

Table of Contents

Abstract.....	i
Declaration	iv
Certificate	v
Acknowledgements	vi
Table of Contents	viii
Chapter 1	1
1.1 Direct Solar Dryer	3
1.2 Indirect Solar Dryer.....	4
1.3 Mixed Mode Solar Dryer	6
1.4 Hybrid solar dryer	7
1.4.1 Thermal Energy Storage.....	8
1.4.2 Solar-Biomass.....	10
1.4.3 Solar-LPG.....	11
1.5 Motivation and research objectives.....	12
Chapter 2	15
2.1 Drying kinetics analysis	15
2.2 Energy and exergy assessments	17
2.3 Economic evaluations	19
2.4 Environmental considerations	21
2.5 Numerical work on improved solar dryer	23
2.6 Summary of the literature review	24
2.7 Scope of the present work	24
Chapter 3	27
3.1 Description of free convection corrugated type of solar dryer.....	27
3.2 Experimental procedure	29
3.3 Uncertainty	30

3.4	Performance Analysis	30
3.4.1	Energy analysis of SAC.....	31
3.4.2	Energy analysis of the drying chamber	31
3.5	Drying kinetics	32
3.6	Economic Analysis.....	34
3.7	Results and Discussion.....	36
3.7.1	Performance analysis of <i>Garcinia pedunculata</i>	36
3.7.2	Drying kinetics of GP	45
3.7.3	Economic analysis of GP.....	55
3.8	Summary	56
	Chapter 4	58
4.1	Description of forced convection of solar dryer.....	58
4.2	Working principle of the dryer.....	61
4.3	Experimental procedure	61
4.4	Results and Discussion.....	62
4.4.1	Performance study of drying <i>Garcinia pedunculata</i>	63
4.4.2	Drying kinetics	74
4.4.3	Economic study	84
4.5	Summary	85
	Chapter 5	87
5.1	Uncertainty study	88
5.2	Drying study	88
5.3	Exergy study.....	88
5.3.1	Exergy study of SAC	89
5.3.2	Exergy study of the drying chamber.....	90
5.4	Mass shrinkage ratio.....	90
5.5	Environmental Study.....	90

5.5.1	Energy payback period (EPPD).....	90
5.5.2	Carbon-dioxide (CO ₂) emission	91
5.5.3	CO ₂ mitigation and Carbon Credit earned (CCE) [116].....	91
5.6	Results and discussion.....	92
5.6.1	Exergy Study	95
5.6.2	Mass shrinkage ratio.....	99
5.6.3	Environment Study	100
5.7	Summary	104
Chapter 6	105
6.1	Development and experimentation.....	105
6.2	Uncertainty Analysis.....	108
6.3	Thermo-hydraulic performance parameter.....	109
6.4	Exergy sustainability indicators	110
6.5	Quality Analysis.....	110
6.6	Results and Discussion.....	111
6.6.1	Drying Kinetics.....	114
6.6.2	Energy Analysis.....	119
6.6.3	Exergy Analysis.....	122
6.6.4	Mass shrinkage ratio	126
6.6.5	Quality Analysis	126
6.6.6	Economic Analysis	127
6.7	Comparisons of the different modes of solar dryer in terms of performance.....	129
6.8	Summary	130
Chapter 7	132
7.1	Conclusion.....	132
7.1.1	Evaluation of a free convection corrugated type of solar dryer for <i>Garcinia pedunculata</i> : An investigation on kinetics, energy, and economic aspects	132

7.1.2	Evaluation of a PV-driven innovative solar dryer with and without sensible heat storage for <i>Garcinia pedunculata</i> : An investigation on kinetics, energy, and economic aspects.....	133
7.1.3	Evaluation of a PV-driven innovative solar dryer with and without sensible heat storage for <i>Garcinia pedunculata</i> : An investigation on exergy and environmental aspects.....	133
7.1.4	Evaluation of a PV-driven innovative solar dryer for <i>Curcuma amada</i> without and with gravels as thermal energy storage: An investigation on kinetics, energy, exergy, quality and economic aspects.....	134
7.2	Future Scope.....	135
	References	136
	List of publications	153