

Table of contents

Chapters	Title	Page No.
Chapter 1	General Introduction	1 - 47
1.1	Increasing need of fossil fuel	1
1.2	Hazards of fossil energy	3
1.2.1	Carbon emission	3
1.2.2	Increasing temperature of the globe	5
1.2.3	Rise of fuel prices	7
1.3	Need for an alternative	7
1.4	Available sources of renewable energy	7
1.5	Biodiesel – the sustainable and future generation fuel	8
1.5.1	Biodiesel of plant origin is the replacement of transport fossil fuel	9
1.5.2	Biodiesel of plant origin as key to a cleaner ecosystem	9
1.5.3	Advantages of biodiesel	10
1.5.4	The chemistry of biodiesel	11
1.5.5	Properties of biodiesel	11
1.5.6	World-wide production of biodiesel	12
1.5.7	Non-edible oil - the preferred source of feedstock for biodiesel	14
1.5.8	Putative plants for biodiesel	15
1.6	Review on <i>Jatropha curcas</i> L.	16
1.6.1	Scientific classification <i>Jatropha curcas</i> L.	16
1.6.2	Taxonomy of <i>Jatropha curcas</i> L.	17
1.6.3	Agronomy of <i>Jatropha curcas</i> L.	18
1.6.4	Chemical content of <i>Jatropha curcas</i> L.	19
1.6.5	Chemical content of <i>Jatropha curcas</i> L. seed oil	19
1.6.6	Uses of <i>Jatropha curcas</i> L. seed oil	20
1.6.7	Medicinal Property and uses of <i>Jatropha curcas</i> L.	20

1.6.8	<i>Jatropha</i> seed oil as biodiesel	22
1.7	Seed storage	24
1.7.1	Types of seeds	25
1.7.2	Seed morphology	25
1.7.3	Chemical composition of seed	25
1.7.4	Storage environment	26
1.7.5	Role of reactive oxygen species (ROS) in seed biology	26
1.8	Seed deterioration during storage	29
1.8.1	Lipid peroxidation	30
1.8.2	Membrane disruption	31
1.8.3	Alteration of proteins during aging of seeds	32
1.8.4	Antioxidant enzymes in aging seeds	33
1.8.5	Non-enzymatic antioxidants level with aging in seeds	35
1.8.6	Effect of seed storage on germination	38
1.8.7	Seed oil content during seed storage	40
1.8.8	Free fatty acids during seed storage	41
1.8.9	Molecular level damage during seed storage	43
1.8.9.1	DNA damage	43
1.8.9.2	mRNA damage	46
1.8.9.3	Protein damage	46
1.8.10	Oil body changes during storage	47
	Aim of this study	48
Chapter 2	Materials and Methods	49 - 58
Chapter 3	Studies on biochemical changes in <i>Jatropha curcas</i> L. seeds on storage	59 - 78
3.1	Introduction	59
3.2	Results	63
3.2.1	Estimation of lipid peroxidation	63

3.2.2	Estimation of electrolyte leakage	66
3.2.3	Estimation of H ₂ O ₂	70
3.3	Discussion	75
3.3.1	Estimation of lipid peroxidation	75
3.3.2	Estimation of electrolyte leakage	76
3.3.3	Estimation of H ₂ O ₂ (Hydrogen peroxide)	77
Chapter 4	Studies on effect of storage of <i>Jatropha curcas</i> L. seeds on germination	79 - 89
4.1	Introduction	79
4.2	Results	81
4.2.1	Determination of germination	81
4.2.2	Measurement of radicle length	85
4.3	Discussion	87
4.3.1	Seed germination studies	87
Chapter 5	Alterations in antioxidant profile in <i>Jatropha curcas</i> L. seeds upon aging	90 - 112
5.1	Introduction	90
5.1.1	Oxidative stress and oxidative damage	91
5.1.2	Generation of oxygen radicals	91
5.1.3	Level of antioxidant enzymes actions	92
5.1.4	Responses of the enzymatic antioxidants against reactive species	93
5.1.5	Responses of the non-enzymatic antioxidants against reactive species	95
5.2	Results	98
5.2.1	Estimation of DPPH free radical scavenging capacity of seed extract of <i>Jatropha curcas</i>	98
5.2.2	Estimation of the activity of the antioxidant enzymes:- - Superoxide dismutase (SOD) - Catalase (CAT) - Peroxidase (POD)	99

5.2.3	Estimation of gamma – tocopherol (non-enzymatic antioxidant)	102
5.3	Discussion	108
5.3.1	Determination of DPPH free radical scavenging activity of the antioxidants	108
5.3.2	Estimation of the activity of the antioxidant enzymes	109
5.3.3	Estimation of gamma - tocopherol (non-enzymatic antioxidant)	111
Chapter 6	Influence of aging of <i>Jatropha curcas</i> L. seeds on the oxidative stability of its oil	113 - 135
6.1	Introduction	113
6.2	Results	115
6.2.1	Extraction of oil from <i>J. curcas</i> seeds	115
6.2.2	Determination of Acid value/free fatty acids content in <i>J. curcas</i> oil	118
6.2.3	Determination of saponification value in <i>J. curcas</i> oil	121
6.2.4	Determination of peroxide value in <i>J. curcas</i> oil	123
6.2.5	Determination of iodine value in <i>J. curcas</i> oil	126
6.2.6	Estimation of fatty acid methyl esters in <i>J. curcas</i> oil	129
6.3	Discussion	131
6.3.1	Extraction of oil from <i>J. curcas</i> seeds	131
6.3.2	Determination of Acid value/free fatty acids content in <i>J. curcas</i> oil	131
6.3.3	Determination of saponification value in <i>J. curcas</i> oil	133
6.3.4	Determination of peroxide value in <i>J. curcas</i> oil	133
6.3.5	Determination of iodine value in <i>J. curcas</i> oil	134
6.3.6	Estimation of fatty acid methyl esters in <i>J. curcas</i> oil	134
Chapter 7	Effect of storage of <i>Jatropha curcas</i> L. seeds on the oil bodies, Oleosin – protein and DNA	136 - 162
7.1	Introduction	136
7.1.1	Oil body and its synthesis	136
7.1.2	Fatty acid synthesis	136

7.1.3	Triacylglycerol (TAG) assembly	137
7.1.4	Isoforms of Oleosin	139
7.1.5	Characterization of <i>J. curcas</i> oleosin	140
7.1.6	DNA and RNA integrity and damage	140
7.2	Results	141
7.2.1	Staining of oil body and studying its structure	141
7.2.2	Studies on oil body specific protein – Oleosins	147
7.2.3	Extraction and isolation of genomic DNA	153
7.2.4	Studies on nuclear morphology by DAPI staining	155
7.3	Discussion	159
7.3.1	Studies on oil body staining and structure	159
7.3.2	Studies on oil body protein - Oleosin	159
7.3.3	Studies on genomic DNA of <i>J. curcas</i> seeds on storage	160
7.3.4	Studies on nuclear morphology of cells by DAPI staining	161
Summary & Conclusion		163
Bibliography		166
Presentation		216
Award		217
Publications		218
Synopsis		