Development of Poly(caprolactone) (PCL)-Based Polymeric Implantable Devices for Schizophrenia Treatment

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Introduction

Chronic diseases, e.g., Schizophrenia

Implantable delivery system

PCL biodegradable biocompatible long degradation time inexpensive

Poor patient adherence

Improve patient compliance

Better treatment outcomes

Unsuccessful treatment

The development of implantable devices is widely explored to provide long-acting drug delivery, especially to improve the treatment of chronic diseases (e.g., schizophrenia) (1). PCL offers many advantages which makes it suitable for the purpose of implantable delivery system (2). This work investigates the use of PCL and its combination with PEG 600, PEG 3000, and Tween 80 for the development of implantable devices aimed to treat schizophrenia.

Methods

Compositions of PCL-based implants (%w/w)

<table>
<thead>
<tr>
<th>Formula</th>
<th>RIS</th>
<th>PCL</th>
<th>Additional Substances</th>
<th>DCM</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMP1</td>
<td>20%</td>
<td>20%</td>
<td>-</td>
<td>60%</td>
</tr>
<tr>
<td>IMP2</td>
<td>20%</td>
<td>10%</td>
<td>PEG 600 10%</td>
<td>60%</td>
</tr>
<tr>
<td>IMP3</td>
<td>20%</td>
<td>10%</td>
<td>PEG 3000 10%</td>
<td>60%</td>
</tr>
<tr>
<td>IMP4</td>
<td>20%</td>
<td>10%</td>
<td>Tween 80 10%</td>
<td>60%</td>
</tr>
</tbody>
</table>

The polymer and drug mixture in DCM was poured in a petri dish. The implant was allowed to solidify in room temperature for 6 hours.

Evaluation

DSC, TGA, FTIR, SEM

In vitro release studies

Degradation studies

Results

FTIR

SEM

TGA

Degradation studies

In vitro release studies

The prepared implants were solid and flexible. Importantly, no new chemical bonds were observed between any of the components and that the addition of excipients modified the properties of the resulting implants as can be seen in DSC and TGA results, as well as degradation kinetics and release studies. The average release rate of IMP1 was 1.17 ± 0.07 mg/day, which will be clinically relevant as the recommended dose of RIS for schizophrenia is 1-2 mg/day.

Conclusion

In this work, monolithic implants containing RIS were successfully fabricated using a solvent-casting method. Based on the results obtained, the addition of hydrophilic and amphiphilic compounds modified the properties of the implant, including the drug release rate. Based on results obtained in the in vitro release studies, it can be concluded that implants made of PCL showed the more sustained release profile providing up to 28 days.

References
