



Lipid Multiparticulates (LMPs) are round, smooth matrix multiparticulates, typically 50-1,200 µm in diameter depending on the method of manufacture, which consist of one or more GRAS lipid excipients that are solid at room temperature. LMP technology has the capacity to combine a breadth of functionality with a range of finished dosage formats — capsules, sachets, suspensions and tablets. Capsugel has developed novel LMP technology based on a proprietary melt-spray-congeal process. This innovative drug delivery approach, which has market precedence, can be used for taste-masking, extended release and bioavailability enhancement for pharmaceutical, health and nutritional products.

#### Enhanced Performance

LMPs provide the superior gut distribution and safety benefits of multiparticulates with additional functionality tailored through the choice of lipid excipients. LMPs can also be coated with polymers for additional taste-masking protection or targeted delivery within the gastro-intestinal tract. The incorporated compound may be suspended or dissolved in the LMP matrix, at loadings up to 60%, while the core lipidic excipients may be degraded by digestive enzymes in the intestine.

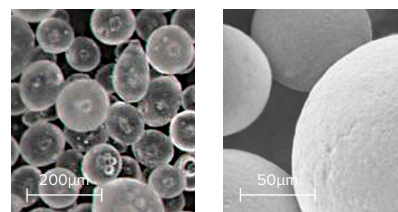
- Self-emulsification
- Extended release properties
- Use of non-toxic, GRAS excipients
- Taste-masking and palatability
- Bioavailability enhancing properties
- Compound protection from H<sub>2</sub>O & O<sub>2</sub>

#### Impressive Versatility

Dosage Form Flexibility for Patient-Centric Drug Delivery

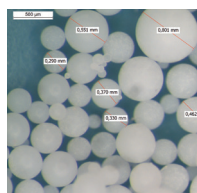


Combining the functionality of lipids and flexibility of multiparticulates, LMP technology provides an attractive formulation option for specialized applications, such as pediatrics and geriatric patient groups.



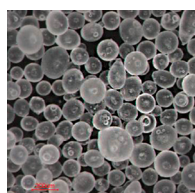
Scanning Electron Microscopy

#### Sample Applications



##### Taste masking

OTC: hydrophilic drug suspended in hard fat LMP matrix



##### Extended Release

Rx: water soluble drug suspended in hard fat LMP matrix

# Lipid Multiparticulate Technology

## Case Study

Azithromycin for acute bacterial sinusitis (adults) and community-acquired pneumonia (adults and children)

**Problem Statement:** High, single-dose product to be used by both adults and children (>6 months), offering acceptable palatability as a suspension final product — along with extended release properties to reduce side effects associated with fast dissolution in the stomach and rapid compound absorption.

**Solution:** LMP technology for high drug-loading capacity, taste-masking, extended release, good palatability and long shelf life.

<p><b>LMP produced by proprietary Melt-Spray-Congreal process</b></p>	<p><b>LMP technology met the target release profile over 1-2 hours in a bid to dampen Cmax in vivo</b></p>																																	
<div> </div> <p>Process optimization &amp; understanding</p> <ul style="list-style-type: none"> <li>• Understand/model key process: centrifugal atomization</li> <li>• Define key process parameters</li> <li>• Product annealing for production of physically stable product</li> <li>• Design suitable suspension vehicle</li> <li>• Design and develop commercial scale production line</li> </ul>	<div> <table border="1"> <caption>% Dissolved vs Time in minutes</caption> <thead> <tr> <th>Time (minutes)</th> <th>% Dissolved</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td></tr> <tr><td>5</td><td>15</td></tr> <tr><td>10</td><td>25</td></tr> <tr><td>15</td><td>35</td></tr> <tr><td>30</td><td>55</td></tr> <tr><td>60</td><td>75</td></tr> </tbody> </table> </div>	Time (minutes)	% Dissolved	0	0	5	15	10	25	15	35	30	55	60	75																			
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<p><b>Commercial Precedence</b></p>	<p><b>Mean serum azithromycin concentration following administration of 1x2g extended release LMP or 2x1g commercial sachet to healthy fasted subjects</b></p>																																	
<p>Zmax® approved for use in U.S., Japan, Canada and New Zealand. LMP consist of azithromycin suspended in a glyceryl behenate/poloxamer matrix</p> <div> </div> <div> </div> <p>Zmax is a registered trademark of Pfizer, Inc.</p>	<div> <table border="1"> <caption>Mean serum azithromycin concentration (mg/mL) vs Time (hours)</caption> <thead> <tr> <th>Time (hours)</th> <th>LMP product (mg/mL)</th> <th>Sachet product (mg/mL)</th> </tr> </thead> <tbody> <tr><td>0</td><td>0.0</td><td>0.0</td></tr> <tr><td>1</td><td>0.2</td><td>2.2</td></tr> <tr><td>2</td><td>0.4</td><td>1.3</td></tr> <tr><td>4</td><td>0.6</td><td>0.8</td></tr> <tr><td>6</td><td>0.7</td><td>0.6</td></tr> <tr><td>8</td><td>0.6</td><td>0.5</td></tr> <tr><td>12</td><td>0.4</td><td>0.4</td></tr> <tr><td>16</td><td>0.3</td><td>0.3</td></tr> <tr><td>24</td><td>0.2</td><td>0.2</td></tr> <tr><td>36</td><td>0.1</td><td>0.1</td></tr> </tbody> </table> </div>	Time (hours)	LMP product (mg/mL)	Sachet product (mg/mL)	0	0.0	0.0	1	0.2	2.2	2	0.4	1.3	4	0.6	0.8	6	0.7	0.6	8	0.6	0.5	12	0.4	0.4	16	0.3	0.3	24	0.2	0.2	36	0.1	0.1
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Learn more about how Capsugel's Lipid Multiparticulate Technology can improve the tastemasking, extended release and bioavailability of your products.



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solutions@capsugel.com  
 Capsugel.com  
 US: 800-845-6973  
 Europe: + 33 389 205 725