Optimal chemical composition of modified polyamide waste agglomerate

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The current situation in polymers waste recycling requires the search for an effective polymer waste management solution. Effective technologies development for the secondary processing recycling polymers and plastic that contributes to natural resources preservation. That is because polymer materials are produced from oil and gas and, in conditions of polymer raw materials shortage, polymer-containing waste becomes a powerful raw material and energy resource.

Therefore, the polymer waste processing can become a highly profitable type of economic activity, including light industry, and will ensure the ecological situation enhancement in the country. It is urgent to find effective ways of polymer waste handling to solve the polymer raw materials shortage.

The polyamides recycling possibility makes them sustainable and environmentally safe materials by reducing the waste volume in landfills, reducing the production carbon footprint and its cost, since the waste polymer materials processing is cheaper than new production [9]. Despite these promising advantages, polyamide waste recycling can lead to a decrease in its molecular weight [8], which can affect its mechanical properties and reduce its thermal stability, making it more susceptible to melting or deformation and discoloration due to contamination that can reduce the aesthetic aspect of the final product. Compared the secondary processing of traditional thermoplastic polymers (polyethylene, polypropylene, etc.), the secondary polyamide 6 processing is often more complicated and unpredictable in terms of obtaining secondary raw materials with stable and predictable strength and exploitation characteristics.

That is why it is very useful to design and modeling of effective chemical compositions of modified polyamide waste agglomerate based on polyamide-6. Currently, the creation of high-quality, competitive secondary raw materials with various masterbatches and additives is impossible without using computer modeling technologies to simulate their optimal compositions with target operational and strength characteristics achievement.

That is why modeling for predicting the stiffness and strength characteristics of polymer composites based on polyamide 6 waste agglomerate and MW-PA CB10 masterbatch with their combined modification with humic acids (HA) in order to achieve the optimal operational properties in such waste agglomerate materials is a very relevant issue.

The research aims to create the foundation for computer modeling of the optimal chemical composition of polyamide-6 waste agglomerate with increased set of strength properties. The research tasks are identifying the optimal chemical composition of modified polyamide waste agglomerate and building computer models for forecasting their most important performance characteristics. The research is modified polyamide waste agglomerate based on polyamide-6, MW-PA CB10 masterbatch and humic acids. The research subject is computer modeling processes of optimal chemical composition of modified polyamide waste agglomerate. The research method is computer simulation in MathCad Prime 6.0.

The authors developed models for forecasting the performance properties of modified polyamide waste agglomerate depending on their chemical composition were built, which can be adapted to any content of MW-PA CB10 masterbatch and humic acids. It was established that the polyamide-6 waste agglomerate with 2 % wt. of masterbatch MW-PA CB10 has the best properties. The impact strength for this composition is 43.5 MPa, breaking stress during bending is 126.4 MPa, tensile strength is 342 N and elongation at break is 117 %. The authors recommended utilizing the same composition in traditional fields of primary.