Faculty of Pharmacy

Developing new microemulsions containing high molecular weight heparin sodium for transdermal application

By

Yousuf Ali Yousif

Supervisor

Dr Jamal Alyoussef Alkrad

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Prof. Enam Ayoub Khalil Pharmaceutical technology	.....

Dedication

To the last final prophet and messenger of almighty Allah our master, leader and teacher Muhammad bin Abdullah (peace and blessing be upon him).

To my father who always encouraged me to seek knowledge.

My precious diamond and the light of my life, to my dear mother, thanks to her prayers asking almighty God helping me to reach this level of education.

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List of Abbreviations

Abbreviation	Meaning
AUC	Area under the curve
aPTT	Activated partial thromboplastin time
%	Percentage
^{o}C	Degree Celsius
DMSO	Dimethyl sulfoxide
Eq	Equation
FTIR	Fourier transform infrared spectroscopy
GIT	Gastrointestinal tract
GAG	Glycosaminoglycan
g	Gram
HPLC	High performance liquid chromatography
h	Hour
Hp	Heparin
HMH	High Molecular weight Heparin
iv	Intravenous
IPM	Isopropyl myristate
LMH	Low Molecular weight Heparin
mL	Milliliter
µL	Microliter
mg	Milligram
µg	Microgram
min	Minute
ME	Microemulsion
MWt	Molecular weight
nm	Nanometer
sc	Subcutaneous
UFH	Un-fractionated Heparin
UV	Ultraviolet

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Abstract

Heparin is an anticoagulant which administrated usually either by Intravenous or Subcutaneous injection. This study aimed to formulate microemulsions containing heparin using nonionic surfactants for transdermal application. Five microemulsions were developed and characterized for their rheological properties and droplets size. The in vitro permeation of heparin was measured using Franz diffusion cell. Hence, an HPLC-method was developed to study the permeability through the skin. Furthermore the efficacy of one developed heparin was orally and transdermally tested using rats model in comparison to subcutaneous administration.

The rheograms and droplets size measurements evidenced that the developed drug delivery systems are microemulsions. Furthermore, the permeation of heparin using MEs could be proved using Franz diffusion cells. Moreover, the in vivo results could reflect the effect of absorbed heparin through the skin as well as after oral administration. Finally the novel MEs containing heparin can be promised carriers for noninvasive application of heparin.

Chapter 1

Introduction