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FLOW RATE EFFECT ON DEGRADATION PROCESS FOR PARTIALLY MODIFIED POTATO STARCH MICROSPHERES

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Abstract:
Starch microspheres are one of the best choices for drug delivery applications, because of their natural origin as well as to the high biodegradable and biocompatibility. Native starches in their native origin are not the first choice for this process. In this work potato starch was modified by enhancing hydrogen bonding using glycerol as hydrogen bond source and sodium alginate as thickening phase. Using a microfluidic capillary, microspheres were produced with different flow rates. The resulting microspheres were divided into two groups. In first group microspheres were kept in PVA suspension phase, while the second group was subjected to phosphate buffer solution PBS with PH=7.4 to study the degradation and release behavior of microspheres with time. Scan electron microscopy SEM, optical microscopy and PH tests were used to track the behavior of microspheres. The results show that the first group takes four weeks to oozing starch from microsphere at high flow rate (0.00059) cm^3/sec, and eight weeks to ooze starch as flow rate decrease. The second group degradation was initiated after 24 hour of subjection in PBS. The PBS effect on second group varied with flow rate. At high flow rate (0.00059) cm^3/sec due to thin shell wall from one side, the shell breaks up and starch was released after 24 hour in PBS. As flow rate decreased and microspheres spherical shape accumulation, the breakup takes evenly distribution. The degradation time of the second group take from 24 hr to three weeks depending on microspheres shape formed according to flow rate effect.

Keywords: *potato starch, rheology, microfluidic, microsphere, degradation.*

I. INTRODUCTION

Microspheres and microparticles are polymer particles produced on a micron scale, capable of releasing a pre-loaded drug that has been incorporated into a central reservoir [1]. Biodegradable polymer microspheres are one of the most common types and hold several advantages including encapsulation for many types of drugs such as small molecules, proteins, and nucleic acids and are easily administered through a syringe needle [2].

Degradation of polymers carried out by microorganisms in the environment by excretes enzymes making the polymer eating itself literally. Biopolymers degradation starts as soon as contacting to fluids of human body and tissues either by oxidation or hydrolysis with the assistance of several enzymes. Enzymes accelerate the biopolymers degradation rate in vivo and help the sample in the absorption of nutrients and solutes. Polysaccharides one of the major biopolymers used in biomedical applications. These polymers are extracted from plant and microbial sources include cellulose, starch, alginate dextran and gellan [3].

Starches are composed of semicrystalline amylose and branched amylopectin. Amylopectin is synthesized via three committed enzyme steps: ADP-Glc pyrophosphorylase, which synthesizes sugar nucleotide precursors; starch synthase, which