

# Contents

<b>1</b>	<b>Definitions</b>	<b>1</b>
1.1	Nearly Zero Energy Building (NZEB)	1
1.2	Building Envelope	1
1.3	Thermal Insulation	1
1.4	Airtightness	2
1.5	Thermal Decoupling	2
1.6	ETICS	2
1.7	Sick Building Syndrome	2
1.8	Bioreceptivity	3
1.9	Biofilm	3
1.10	Biodeterioration	3
<b>2</b>	<b>Introduction</b>	<b>5</b>
<b>3</b>	<b>Algal Growth on External Building Envelope</b>	<b>7</b>
3.1	Most Common Varieties of Algae Proliferating on Building Envelope	7
3.1.1	Cyanobacteria	10
3.1.2	Microalgae	10
3.2	Main Causes and Conditions of Growth	12
3.2.1	Presence of Water on the External Surfaces: The Driving Rain	14
3.2.2	Presence of Water on External Surfaces: Condensation	14
3.2.3	Additional Environmental and Climatic Factors	15
3.2.4	Influence of Technical and Manufacturing Solutions	17
3.3	Consequences for Durability and Performance of Building Elements	20
	References	22
<b>4</b>	<b>Development of Mould in Indoor Environments</b>	<b>25</b>
4.1	Mould Life Cycle	25
4.2	Main Causes and Conditions of Growth	26
4.2.1	Environmental Factors	27

4.2.2	Influence of the Type of Support . . . . .	29
4.3	Effects on Human Health . . . . .	32
	References . . . . .	33
<b>5</b>	<b>Analytical and Experimental Methods for the Assessment of the Biological Proliferation in Buildings . . . . .</b>	<b>37</b>
5.1	Analytical Models . . . . .	37
5.1.1	Models of Biological Growth on Facades . . . . .	38
5.1.2	Models of Internal Mould Growth . . . . .	40
5.2	Accelerated Experimental Testing . . . . .	48
5.2.1	Algae . . . . .	49
5.2.2	Mould. . . . .	53
	References . . . . .	57
<b>6</b>	<b>Nearly Zero Energy Buildings and Proliferation of Microorganisms . . . . .</b>	<b>59</b>
6.1	Why NZEB Could be at Greater Biological Risk? . . . . .	59
6.1.1	The ‘Thermal Decoupling Phenomenon’ in NZEB . . . . .	61
6.1.2	Internal Moisture Loads in NZEB . . . . .	63
6.2	Proliferation of Microorganisms on NZEB Facades . . . . .	65
6.3	Mould Growth Inside NZEB . . . . .	68
	References . . . . .	72
<b>7</b>	<b>Remedial Actions and Future Trends . . . . .</b>	<b>75</b>
7.1	Traditional Methods . . . . .	76
7.1.1	Mechanical Methods . . . . .	76
7.1.2	Chemical Methods . . . . .	76
7.1.3	Physical Methods. . . . .	79
7.2	A Promising Prospect: Innovative Engineered Nanoparticles . . . . .	80
7.3	Prevention and Control Strategies in NZEB . . . . .	85
	References . . . . .	89
<b>8</b>	<b>Conclusions . . . . .</b>	<b>93</b>

Nearly Zero Energy Buildings and Proliferation of  
Microorganisms

A Current Issue for Highly Insulated and Airtight Building  
Envelopes

Di Giuseppe, E.

2013, X, 94 p. 26 illus., 15 illus. in color., Softcover

ISBN: 978-3-319-02355-7