# Developing and Characterization of Nonionic Microemulsions Containing Ferrous Sulfate and Folic Acid for Transdermal Application

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# Dedication

***To my mother (Safia), who leads me through the valley of darkness***

***with light of hope and support.***

***To my father (Yousef), who stands by me when the things look gloomy.***

***To my family, the symbol of love and giving.***

***To anyone who has shown me friendship and Kindness during my life.***

***Whose effective, Love, encouragement and prays of day and night make me able to get success.***

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## INDEX


| | |
|---|---|
| COMMITTEE DECISION | I |
| AUTHORIZATION STATEMENT | II |
| Dedication | III |
| Index | V |
| List of tables | VII |
| List of figures | VIII |
| Lest of used abbreviation | X |
| Abstract | XII |
| 1. Introduction | 1 |
| 1.1 Transdermal Drug Delivery | 2 |
| 1.1.1 Advantages of Transdermal delivery over other delivery systems | 3 |
| 1.1.2 Enhancing Transdermal Drug Delivery | 4 |
| 1.2 Ferrous Sulfate | 5 |
| 1.2.1 Ferrous sulfate heptahydrate structure | 6 |
| 1.2.2 Mechanism of action of Ferrous sulfate | 6 |
| 1.2.3 Pharmacokinetics | 7 |
| 1.2.4 Dose of Ferrous sulfate | 7 |
| 1.2.5 Toxicities and interactions | 7 |
| 1.2.6 Physiochemical properties of Ferrous sulfate | 8 |
| 1.2.7 Solubility of ferrous sulfate | 9 |
| 1.3.1 Folic Acid | 9 |
| 1.3.2 Chemistry of Folic Acid | 9 |
| 1.3.3 Physiochemical properties of Folic Acid | 10 |

| | |
|---|---|
| 1.3.4Therapeutic uses of folic acid | 11 |
| 1.3.5 Hypervitaminosis | 11 |
| 1.3.6 Folic Acid structure | 11 |
| 1.4.1 Skin Anatomy | 12 |
| 1.4.2 Epidermis | 12 |
| 1.4.3 Dermis | 13 |
| 1.4.3 Subcutis | 14 |
| 1.5.1 Microemulsions | 14 |
| 1.5.2 Components of the µEm Formations | 14 |
| 1.5.2.1 Aqueous phase | 14 |
| 1.5.2.2 Surfactants | 14 |
| 1.5.2.3 Oil phase | 15 |
| 1.5.2.4 Cosurfactants | 16 |
| 1.5.3 Characterization of Microemulsions | 16 |
| 1.6 Transdermal Application of Iron (Previous studies) | 17 |
| 1.7 Objective | 18 |
| 2. Methodology | 19 |
| 2.1 Materials used in this study | 19 |
| 2.2 Instrumentals used in this study | 20 |
| 2.3 Preparing of w/o µEm for $FeSO_4$ | 20 |
| 2.4 Preparing of w/o µEm for Folic Acid | 22 |
| 2.5 Pseudo-ternary phase diagrams of µEm system for ferrous sulfate and folic acid | 23 |
| 3. Results and Discussion | 25 |
| 3.1 Droplet size measurements for $FeSO_4$ | 25 |

| | |
|---|---|
| 3.1.1 Droplet size measurements for Folic acid | 26 |
| 3.2 Seudoternary phase diagram | 28 |
| 3.3 Rheological properties | 29 |
| 3.4 Studying of folic acid using FTIR (Fourier Transform Infrared Spectroscopy): | 32 |
| 3.5 Discussion | 33 |
| 4. Conclusion | 34 |
| 4.1 Recommendation | 34 |
| 5. References | 35 |

**List of tables:**


| | | |
|---|---|---|
| Table 1 | Some of the currently approved Transdermally delivered drugs | 4 |
| Table 2: | Oral Iron product and Elemental iron content. | 5 |
| Table 3: | Physiochemical properties of FeSO4 | 8 |
| Table 4 | Solubility of $FeSO_4$ | 9 |
| Table 5 | Physiochemical properties of Folic acid | 10 |
| Table 6 | Layers of Dermis | 13 |
| Table 7 | Materials Used in the Preparation and Analysis of Ferrous Sulfate Heptahydrate , Folic Acid Microemulsions | 19 |
| Table 8 | Instruments Used in this Study | 20 |
| Table 9 | Composition of prepared Ferrous sulfate microemulsions | 21 |
| Table 10 | composition of prepared Folic acid microemulsions | 23 |
| Table 11 | The measured droplet size, Polydispersity index (PDI) and zeta potential for different formulated µEm of FeSO4 | 26 |
| Table 12 | The measured droplet size,(PDI) and zeta potential for different formulated µEm of Folic Acid. | 27 |

## LIST OF FIGURS


| Figure | | page |
|---|---|---|
| Figure 1 | structure of ferrous sulfate | **6** |
| Figure 2 | structure of Folic acid | **11** |
| Figure 3 | skin structure | **12** |
| Figure 4 | anatomy of EpiDermis | **13** |
| Figure 5 | Non-ionic µEms for FeSO4 | **21** |
| Figure 6 | Non-ionic µEms for folic acid | **22** |
| Figure 7 | The Seudoternary phase diagram for µEm composed of IPM, water and a mixture of span 20:Tween80(4:2) with 50 mg FeSO4 and without FeSO4 | **28** |
| Figure 8 | The three phase diagrams for µEm composed of IPM, water and a mixture of span 20:Tween80(4:2) with 50 mg folic acid and without Folic acid | **29** |
| Figure 9 | Comparison of different developed FeSO4 µEm. Shear rate against shear stress. | **30** |
| Figure 10 | Comparison of different developed FeSO4 µEm. Viscosity against shear rate. | **30** |
| Figure 11 | Comparison of different developed folic acid µEm. Shear rate against Shear stress | **31** |
| Figure 12 | Comparison of different developed folic acid µEm. Viscosity against Shear rate. | **31** |
| Figure 13 | FTIR-spectra of folic acid as powder, µEm without folic acid and µEm with folic acid. | **32** |

## LIST OF ABBREVIATION AND SYMBOLS

| SAMBOL ABBREVIATION | DEFINITION |
|---|---|
| DMSO | Dimethyl Sulfoxide |
| Span 20 | Sorbitan mono laurate |
| Tween 80 | Poloxyethlene Sorbitan mono-oleate |
| Vol. | Volume |
| IPM | Isopropyl Myristate |
| W/O | Water in Oil |
| W | Water |
| O/W | Oil in Water |
| µEm | Microemulsion |
| HLPC | High Pressure Liquid Chromatography |
| GI | Gastrointestinal |
| SC | Stratum corneum |
| TDDS | Transdermal drug delivery system |
| FPP | Ferric Pyrophospgate |
| IDA | Iron Deficiency Anemia |
| $FeSO_4$ | Ferrous Sulfate |
| PDI | Polydispersity index |
| FTIR | Fourier transform infrared spectroscopy |

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# Abstract

Ferrous sulfate and Folic acid have been widely used for the treatment of iron deficiency such as in anemia or pregnancy. Because they are ingested by oral they are leading to many of complication, for instance, GI disturbances (constipation, nausea, and unpleasant taste), and dangerously high blood pressure, severe headache, blurred vision and confusion with anxiety if taken as parenteral route. In the other hand, they are also interacting with numerous drugs, food and minerals). In this study, four $FeSO_4$ µEm and 8 folic acid µEm systems were developed for transdermal application purpose to overcoming these problems resulted from Oral and parenteral routes. These W/O µEms are prepared by nonionic surfactants (Span20 & Tween80), IPM as oil phase, and water as aqueous phase. The µEms for both $FeSO_4$ and Folic acid were characterized for their droplet sizes, zeta potential, pseudo-ternary phase diagram, and rheological properties. Moreover, the FTIR used to prove the encapsulation of folic acid in the µEm. The investigation demonstrate that $FeSO_4$ and Folic acid µEms are correspond to the characteristics and properties of the µEm in literature. In this study, although, the most Microemulsions prepared have ideal characters to the Microemulsions properties written in literature. The results are shows that a significant variance between droplet size, Zeta

potential, rheological properties and characterization of Microemulsions. The surfactants used in this study shows a factor that may play a role in preparation of those Microemulsions, and also the ratio of these surfactants have an important function to produce an ideal Microemulsion.