Geopolymer-based drug formulations for oral delivery of opioids

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Abstract

Opioid therapy for chronic pain generally use controlled release formulations to deliver analgesic drugs around-the-clock. Controlled release dosage forms can enlarge the therapeutic effect by controlling the rate and site of release. However, with high drug content, opioid formulations are easily targeted for non-medical use. With the increasing concern of opioid abuse, tamper-resistance becomes an important attribute for opioid controlled-release dosage forms. Geopolymers have been studied as drug carrier for opioids to improve the tamper-resistance but there are still some issues, such as curing condition and fast drug release in acid, have not been studied in detail yet. This thesis focuses on the optimization and evaluation of the geopolymer-based formulation on its controlled-release and tamper-resistance properties with the aim of achieving optimal therapeutic outcomes and reducing abuse potential.

In this work, we showed some further improvement and evaluations on geopolymer-based drug formulations. The mechanical strength and porosity of geopolymers could be influenced by the curing conditions: high humidity for at least 48 hours could improve its mechanical strength, but elevated temperature only accelerated the geopolymerization but promoted water evaporation, leading to shrinkage and crack formation. Incorporating pH-sensitive organic polymers could improve the acid resistance of geopolymer formulation and thus reduce the risk of dose dumping. Comparing to a commercial opioid tablet, the geopolymer matrix have higher mechanical strength and could offer better resistance against physical manipulation and extraction under heating. The results provided solid experimental support on the potential for geopolymer as matrix for oral opioid delivery systems.