APPLICATION OF FUSED DEPOSITION MODELING IN PREPARATION OF CARBOHYDRATE-BASED DRUG FORMS

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Fused deposition modeling (FDM) is almost the best-known technique of additive preparation in various fields of industry. Depending on the type of industry in which the printed form belongs, the quality requirements of this product may vary. In healthcare filed (pharmaceutical industry, medicine) or food processing industry is the most important factor toxicity of the product, which clearly defines the class of the materials that can be applied. Natural polysaccharides such as alginate, chitosan, pectin, starch, or xanthan gum represent group of materials with potential interest due their great biodegradability, absence of toxicity and ability to swell. Unfortunately, the thermal and mechanical properties of these material are unsatisfactory, therefore the usage of fillers and plasticizer during the processing is necessary.

Despite the significant references to the green chemistry and sustainability, there are no producers offering natural or pharmaceutical filaments. (Certain exception is a commercial filament made of polyvinyl alcohol that is approved by FDA as a possible excipient). The only option is a self-preparation of the pharmaceutical filaments with suitable biological and physico-chemical properties. The most typical method for the preparation is hot melt extrusion (HME).

The most critical steps of the preparation of the pharmaceutical filaments and their ability of FDM 3D printing which will be presented. In the presented study, the materials used for HME and 3D printing were Affinisol®15 LV HME (hydroxypropyl methyl cellulose in amorphous state), PVA (polyvinyl alcohol), alginate sodium salt, chitosan and pectin (made from citrus peel) and PEG (polyethylene glycol). FDM 3D printing was applied for preparation of the coatings of matrix tablets and capsules with improved dissolution properties that were studied. Thermal characterization of the raw materials and products was done by differential scanning calorimetry (DSC).