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MATHEMATICAL MODELLING OF HEAT-MASS-TRANSFER PROCESSES FOR A HIGH INTENSITY GRANULAR DRYING [1]

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When drying a wet particle in hot flow air (at a temperature higher than the boiling one), different stages of the drying process are observed. At the initial stage, when the particle is moist in full, a significant amount of moisture is removed by evaporation at the particle surface under temperatures close to the wet bulb temperature. Here, the temperature and moisture distributions in the particle are subjected to the heat conductivity and diffusion equations, respectively. At the later stages, when the moisture content is reduced, the moisture diffusion to the particle surface becomes more restricted that causes the increase of the particle temperature. At the advanced stage, moisture is removed at the boiling regime when a granule part adjoining to surface is already dry (at a temperature above boiling) but another part of the granule is still wet (at a temperature below boiling). Here, a Stefan type problem arises, when it is required to find the boiling front position and also temperature and moisture distributions in granules.

A mathematical model of a process to high intensity drying granules is constructed that describes the temperature and moisture distributions along the particle radius in time for different stages of the process. The qualitative adequacy of the mathematical model constructed to the experimental data observed, and also a finite difference numerical method to solve the above differential problem are discussed.

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