Artificial Stomach-Duodenum (ASD) Model

The Artificial Stomach-Duodenum (ASD) model was designed as to mimic the physical conditions of the upper gastrointestinal (GI) tract. This model provides a convenient platform to investigate the effect of various API and formulation properties (e.g. salt forms, polymorphs and excipients) on dissolution, bioavailability and formulation performance and enables the selection of optimum API form and/or formulation for pre-clinical and early clinical studies.

Experimental Set-Up

The ASD model consists of two chambers connected in series representing the stomach and duodenum (Figure 1). Two infusion pumps are used to replenish gastric and duodenal fluids while a transfer pump is used to transfer the contents of the gastric chamber to the duodenal chamber using a first order transfer rate. These processes are controlled using customised software.

The concentration of dissolved drug in the stomach and/or the duodenal chambers is measured either using in situ fibre optic UV probes or sampled manually and analysed by HPLC.

Figure 1. Schematic Diagram of the ASD Model

Experimental condition

The experimental conditions used for the OrBiTo work are summarised in Table 1.

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<thead>
<tr>
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<th>Stomach</th>
<th>Duodenum</th>
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<tbody>
<tr>
<td><strong>Volume</strong></td>
<td>250 ml → 50 ml(^a)</td>
<td>100 ml (constant)</td>
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<tr>
<td><strong>Media</strong></td>
<td>0.01M HCl (pH 2)</td>
<td>Modified FaSSIF v1 (pH 6.5)(^b)</td>
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<tr>
<td><strong>Infusion rate</strong></td>
<td>3 ml/min</td>
<td>2 ml/min</td>
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<tr>
<td><strong>Transfer rate</strong>(^d)</td>
<td>1(^{st}) order transfer rate with 1(1/2) of 10 mins</td>
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</table>

\(^a\) Stomach volume changes over course of experiment. Initial volume mimics glass of water with dosage form, final volume mimics resting gastric volume.

\(^b\) FaSSIF prepared with 200 mM phosphate buffer to maintain pH in duodenal chamber following transfer of gastric media.

\(^c\) Stomach and duodenal chamber replenished with fresh gastric and duodenal media over course of experiment to mimic gastric and intestinal secretions.

\(^d\) Gastric emptying rate.

Table 1. Experimental conditions used for OrBiTo work.
Limitations

- Absence of absorptive compartment potentially results in overprediction of supersaturation and precipitation behaviour of BCS 2 compounds

References