

Table of Contents

1	Introduction and aim of work.....	1
2	Theoretical background.....	5
2.1	Submerged cultivation of filamentous fungi	5
2.1.1	Importance of filamentous fungi.....	5
2.1.2	Aggregation behavior and pellet formation.....	7
2.1.3	Pellet morphology and productivity.....	10
2.2	Fluid dynamics in a stirred tank reactor.....	14
2.2.1	Effect of agitation on fluid dynamics.....	14
2.2.2	Effect of aeration on fluid dynamics.....	17
2.2.3	Influence of fluid dynamics on pellet morphology	22
2.3	Model product glucoamylase (GA).....	24
3	Materials and methods.....	26
3.1	Cultivation	26
3.1.1	Microorganism	26
3.1.2	Inoculum preparation	27
3.1.3	Spore concentration.....	28
3.1.4	Cultivation media	29
3.1.5	Bioreactors.....	31
3.2	Growth kinetics and product formation	34
3.2.1	Biomass growth and substance turnover	34
3.2.2	Glucoamylase (GA) activity	35

Table of Contents

3.3 Pellet concentration and pellet size.....	37
3.3.1 Digital image analysis	37
3.3.2 Laser diffraction.....	40
3.4 Pellet structure	42
3.4.1 Pellet internal structure via pellet slices	42
3.4.2 Pellet surface structure via sedimentation velocity	43
3.5 Volumetric power inputs.....	44
4 Results and discussions.....	46
4.1 Effect of volumetric power input by agitation on pellet morphology	46
4.1.1 Analysis software MATLAB	46
4.1.2 Pellet growth	49
4.1.3 Pellet size and pellet concentration	50
4.2 Effect of volumetric power input by agitation on pellet morphology and product formation	55
4.2.1 Pellet growth and product formation.....	57
4.2.2 Pellet size and pellet concentration	60
4.2.3 Pellet structure	65
4.3 Effect of volumetric power input by agitation and aeration on pellet morphology and product formation	68
4.3.1 Product formation and pellet growth	70
4.3.2 Pellet size and pellet concentration	72
4.3.3 Pellet internal structure and pellet surface structure.....	75
4.3.4 Volumetric oxygen transfer coefficient (k_{La})	80
5 Summary and outlook	86
6 Nomenclature.....	89
7 References.....	92
8 Appendix.....	105