Table of Contents

[List of Abbreviations vi](#_Toc408657536)

[List of Symbols viii](#_Toc408657537)

[List of Figures ix](#_Toc408657538)

[List of Tables xi](#_Toc408657539)

[1 Introduction 1](#_Toc408657540)

[2.1 Introduction into Transient Heat Conduction 3](#_Toc408657542)

[2 Thermodynamic Principles 3](#_Toc408657541)

[2.1 Introduction into Transient Heat Conduction 3](#_Toc408657542)

[2.2 Lumped System Approach 5](#_Toc408657543)

[2.3 Convective Heat Transfer Coefficient 6](#_Toc408657544)

[3 Dairy Industry and Chemistry 8](#_Toc408657545)

[3.1 Dairy Market 8](#_Toc408657546)

[3.2 Dairy Products 9](#_Toc408657547)

[3.3 Milk Powder Production 11](#_Toc408657548)

[3.4 Nutritional Value of Milk Powder 16](#_Toc408657549)

[3.5 Fundamentals of Dairy Chemistry 19](#_Toc408657550)

[3.5.1 Protein Denaturation 19](#_Toc408657551)

[3.5.2 Maillard Effect 20](#_Toc408657552)

[4 Methodology 21](#_Toc408657553)

[4.1 Statistical Methodology 21](#_Toc408657554)

[4.1.1 Introduction into Design of Experiments (DOE) 21](#_Toc408657555)

[4.1.2 Step by Step Approach on Designing an Experiment 22](#_Toc408657556)

[4.2 Chemical Methodology – Moisture Content and Dry Matter 24](#_Toc408657557)

[4.2.1 Determination of total solids content of milk, cream and evaporated milk according to ISO 6731:2010 26](#_Toc408657558)

[4.2.2 Determination of moisture content of dried milk products using halogen drying 27](#_Toc408657559)

[5 Design of Experiments 29](#_Toc408657560)

[6 Experimental Part 41](#_Toc408657561)

[6.1 Experimental Series 1 – OFAT Analysis 41](#_Toc408657562)

[6.1.1 Materials & Methods 41](#_Toc408657563)

[6.1.2 Observations & Results 43](#_Toc408657564)

[6.1.3 Discussion 44](#_Toc408657565)

[6.2 Experimental Series 2 – Full Factorial Analysis 47](#_Toc408657566)

[6.2.1 Materials & Methods 47](#_Toc408657567)

[6.2.2 Observations & Results 48](#_Toc408657568)

[6.2.3 Discussion 49](#_Toc408657569)

[7 Application and Verification of Results 53](#_Toc408657570)

[7.1 Development of an Excel Tool 53](#_Toc408657571)

[7.2 Verification of Results 55](#_Toc408657572)

[7.3 Economic Feasibility of Belt Drying in Comparison to Spray Drying and Drum Drying ……………………………………………………………………………………….60](#_Toc408657573)

[7.4 Optimization Ideas 61](#_Toc408657575)

[8 Conclusion and Outlook 64](#_Toc408657576)

[List of References 66](#_Toc408657577)

[Annex 69](#_Toc408657578)

[Appendix A. Data Tables 69](#_Toc408657579)

[Declaration of Authenticity 71](#_Toc408657580)

**Introduction**