

TABLE OF CONTENTS

1. GENERAL INTRODUCTION	1
1. Brief Historical Background.....	3
2. Systems for controlled release into the gastrointestinal tract	5
3. Gated-MSPs.....	16
4. Gated-MSPs to protect and/or deliver nutraceutical molecules	27
5. Gated-MSPs for treatment of nutraceutical deficits and their related diseases.....	36
6. References.....	44
2. OBJECTIVES	65
3. CHAPTER 1 Lipid-gated Microdevices.....	69
Article 1. New oleic acid-capped mesoporous silica particles as surfactant- responsive delivery systems (<i>Communication</i>)	71
1. Communication	75
2. Experimental Section	83
SUPPORTING INFORMATION	87
Article 2. Surfactant-Triggered Molecular Gate Tested on Different Mesoporous Silica Supports for Gastrointestinal Controlled Delivery	101
1. Introduction	105
2. Materials and Methods.....	107
3. Results and Discussion	113
4. Conclusions	128
Article 3. Gated-organoclays for large biomolecules-controlled release triggered by surfactant stimulus.....	135
1. Introduction	138
2. Materials and methods	141
3. Results and discussion.....	145
4. Conclusions	165
SUPPORTING INFORMATION	171

4. CHAPTER 2 Protein-gated microdevices	179
Article 4. Towards the Enhancement of Essential Oil Components Antimicrobial Activity Using New Zein-Protein-Gated Mesoporous Silica Microdevices	181
1. Introduction	184
2. Materials and methods	187
3. Results and discussion	193
4. Conclusions	203
5. CHAPTER 3 Saccharide-gated microdevices.....	211
Article 5. Lactose-gated mesoporous silica particles for controlled intestinal delivery of essential oil components: an <i>in vitro</i> and <i>in vivo</i> study	213
1. Introduction	216
2. Materials and methods	219
3. Results and Discussion	229
4. Conclusions	255
6. GENERAL DISCUSSION	263
7. CONCLUSIONS AND FUTURE PERSPECTIVES.....	269
8. APPENDICES.....	277
Appendix I. List of publications included in this thesis	279
Appendix II. Other scientific publications	280