50%, which hinders their direct pressure agglomeration—pellets produced only from peanuts have low kinetic durability. “Sponge flour” is generated during the baking of biscuits and it constitutes products not meeting quality standards,

especially obtained during the launch and stopping of a baking furnace. It is characterized by low moisture content and a non-cohesive structure that prevents direct granulation. Because of the content of sugar in “sponge flour”, it cannot be used in farm animal fodder production, although its aroma is attractive for some fish species and it is popularly used for the production of groundbaits.

Study of the granulation process was carried out with a granulating device P-300 (produced by Protechnika company located in Łuków, Poland), using a flat die with a hole diameter of 6 mm and a thickness of 28 mm. The influence of peanut postproduction sweepings content (20%, 30%, 40%, 50%) in the mixture with sponge flour on the power demand and on the density and kinetic strength of the obtained granulate was determined. The obtained results were analyzed using StatSoft® Statistica 13.0 and Microsoft® Office Excel.

4. Results and Conclusions

On the basis of the conducted research, it was concluded that an increase in the content of peanuts (from 20% to 50%) in the mix:

1. slightly increases the power demand of the pelleting system by approx. 3% (Figure 1),
2. increases the physical density of the obtained granules by approx. 3% (Figure 2),
3. causes a decrease in the kinetic durability of the obtained granules by approx. 40% (Figure 3).

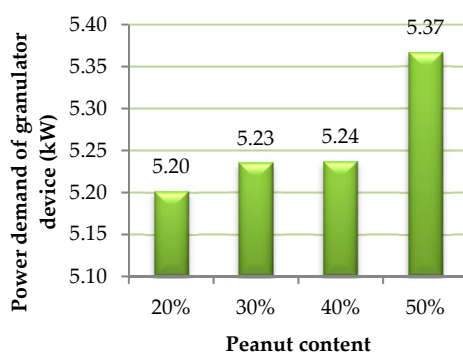


Figure 1. Dependence of granulator demand on power from peanut content in mixture with sponge flour.

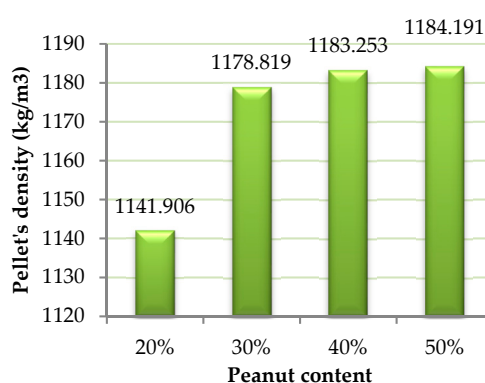


Figure 2. Effect of peanut content in the mixture with sponge flour on the density of granulate.

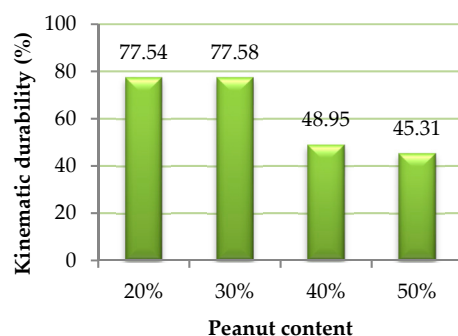


Figure 3. Dependence of the content of peanut in the mixture with sponge flour on the kinetic durability of the granulate.

Based on the conducted tests, it was found that increasing the addition of peanuts to sponge flour reduces the kinetic durability of the granules due to the high fat content in peanuts. Pellets with the highest possible kinetic durability (high quality) are available on the market, which enables their easy transport, storage, and use in automatic feeding systems.

Author Contributions: M.D. and S.O. conceived and designed the experiments; K.K., D.J. and R.B. performed the experiments; M.K.-S. and M.K. analyzed the data; M.D. wrote the paper.

Conflicts of Interest: The authors declare no conflict of interest.

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