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Частина 2

Київ НУХТ 2024

9. Effect of grinding time in bead mill and size of working bodies on the particle size of suspension

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Introduction. Knowledge of the change in particle size during grinding in a bead mill is necessary for proper planning and optimization of the production process.

Materials and Methods. The grinding of suspension particles based on castor oil and iron oxide pigment "Red 120" in a ratio of 60%/40% was studied. The diameters of the beads were 1.5, 2.0, and 3.0 mm. The type of the working organ of the bead mill was disc. The particle size was determined by the express method on a grindometer according to ISO 1524.

Results and Discussion. At the beginning of the process, the solid phase of the suspension contains a wide range of particle sizes and clusters of agglomerates, where the largest diameter equals 138 μm (bead diameter – 3 mm). The most intensive grinding occurs in the first 5 minutes of the process. The largest particle diameter after 45 minutes of grinding is 14 μm when grinding with beads of 3 mm diameter.

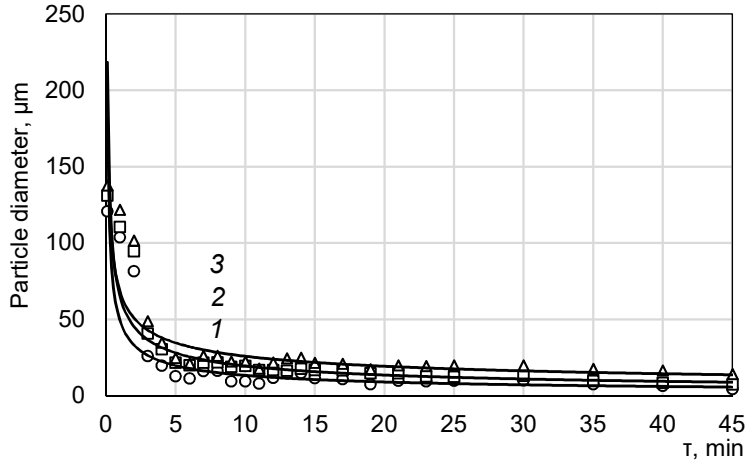

Figure 1. Degree of grinding (size of largest suspension particle) of compositions 1 (60/40%) depending on size of the working bodies: 1 – 1.5 mm; 2 – 2 mm; 3 – 3 mm.

Larger diameter beads transfer more energy through their greater mass. This amount of energy can be more than needed for the destruction during fine grinding, leading to wasted energy and less efficient grinding. Moreover, the effective contact surface area when grinding with beads of 2 and 3 mm thickness is smaller than that of 1.5 mm, resulting in fewer collisions between the material and particles.

Conclusion. Bead size of 1.5 mm is more energy-efficient and significantly more effective in terms of productivity (grinding time). The particle size changes insignificantly after 10–15 minutes, and grinding should be stopped.

References

Hrining K., Hordeichuk R., Gubenia O. (2018), Comparative analysis of equipment and research the superfine grinding process of titanium dioxide and quinacridone red suspensions in the bead mill, Ukrainian Journal of Food Science, 6(1), pp. 82–94, DOI: 10.24263/2310-1008-2018-6-1-11