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Effect of heat treatment on mechanical properties of poly(ethylene oxide)-based tablets

Srinath Muppalaneni, Arghavan Kariman, David Mastropietro and Hossein Omidian
Nova Southeastern University, USA

Prescription drug abuse is an epidemic, and medications that can help deter this abuse are needed. Poly (ethylene oxide) (PEO) is a common tablet excipient used in formulating abuse-deterrent medications due to its high solution viscosity and plastic-like properties after thermal treatment. This study was intended to evaluate hardness, deformation and crush resistance of both regular and heat-treated PEO tablets containing acetaminophen as a model drug. Regular tablets consisting of 80 mg acetaminophen and 320 mg high molecular weight PEO (Polyox® WSR coagulant) were made on a single station Carver press, and compressed to 2000 pounds. Heat-treated tablets were further heated to 80°C for 30 minutes in a forced-convection oven. Tablet hardness and deformation were evaluated using a Vanguard hardness tester (LIH series) and a hammer, respectively. Tablet thickness and diameter were recorded before and after ten hammer strokes. Ease of crushing was determined using two manual methods, a pill crusher and a pestle-mortar, for one minute. Resultant particles were then evaluated for particle size distribution using sieve analysis. Heat-treatment increased tablet hardness from $124 \pm 3.2\text{N}$ (n=6) to over 200 N (max reading on tester). Heat-treated tablets also deformed under hammer strokes and reduced in thickness by $16.2 \pm 0.72\%$ (diameter increase of $7.1 \pm 0.19\%$) (n=3). Regular tablets were found to be easily friable and could be crushed into small particles after three strokes. Regular tablets could also be easily crushed using both the pill crusher or mortar and pestle whereas heat-treated tablets remained intact. It was concluded that thermal treatment of PEO tablets improved mechanical strength and provided plastic deformation properties.

Biography

Srinath Muppalaneni earned a BS in Pharmacy from Andhra University and a MS in Pharmaceutical Sciences from Campbell University. He is currently a Doctoral candidate in Pharmaceutics at Nova Southeastern University (NSU) with dissertation research focusing on abuse-deterrent formulations. He has so far participated in 6 inventions, 3 publications, 26 presentations, 1 grant, and 2 book chapters. He also won the best poster award at the 2013 OMICS 3rd International Conference and Exhibition on Pharmaceutics & Novel Drug Delivery Systems.

srinathmuppalaneni@gmail.com

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