# ESTABLISHING HALAL PHARMACEUTICALS INFORMATION SYSTEMS: CONCEPTS, SOURCES AND, POTENTIALS IN THE INDUSTRY

**MOHAMMED ALI AL-SHEIKH WACE**

**UNIVERSITI SAINS MALAYSIA**

**2014**

# ESTABLISHING HALAL PHARMACEUTICALS INFORMATION SYSTEMS: CONCEPTS, SOURCES AND, POTENTIALS IN THE INDUSTRY

**by**

**MOHAMMED ALI AL-SHEIKH WACE**

**Thesis submitted in the fulfillment of the requirements for the degree of Doctor of Philosophy**

**September 2014**

## DEDICATION

To my beloved mother

Mrs. Falak Al-Sheikh Wace

**ACKNOWLEDGEMENTS**

Praise be to Allah, Lord of the Worlds because this research could not have been completed and this thesis could not have been written without the help and guidance from his almighty Allah SWT, hoping that he will accept this thesis as a part of my duty towards the Muslim nation.

I would like to express my sincere appreciation and heartfelt thanks to my supervisor, Prof. Dr. Syed Azhar Syed Sulaiman, for his creative guidance, intellectual support, stimulating discussions and inspiring words. I am grateful for his excellent hospitality and wonderful attitude; and I feel very fortunate to have had this opportunity to study under his supervision.

In addition, I would like to thank my knowledgeable co-supervisor, Prof. Dr. Zhari Ismail, for his constructive contribution, invaluable advice, critical comments, and patience. I will never forget his advices for me in pharmacy and life; and I feel very fortunate to have had this opportunity to study halal pharmaceuticals with him.

I would like to thank Prof. Dr. Abu Bakar Abdul Majeed, Assoc. Prof. Razak Lajis, and Dr. Amer Hayat Khan for their corrections, evaluation for the thesis, and help during the editing time.

I would like to thank Dr. Noorizan Binti Abd Aziz and Dr. Azmi Sarriff for their valuable information during the first year in the research. I would like to thank the following administrative staffs in the school of pharmacy: Puan Nor Risah

Othman, Puan Zaidah Aziz, Puan Sopiah Nor Mohamad, Encik Mohd Jasmie, Cik Jelfariny Mohd. Jelahni, and Puan Hajar Zituakmar Mohd Fauzi for their support and patience during my research.

I owe special thanks to all the administrative staff in the USM library for their valuable support and patience especially to Puan Aini Yusof, Puan Arinawati Ayob, Encik Basheer Ahamadhu Ameer Sultan and Encik Basheer.

Finally, thanks to my family, especially my father and mother who are the real unknown soldiers in this thesis. I would like to thank my beloved wife who offered support during this long process with me.

## TABLE OF CONTENTS

DEDICATION ..... i
ACKNOWLEDGEMENTS ..... ii
TABLE OF CONTENTS ..... iii
LIST OF TABLES ..... vii
LIST OF FIGURES ..... viii
LIST OF ABBREVIATION ..... xi
LIST OF PUBLICATIONS ..... xvii
ABSTRAK ..... xviii
ABSTRACT ..... xx
CHAPTER ONE: INTRODUCTION AND LITERATURE REVIEW ..... 1
1.1 Methods ..... 2
1.1.1 Database and search strategies ..... 2
1.1.2 Inclusion and Exclusion Criteria ..... 2
1.1.3 Data Extraction and Quality Assessment ..... 2
1.2 Results and Discussion (Information Report) ..... 3
1.2.1 Pharmaceuticals Definition and Their Method of Manufacturing ..... 3
1.2.2 Halal Definition and Background ..... 4
1.2.3 Drug Information Definition and Background ..... 3
1.2.4 Halal Pharmaceuticals Systematic Literature Review ..... 9
1.2.5 Halal Pharmaceuticals Current Situation ..... 20
1.3 Objectives and Scope of Research ..... 23
1.4 Contribution of This Study ..... 24
1.5 Summary & conclusions ..... 26
CHAPTER TWO: HALAL PHARMACEUTICALS LAWS IN SHARIAH ..... 27
AND THE MEDICAL FIQH INFORMATION RESOURCES ..... 27
2.1 Introduction ..... 27
2.2 Objectives ..... 28
2.3 Methods ..... 30
2.3.1 Finding the Topics Which Related to Halal Pharmaceuticals in the Islamic Fiqh Books ..... 30
2.3.2 Determining the Enquiries Related to Halal Pharmaceuticals ..... 32
2.3.3 Determining the Books Which Represent Different Mathabs in Fiqh . 33
2.3.4 Meeting and Contacting Medical Fiqh Experts ..... 34
2.4 Results and Discussions (Information Report) ..... 35
2.4.1 Shariah Definition, Objectives and Sources ..... 35
2.4.2 Fiqh Definition and Schools of Thought ..... 36

2.4.3 Basics in Halal and Haram ..... 40
2.4.4 Fatwa Definition and Rules ..... 42
2.4.5 The Collective Fatwa and the Fiqh Academy and Councils ..... 44
2.4.6 The Halal Pharmaceuticals Laws ..... 48
2.4.6.1 Prohibition of Najis ..... 49
2.4.6.2 The Prohibited Animals ..... 51
2.4.6.3 Prohibition of Blood ..... 53
2.4.6.4 Method of Slaughtering and Blessing ..... 54
2.4.6.5 Prohibition of Carrion ..... 58
2.4.6.6 Prohibition of Intoxicant ..... 58
2.4.6.7 Prohibition of Gold ..... 63
2.4.6.8 Prohibition of Silk ..... 64
2.4.7 Differences between Sunni Fiqh schools ..... 64
2.4.8 Types of Information Inquiries in Medical Fiqh ..... 65
2.4.9 Searching in Traditionally and Modern Fiqh Resources ..... 66
2.4.10 The Modern Fiqh Resources ..... 67
2.4.11 The Traditional Fiqh Resources ..... 72
2.4.12 Writing Professional Medical fiqh expert Report ..... 73
2.4.12.1 The Medical fiqh expert Definition, Conditions, and Tasks ..... 74
2.4.12.2 Rules and Tips to Formulate the Fiqh Report ..... 75
2.5 Summary & conclusions ..... 77
CHAPTER THREE: HALAL PHARMACEUTICALS DIFFERENT ISSUES: CURRENT STATUS AND THE APPLICATIONS OF DRUG INFORMATION IN IT 78
3.1 Introduction ..... 78
3.2 Objectives ..... 86
3.3 Methods ..... 87
3.3.1 Determining the Issues Related to Halal Pharmaceuticals ..... 87
3.3.2 Keywords Used in Searching ..... 88
3.3.3 Searching for Economic Reports About Halal Pharmaceuticals ..... 88
3.3.4 Meeting and Contacting Halal Pharmaceuticals Experts ..... 89
3.4 Results and Discussions (Information Report) ..... 90
3.4.1 Halal Certification and Auditing ..... 90
3.4.1.1 Halal Certification Bodies and Authorities around the World ..... 90
3.4.1.2 Halal Certification in Malaysia ..... 98
3.4.1.3 Halal Certification Processes ..... 101
3.4.1.4 Halal Auditing Processes ..... 107
3.4.2 Halal Pharmaceuticals Market and Opportunities ..... 115

3.4.2.1 Industry or Market Research ..... 115
3.4.2.2 Marketing Research ..... 118
3.4.2.3 Information Resources to Conduct Market and Marketing Researches ..... 120
3.4.2.4 Companies Specialized in Halal Marketing and Halal Market Researches ..... 122
3.4.2.5 Companies Specialized in Marketing and Market Researches ..... 124
3.4.2.6 Halal Pharmaceuticals Market and Opportunities ..... 127
3.4.3 Increasing Halal Pharmaceuticals Awareness by Patient Education and Healthcare Professional Training ..... 130
3.4.3.1 Halal Pharmaceuticals Awareness Current Situation ..... 131
3.4.3.2 Halal Pharmaceuticals Patient Education ..... 132
3.4.3.3 Consumer Medication Information Types ..... 134
3.4.3.4 Consumer Health Information Resources ..... 137
3.4.3.5 Creative Halal Pharmaceuticals Patient Education Tools ..... 142
3.4.3.6 Patient and Consumer Role in Halal Pharmaceuticals Awareness 144
3.4.4 Halal Pharmaceuticals: Pharmacists, Doctors and Health Care Providers Training ..... 146
3.5 Summary & conclusion ..... 148
CHAPTER FOUR: PROPOSING HALAL PHARMACEUTICALS STANDARD OPERATING PROCEDURES ..... 149
4.1 Introduction ..... 149
4.2 Objectives ..... 152
4.3 Literature Review ..... 153
4.3.1 Standard Operating Procedures Definition ..... 153
4.3.2 Difference between SOPs and GMP ..... 154
4.3.3 The Importance of Standard Operating Procedures ..... 155
4.3.4 Standard Operating Procedures Life Cycle ..... 157
4.3.5 Standard Operating Procedures Contents ..... 158
4.4 Methods ..... 163
4.4.1 Collecting and Formulating the Proposed Halal Pharmaceuticals SOPs 163
4.4.2 Meeting and Contacting Halal Pharmaceuticals Experts ..... 164
4.4.3 Halal Pharmaceuticals SOPs Knowledge and Importance: An Expert-focused Questionnaire ..... 164
4.5 Results and Discussions (Information Report) ..... 165
4.5.1 Halal Pharmaceuticals Standard Operating Procedures ..... 165
4.5.2 The Need and the Goal of Writing SOPs ..... 166

4.5.3 SOPs Information Resources ..... 168
4.5.4 Questionnaire Results and Discussions ..... 170
4.5.5 Proposed Halal Pharmaceuticals SOPs for Manufacturing Field ..... 191
4.6 Summary & conclusions: ..... 221
CHAPTER FIVE:PROPOSING HALAL PHARMACOPOEIA: WRITING PLAN AND INFORMATION RESOURCES ..... 222
5.1 Introduction ..... 222
5.2 Objectives ..... 223
5.3 Methods ..... 223
5.3.1 Searching for Pharmaceuticals Origins ..... 223
5.3.2 Keywords Used in Searching ..... 224
5.4 Results and Discussions (Information Report) ..... 225
5.4.1 Pharmacopeia: Definition, Mission and Contents ..... 225
5.4.2 Pharmacopoeias around The World ..... 226
5.4.3 Pharmacopoeias in the Islamic Countries: Current Situation ..... 230
5.4.4 The Pharmacopoeia Monograph Structure and Contents ..... 232
5.4.5 The Halal Pharmacopoeia Nature and Definition ..... 234
5.4.6 The Pharmacopoeia Information Resources ..... 239
5.4.6.1 The previous well known pharmacopoeias ..... 239
5.4.6.2 The Information Resources About the Origin of the Pharmaceutical Substances ..... 244
5.4.6.3 The Information Resources About the Manufacturing Processes of the Pharmaceutical Substances ..... 249
5.4.6.4 The Information Resources About the Analytical Methods of the Pharmaceutical Substances ..... 253
5.5 Halal Pharmaceuticals Critical Chemicals List: Plan and Examples ..... 258
5.6 Summary & conclusions ..... 266
CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS ..... 268
6.1 Conclusions ..... 268
6.2 Study limitations ..... 270
6.3 Recommendations for Future Studies ..... 271
7 REFERENCES ..... 272
8 APPENDICES ..... 280

## LIST OF TABLES

Table 1.1: Types of API manufacturing techniques, (adapted from (PIC/S, 2013)..... 4

Table 1.2: Medication information services, (adapted from Malone, Kier, & Stanovich, 2011). ..... 5

Table 1.3 Medication information skills, (adapted from (Malone et al., 2011)..... 6

Table 1.4 Systematic review of halal pharmaceuticals peer reviewed articles. ..... 11

Table 2.1 Important keywords in searching for halal pharmaceuticals fiqh resources ..... 31

Table 2.2 The five rulings of Shariah, (adapted from Al-Qaradawi, 2001)..... 41

Table 3.1 Malaysian halal certification application categories. ..... 105

Table 3.2 Malaysian halal certification application procedure, (adapted from Halal Hub Division JAKIM, 2013a) ..... 106

Table 3.3 Turnover of the main global market research companies in 2009, adapted from Wikipedia ("Wikipedia," 2013) ..... 126

Table 3.4 Patient communication tools, (adapted from Allen, 2012) ..... 134

Table 3.5 Criteria for consumer medication information, (adapted from Allen, 2012) ..... 136

Table 3.6 Online consumer information sources, (adapted from Malone et al., 2011) ..... 139

Table 4.1 Descriptive characteristics of expert respondents of the questionnaire ... 171

## LIST OF FIGURES

Figure 1.1 Illustration of the basic steps in response to medication information request. 8
Figure 2.1 Chapter Two - General plan and flow chart 27
Figure 2.2 Main topics covered in chapter two 28
Figure 2.3 Fatawas sources for halal pharmaceuticals inquiries. 32
Figure 2.4 Profession of inquiry requester for the halal pharmaceuticals fatawas 33
Figure 2.5 Islamic fiqh schools of thought and their distribution among Islamic countries, adapted from Wikipedia (Wikipedia, 2012). 38
Figure 2.6 Islamic fiqh - Sunni schools of thought and their distribution among Islamic countries, adapted from Wikipedia (Wikipedia, 2012) 39
Figure 2.7 Types of fiqh academies or councils. 46
Figure 2.8 Slaughtering part for cattle, adapted from MS1500 2009 (SIRIM, 2009) 57
Figure 2.9 Method of slaughtering cattle, adapted from MS1500 2009 (SIRIM, 2009) 57
Figure 3.1 The parties in direct contact with the halal pharmaceuticals concept 79
Figure 3.2 Drug information role and applications to help consumers in achieving the goal of the research. 79
Figure 3.3 Drug information role and applications to help legislation bodies of governments 80
Figure 3.4 Drug information role and applications to help media in achieving the goal of the research. 81
Figure 3.5 Drug information role and applications to help health care providers in achieving the goal of the research. 82
Figure 3.6 Drug information role and applications to help pharmaceuticals companies and manufacturers in achieving the goal of the research. 83
Figure 3.7 The role and applications of drug information to help halal certifying and auditing bodies in achieving the goal of the research. 84
Figure 3.8 Main topics covered in chapter three. 85
Figure 3.9 The distribution of the halal certification bodies around the world 94
Figure 3.10 The international benchmark and halal benchmark comparison and the proposed solution. 95
Figure 3.11 Halal accreditation process general flowchart. 102
Figure 3.12 Halal Pharmaceuticals accreditation process general flowchart, 1) halal control 2) quality control 3) safety and efficacy control 103
Figure 3.13 Malaysian halal certification process and guidelines, (adapted from Halal Hub Division JAKIM, 2013a) 105
Figure 3.14 The guarantee system halal certification body 108
Figure 3.15 The administrative structure of halal certification body 108
Figure 3.16 Types of marketing research 120
Figure 3.17 Global Potential Size of Halal Market 2005 129
Figure 3.18 The success equations in halal marketing, (adapted from Jan, 2012) 130
Figure 3.19 Examples of halal creative education tools (Activity books, comics, cartoon, TV programs and halal expo) 143
Figure 4.1 Chapter four - general plan. 151
Figure 4.2 Chapter four - main topics. 152

Figure 4.3 Overview of the SOP life cycle, adapted from: (Colligon & Rosa, 2007) ..... 158
Figure 4.4 Results for question 1 section 1 in the questionnaire ..... 172
Figure 4.5 Results for question 2 section 1 in the questionnaire ..... 173
Figure 4.6 Results for question 3 section 1 in the questionnaire ..... 174
Figure 4.7 Results for question 4 section 1 in the questionnaire ..... 175
Figure 4.8 Results for question 5 section 1 in the questionnaire ..... 176
Figure 4.9 Results for question 6 section 1 in the questionnaire ..... 177
Figure 4.10 Results for question 7 section 1 in the questionnaire ..... 178
Figure 4.11 Results for question 8 section 1 in the questionnaire ..... 179
Figure 4.12 Results for question 1 section 2 in the questionnaire ..... 179
Figure 4.13 Results for question 2 section 2 in the questionnaire ..... 180
Figure 4.14 Results for question 3 section 2 in the questionnaire ..... 181
Figure 4.15 Results for question 4 section 2 in the questionnaire ..... 181
Figure 4.16 Results for question 5 in section 2 in the questionnaire ..... 183
Figure 4.17 Results for question 6 section 2 in the questionnaire ..... 185
Figure 4.18 Results for question 7 section 2 in the questionnaire ..... 186
Figure 4.19 Over Results for question 8 section 2 in the questionnaire ..... 187
Figure 4.20 Results for question 9 section 2 in the questionnaire ..... 188
Figure 4.21 Results for question 10 section 2 in the questionnaire ..... 189
Figure 4.22 Flow chart 1: The general scheme of producing any pharmaceutical product. ..... 191
Figure 4.23 Flow chart 2: The registration of chemical included in producing the final product. ..... 192
Figure 4.24 Flow chart 2.1: Steps in conducting research about the origin of any chemical included in the manufacturing process. ..... 193
Figure 4.25 Flow chart 2.2: The steps to judge if the chemical fulfil the halal requirements that found in the standards and guidelines (e.g. MS 2424 2012). ..... 195
Figure 4.26 Flow chart 2.3: Steps to ensure the halal requirements for chemical synthesis by chemical manufacturing ..... 196
Figure 4.27 Flow chart 2.4: Steps to ensure the halal requirements for pharmaceuticals produced from plant sources ..... 198
Figure 4.28 Flow chart 2.5: Steps to ensure the halal requirements for pharmaceuticals produced from animal sources. ..... 199
Figure 4.29 Flow chart 2.5.1: Halal control points (HCPs) in permitted animals processing, adopted from (Riaz & Chaudry, 2004). ..... 200
Figure 4.30 Flow chart 2.5.2: Halal pharmaceuticals SOPs in non-permitted animals processing ..... 202
Figure 4.31 Flow chart 2.5.3: Halal pharmaceuticals SOPs for different pharmaceuticals products which extract without killing the animal or from the blood or urine products. ..... 203
Figure 4.32 Flow chart 2.6: The basic steps and processes in producing pharmaceuticals from microorganisms. ..... 205
Figure 4.33 Flow chart 2.6.1: Halal pharmaceuticals SOPs for pharmaceuticals produced by classical fermentation methods. ..... 206
Figure 4.34 Flow chart 2.6.2: Halal pharmaceuticals SOPs for pharmaceuticals produced by biotechnology methods. ..... 207
Figure 4.35 Flow chart 2.6.3: Halal control points or halal critical points in conventional process for extracting enzymes of animal origins ..... 208

Figure 4.36 Flow chart 2.6.4: Halal control points in enzyme production in a conventional fermentation process. ..... 209
Figure 4.37 Flow chart 3: Halal pharmaceuticals SOPs for the processing steps in any pharmaceutical production..... 210
Figure 4.38 Flow chart 4: Halal pharmaceuticals SOPs for the packaging processes in any pharmaceutical production..... 211
Figure 4.39 Flow chart 5: Halal pharmaceuticals SOPs for the storage processes in any pharmaceutical production..... 213
Figure 4.40 Flow chart 6: Halal pharmaceuticals SOPs for the transportation processes in any pharmaceutical production. ..... 214
Figure 4.41 Flow chart 7: Halal pharmaceuticals SOPs in the Quality control department, Quality assurance department, research and development department, and documentation issues. ..... 215
Figure 4.42 Flow chart 7.1: The ritual cleaning SOPs for analytical and production equipments..... 216
Figure 4.43 Flow chart 1: Health care providers SOPs for usual patient contact or prescription. ..... 217
Figure 4.44 Flow chart 2: Health care providers SOPs for searching for medicine halal status and origin. ..... 218
Figure 4.45 Flow chart 3: Health care providers SOPs for evaluating the suitable alternatives for haram or doubtful pharmaceuticals ..... 219
Figure 4.46 Flow chart 4: Health care providers SOPs for keep updating with the halal pharmaceuticals information..... 220
Figure 5.1 Chapter Five - main topics..... 222
Figure 5.2 Short explanation of key to use the critical chemical list A ..... 266

## LIST OF ABBREVIATION

| | |
|---|---|
| A.H. | After Hijrah |
| ACD | Accelrys Available Chemicals Directory |
| ADCID | The Animal-Derived cosmetic Ingredient Database |
| AFIC | Australian Federation of Islamic Council |
| AfrHP | African Herbal Pharmacopoeia |
| AMJA | Assembly of Muslim Jurists of America |
| AOAC | The Association of Official Analytical Chemists |
| API | Active Pharmaceutical ingredients |
| APLAC | Asia Pacific Laboratory Accreditation Cooperation |
| B.P | The British Pharmacopoeia |
| BLAST | The Basic Local Alignment Search Tool inside the NCBI website |
| BSE | Bovine spongiform encephalopathy disease |
| CAP | Consumer Association of Penang |
| CAS | Chemical Abstracts Service |
| CBR | Cosmetics Bench Reference |
| CCM | Chemical Company of Malaysia Berhad |
| CD | Compact Disc |
| CDCR | Control of Drug and Cosmetics Regulations |
| CEO | Chief Executive Officer |
| ChP | Chinese Pharmacopoeia |
| CICT | Central Islamic Committee of Thailand |
| CMI | Consumer Medical Information |
| CTFA | The Cosmetic, Toiletry and Fragrance Association |

| | |
|---|---|
| DAB | German Pharmacopoeia |
| DCA | Drug Control Authority Malaysia or Pihak Berkuasa Kawalan Dadah (PBKD) |
| DI | Drug Information |
| DNA | Deoxyribonucleic Acid |
| DSC | The USP Dietary Supplements Compendium |
| DWPISM | Derwent World Patents Index |
| EA | European co-operation for Accreditation |
| EDQM | European Directorate for the Quality of Medicines and Health Care - Council of Europe |
| EFTA | European Free Trade Association |
| ERS | Economic Research Service (department in USDA) |
| Eurostat | Directorate-General of the European Commission, allocated to the portfolio of the European Commissioner for Taxation and Customs Union, Audit and Anti-Fraud |
| FAO | Food and Agriculture Organization |
| FAS | Foreign Agricultural Service (department in USDA) |
| FCC | The Food Chemicals Codex |
| FDA | Food and Drug Administration U.S |
| FIANZ | Federation of Islamic Association of New Zealand |
| FQD | Food Quality Division |
| GAIN | Global Agricultural Information Network |
| GC | Gas Chromatography |
| GCC | Cooperation Council for the Arab States of the Gulf |
| GHP | German Homoeopathic Pharmacopoeia |
| GHSC | Global Halal Support Center |
| GMP | Good Manufacturing Practice |

| | |
|---|---|
| HACCP | Hazard Analysis Control Critical Points |
| Halal WIN | Halal World Industry News |
| HDC | Halal Industry Development Corporation |
| HFA | Halal Food Authority |
| HFCI | Halal Food Council International |
| HKC | Halal Knowledge Center |
| HPLC | High Performance Liquid Chromatography |
| HPV | High Production Volume |
| IAF | International Accreditation Forum |
| IAF | International Accreditation Associations |
| ICCI | The Islamic Chamber of Commerce and Industry |
| ICIDH | International Cosmetic Ingredient Directory and Handbook |
| ICRIC | The Islamic Chamber Research and Information Center |
| IEC | The International Electrotechnical Commission |
| IFANCA | Islamic Food and Nutrition Council of America |
| IHAF | International Halal Accreditation Forum |
| IHI Alliance | The International Halal Integrity Alliance |
| ILAC | The International Laboratory Accreditation Cooperation |
| INFAD | The World Fatwa Management and Research Institute |
| INPADOC | The International Patent Documentation Centre |
| IO | Industrial Organization |
| IOMS | Islamic Organization for Medical Sciences |
| IP | Intellectual Property |
| IslamQA | Islam Question and Answer website |
| ISO | International Organization for Standardization |

| | |
|---|---|
| ISO/IEC17011 | ISO/IEC General requirements for accreditation bodies accrediting conformity assessment bodies |
| JAIN | Jabatan Agama Islam Negeri (State Islamic Religious Department) |
| JAKIM | Jabatan Kemajuan Islam Malaysia (Department of Islamic Development) |
| JP | Japanese Pharmacopoeia |
| KDRC | KasehDia's Research & Consulting |
| MATRADE | Malaysia External Trade Development Corporation |
| MBA | Master of Business Administration |
| MCB | Muslim Council of Britain |
| MCG | Muslim Consumer Group |
| MHLW | Ministry of Health, Labour and Welfare |
| MHRA | Medicines and Healthcare Products Regulatory Agency |
| MLA | Multilateral Recognition Agreements |
| MOSTI | Ministry of Science, Technology and Innovation |
| MRI | Magnetic Resonance Imaging |
| MS | Malaysian Standard |
| MS1500:2009 | Malaysian Standard: Halal Food - Production, Preparation, Handling, and Storage - General Guidelines |
| MS 2424:2012 | Malaysian Standard: Halal Pharmaceuticals - General Guidelines |
| MUI | Majelis Ulama Indonesia (Ulama Council of Indonesia) |
| MUIS | The Majlis Ugama Islam Singapura (Islamic Religious Council of Singapore) |
| MWL | Muslim World League |
| NASS | National Agricultural Statistics Service (following USDA) |
| NCBI | National Centre for Biotechnology Information |
| NGOs | Non-governmental organizations |

| | |
|---|---|
| NHS | National Health Service |
| NLM | National Library of Medicine |
| NMR | Nuclear Magnetic Resonance |
| NPCB | National Pharmaceutical Control Bureau Malaysia or Biro Pengawalan Farmaseutikal Kebangsaan (BPFK) |
| OIC | Organization of Islamic Countries |
| OTC | Over the Counter pharmaceuticals |
| PBKD | Pihak Berkuasa Kawalan Dadah. Or Drug Control Authority (DCA) |
| PBL | Problem-Based Learning |
| PDG | Pharmacopeial Discussion Group |
| PDR | Physician Desk Reference |
| PEST analysis | Political, Economic, Social and Technological Analysis |
| PESTEL analysis | Political, Economic, Social, Technological, Environmental and Legal Factor Analysis |
| Ph. Eur | European Pharmacopoeia |
| Ph.Int | The International Pharmacopeia |
| PIC/S | Pharmaceutical Inspection Convention and Pharmaceutical Inspection Co-operation Scheme (jointly referred to as PIC/S) |
| PMI | Patient Medical Information |
| PPUM | Pusat Perubatan Universiti Malaya (U.M Medical Centre) |
| QC | Quality Control |
| QM | Quality Management |
| R&D | Research and Development |
| RiskMAPs | Risk Mapping, Assessment, and Planning |
| SAP | Service Access Point |
| SFDA | Saudi Food and Drug Authority |

| | |
|---|---|
| SGD | Small Group Dialogue or Discussion |
| SIRIM | SIRIM Malaysia |
| SOPs | Standard Operating Procedures |
| SQAS | Safety and Quality Assessment System |
| Standards Malaysia | Department of Standards, Malaysia |
| SWOT | Strengths, Weaknesses, Opportunities, and Threats Analysis |
| TCC | Trade Compliance Center USA |
| TLC | Thin Layer Chromatography |
| TPPA | Trans-Pacific Partnership Agreement |
| TQM | Total Quality Management |
| U.S.A | United States of America. |
| UK | United Kingdom |
| UPM | Universiti Putra Malaysia |
| USDA | United States Department of Agriculture data and statistics |
| USIM | Universiti Sains Islam Malaysia |
| USM | Universiti Sains Malaysia |
| USP-NF | The United States Pharmacopeia and The National Formulary |
| vCJD | Creutzfeldt–Jakob disease |
| VHM | Veterinary Health Mark |
| WHF | World Halal Forum |
| WHF | The American Halal Association |
| WHFC | World Halal Food Council |
| WHO | World Health Organization |
| WPCM | Working Party on Culture Media |

## LIST OF PUBLICATIONS

1. Oral presentation in the Halal Congress Middle East - Sharjah 2013 entitled: (Halal Pharmacopoeia Monographs: Setting the Details), in 1 Dec 2013. Presentations files and the conference program can be downloaded from:
   http://www.halalfoodme.com/HalalCongress/PDF/SpeakerProfile.pdf
   http://www.halalfoodme.com/HalalCongress/PDF/HME_Program.pdf

2. Trainer in the halal workshop entitled: (Halal Pharmaceutical and Cosmetics - opportunities and challenges) held in 17 Dec 2013.
   http://www.halalfoodme.com/HalalCongress/Workshop.html

3. Poster presentation in BioMalaysia 2011 – Kual Lumpur 21- 23 Nov 2011 titled: (Halal Pharmacopoeia Monographs: Setting the Details).

4. Poster presentation in BioMalaysia 2011 – Kual Lumpur 21- 23 Nov 2011 titled: (Halal Vaccines: Setting the Standards).

**PENETAPAN SISTEM MAKLUMAT UBAT FARMASEUTIKAL HALAL: KONSEP, SUMBER DAN, POTENSI DALAM INDUSTRI**

## ABSTRAK

Bahan bahan farmaseutikal yang dikilangkan atau dihasilkan terdiri daripada sumber dan asal-usul yang berbeza, samada bahan kimia, mineral, tumbuh-tumbuhan, haiwan, bioteknologi atau imunologi. Pengguna Muslim di seluruh dunia menggunakan undang-undang halal, yang merupakan sebahagian daripada Syariah atau undang-undang Islam. Dalam bahasa Arab, halal bermaksud mematuhi undang-undang atau yang dibenarkan, yang tidak hanya digunakan bagi makanan, malahan juga mencakupi kesemua aspek hidup yang lain. Farmaseutikal halal adalah ubat yang mengandungi bahan kandungan yang dibenarkan dan dihasilkan berdasarkan aturan dan undang-undang halal. Pengesahan dan pengauditan halal adalah satu sistem pengurusan kualiti untuk memastikan status halal bagi sesuatu produk tertentu melalui konsep "Quality built-in rather than tested for." Standard atau piawaian tertentu sepatutnya dipatuhi semasa rantaian bekalan, iaitu penyumberan, pengeluaran / pengilangan, pengangkutan dan pemasaran. Ia termasuk bahan mentah, pengilangan / pembuatan, pembungkusan, penyimpanan, agihan dan pendispensan. Walaupun terdapat peningkatan kesedaran tentang farmaseutikal halal dalam kalangan pengguna dan pihak berkuasa, namun tiada rujukan berdasarkan bukti yang menyediakan maklumat tentang status halal farmaseutikal, standard, prosedur operasi standard (standard operating procedures, SOP), dan garis panduan untuk memastikan bahawa pihak pengeluar mematuhi undang-undangf halal. Kajian ini bermatlamat menonjolkan semua isu berkaitan dengan farmaseutikal halal melalui penggunaan kaedah dan peralatan perkhidmatan maklumat ubat. Sorotan literatur secara sistematik dijalankan untuk memastikan aspek yang relevan tentang

farmaseutikal halal (definisi, pensijilan, standard, pengauditan, pemasaran, pendidikan, latihan dan undang-undang Islam). Prinsip perkhidmatan maklumat ubat digunakan untuk menganalisis soalan berhubung dengan isu farmaseutikal halal, sumber maklumat diperoleh, menilai data, dan merumus jawapan dalam format persembahan yang sesuai. Kajian ini memperkenal serta menetapkan garis panduan bagi menjawab kemusykilan baru yang mungkin dihadapi oleh pakar maklumat ubat, yang bertanyakan status halal bagi farmaseutikal tertentu dan asal-usul mereka. Tesis ini juga mendidik undang-undang Islam tentang farmaseutikal halal dan menetapkan aturan untuk mencari, menempatkan dan melaporkan jawapan daripada sumber fiqah yang berbeza. Maklumat yang terkumpul digunakan untuk mencadangkan satu pelan penulisan bagi farmakopoeia halal. Satu monograf model, yang dikenali juga sebagai farmakopoeia halal dicadangkan berdasarkan analisis kritikal daripada bahan kandungan sediaan terpilih. Satu tinjauan menggunakan soal selidik yang diolah dan pertemuan kumpulan pakar dijalankan untuk mencadangkan satu model primitif tentang SOP farmaseutikal halal. SOP yang dicadangkan dan farmakopoeia berpotensi digunakan dalam industri bagi membantu syarikat di seluruh dunia memahami tentang amalan farmaseutikal halal, cara mengamalkannya semasa penghasilan farmaseutikal, dan cara untuk membangunkan jawatankuasa dan pasukan halal mereka sendiri.

# ESTABLISHING HALAL PHARMACEUTICALS INFORMATION SYSTEMS: CONCEPTS, SOURCES AND, POTENTIALS IN THE INDUSTRY


## ABSTRACT

Pharmaceuticals are manufactured from different sources and origins; chemicals, minerals, plants, animals, biotechnologicals and immunologicals. Muslim consumers around the world subscribe to the halal pharmaceuticals, which is a part of Shariah or islamic law. Halal is an Arabic word for the lawful or permitted, usually used for food but also covers all aspects of life. Halal pharmaceuticals are drugs that contain permissible ingredients and are produced according to the rules and conditions of halal pharmaceuticals. Halal certification and auditing is a quality management system to ensure the halal status of a certain product via the concept "Quality built-in rather than tested for." Certain standards should be adhered to throughout the supply chain namely sourcing, production, transporting and marketing. These include; raw materials, manufacturing, quality control, packaging, storing, distributing and dispensing. Even though there is enhanced awareness regarding halal pharmaceuticals among the consumers and authorities, hitherto there is no evidence-based reference that provides information on the halal status of pharmaceutical standards, standard operating procedures (SOPs) and guidelines to ensure that manufacturers stick to the halal pharmaceuticals. This study aims to highlight pertinent issues related to halal pharmaceuticals by using methods and tools of drug information service. A systematic literature review was made to glean relevant aspects of halal pharmaceuticals (definition, certification, standards, auditing, marketing, education, training, and islamic laws). Drug information service principles were used to analyze issues regarding halal pharmaceuticals, locate information resources, evaluate the data and formulate answers in a suitable

presentation format. This study has introduced and set the guidelines to answer new types of inquiries faced by drug information specialists; questioning the halal status of certain pharmaceuticals and their origin. This study also elucidated islamic law on halal pharmaceuticals and has set the rules to search, locate and report answers from different types of fiqh resources. Information compiled was then used to propose a writing plan for a Halal Pharmacopoeia. Model monographs of the proposed Halal Pharmacopoeia were designed based on critical analysis of the ingredients of selected preparations. A survey using a designed questionnaire and expert group meetings were conducted to propose a primitive model of standard operating procedures (SOPs) of halal pharmaceuticals. The proposed SOPs and pharmacopoeia are potentially useful in the industry by helping companies all over the world to understand the practice of halal pharmaceuticals, how to subscribe to it during production of pharmaceuticals and how to set up their in-house halal committees and teams.

# CHAPTER ONE: INTRODUCTION AND LITERATURE REVIEW

Awareness on Halal pharmaceuticals has increased in the last five years, though there is limited research data scientifically presented in pharmaceutical research journals on this subject. This limited availability of data on halal pharmaceuticals became the basis of starting this study.

Halal concepts are among important factors to choose between different pharmaceuticals properties for Muslims. There are different origins of the pharmaceuticals and usually people consume the pharmaceuticals which agree and fit their religion (Simoons, 1994), safety, and health concerns. Drug information tools and methods can help in solving problems related to halal pharmaceuticals. The introduction chapter will cover the aspects of halal pharmaceuticals as in drug information by defining pharmaceuticals and the methods of manufacturing them.

It will also cover the aspects of pharmacy practice, systematic review of halal pharmaceuticals in the main databases followed by discussion on the current situation of halal pharmaceuticals. The objectives of the research will be established and the contribution of this study will also be highlighted.

## 1.1 Methods

### 1.1.1 Database and search strategies

Literature searches were conducted in the following three electronic databases: Pub Med, EBSCO HOST, and Google Scholar. Literature searches were ended on 10th July, 2014. The following search terms were used individually or in combination: ‘halal’, ‘pharmaceuticals’, ‘medicine’, ‘vaccine’, ‘porcine’, ‘animal’, ‘bovine’, and ‘natural’. Reference lists of retrieved papers were searched as well.

### 1.1.2 Inclusion and Exclusion Criteria

All books and peer reviewed articles, written in English, discussing different issues of halal were included. Magazine articles and conference proceedings were excluded as were the articles based on halal economy, halal tourism, Islamic finance, meat science and poultry with the exception of articles discussing food as well as pharmaceuticals from halal perspective.

### 1.1.3 Data Extraction and Quality Assessment

According to the predefined criteria, extracted data information included authors, title of article, year of publication, summary and comments and presented in a table format. The tables will be followed by a short discussion to highlight some important terms and conclusions from the collected articles.

## 1.2 Results and Discussion (Information Report)

### 1.2.1 Pharmaceuticals Definition and Their Method of Manufacturing

Historically, people used medicines from different origins (plants, animals, and minerals) (The Merck Index, 2006). Pharmaceuticals are also referred to as medicinal products, dosage forms, or drug products (Merriam-Webster, 2004) mean: "any compound or preparation used for the treatment or prevention of disease. They are intended for human or veterinary use which is subject to control by health legislation in the manufacturing country or in the importing country" (PIC/S, 2013). Pharmaceuticals include both Active Pharmaceutical Ingredients (API) and excipients. API is defined as: "any substance or mixture of substances intended to be used in the manufacture of a drug (medicinal) product and that, when used in the production of a drug, becomes an active ingredient of the drug product. Such substances are intended to furnish pharmacological activity or cause other direct effects in the diagnosis, cure, mitigation, treatment, or prevention of disease or to affect the structure and function of the body" (PIC/S, 2013).

An excipient is an inactive or inert substance that forms a vehicle, formulated alongside the API of a medication to serve various therapeutic, manufacturing process and for stability enhancing purposes (Swarbrick, 2007). Famous categories include: anti adherents, binders, coatings, colours, disintegrants, fillers, flavours, glidants, lubricants, preservatives, sorbents, and sweeteners. Pharmaceuticals can be obtained from many sources these days. Table 1.1 illustrates the types of API origins according to the PIC/S [the Pharmaceutical Inspection Convention (PIC) and the Pharmaceutical Inspection Co-operation Scheme (PIC Scheme)]. Blood related

products, cosmetics, and dietary supplements are not part of our research according to the previous definition.

**Table 1.1:** Types of API manufacturing techniques, (adapted from (PIC/S, 2013)

| **Types of API Manufacturing Techniques** |
| --- |
| 1. Chemical manufacturing<br>2. API derived from animal sources<br>3. API extracted from plant sources<br>4. Herbal extracts used as API<br>5. API consisting of comminuted or powdered herbs<br>6. Biotechnology: fermentation /cell culture<br>7. “Classical” fermentation to produce an API |

### 1.2.2 Halal Definition and Background

Food and medicine choice normally reflects aspects of lifestyle, culture, religion, diet and health concerns. Every country has specific concerns and wishes to determine its own particular priorities for targeting authenticity issues, labelling and compositional regulations (Nakyinsige, Man, & Sazili, 2012). Religion is among the major factors determining food and medicine avoidance, taboos and special regulation (Simoons, 1994).

Dietary laws describe and give details of food and beverages which people abstain from consuming because of a religious or cultural prohibition. Kashrut is the set of Jewish dietary laws. Food that may be consumed according to halakha (Jewish

law) is termed kosher in English, which means "fit" (in this context, fit for consumption) (Regenstein, Chaudry, & Regenstein, 2003). Diet in Hinduism is traditionally governed by the rules laid out in the Dharmaśāstras, a genre of Sanskrit texts pertaining to Hindu religious and legal duty. Buddhist cuisine is an East Asian cuisine which is followed by some believers of Buddhism. It is primarily vegetarian, a manifestation of the general Buddhist precept of ahimsa (non-violence). Vegetarianism is the practice of abstaining from the consumption of meat – red meat, poultry, seafood and the flesh of any other animal; it may also include abstention from by-products of animal slaughter, such as animal-derived rennet and gelatine (Merriam-Webster, 2004).

From Muslims' point of view, decision to choose one food over the other depends on its halal status. However, the Islamic dietary law is universal and derived from the Holy Quran, which makes it similar in all nations of the world (Nakyinsige et al., 2012). The term halal can describe any human activity but it is most related with food until now. Halal industry Development Corporation (HDC) in Malaysia mentioned nine major sectors in halal industries include the following ("HDC," 2013):

Food

Animal feed

Cosmetics and toiletries

Ingredients and additives

Biologicals and vaccines

Pharmaceuticals

Tourism and hotels

Islamic finance and banking

Logistics

The halal dietary laws define food products as “halal” (permitted) or “haram” (prohibited), however, a few items have been categorize in “makrooh” “mashbooh” (questionable to detestable). The law deals with the following five issues; all but the last are in the animal kingdom (Riaz & Chaudry, 2004).

1) Prohibited animals
2) Prohibition of blood
3) Method of slaughtering/blessing
4) Prohibition of carrion
5) Prohibition of intoxicants.

The Islamic dietary laws are derived from the Quran, a revealed book; the Sunnah (also known as hadith), the traditions of Prophet Muhammad; and through extrapolation of and deduction from the Quran and the Sunnah, by Muslim jurists. Approximately 90% of Muslims are Sunni, while the other 10% are shia (Pulsfort, 2010). This thesis will generally follow Sunni practice.

Halal encompasses origin, species, production system, slaughter procedure, processing method, storage and the logistics of food or medicine. All these characteristics are not visible and cannot be verified by the consumer at the pre-purchase stage (Penang, 2006). Four from the nine sectors of halal industry are related to Pharmaceutical sciences (Center, 2013).

Cosmetics and toiletries

Ingredients and additives

Biologicals and vaccines

Pharmaceuticals

The regulations, awareness and production of halal pharmaceuticals are still in their infancy in comparison to the detailed transcription of halal status of food and beverage. Halal status of food or medicine is a credence attribute that cannot be ascertained by the consumer, even upon consumption of the food or medicine. Owing to the change in peoples' lifestyle today, the food chain has become very long and can be described as from the farm to the table. This has resulted in the need of halal certifying authorities (Vandendriessche, 2008).

The identity and authentication of ingredients in processed or composite mixtures has emanated into appointment or formation of credible halal certification bodies like Halal Food Authority (HFA) in UK, Islamic Food and Nutrition Council of America (IFANCA), Halal Food Council International (HFCI), Australian Federation of Islamic Council (AFIC), Federation of Islamic Association of New Zealand (FIANZ), Islamic Religious Council of Singapore (MUIS), Ulama Council of Indonesia (MUI), Central Islamic Committee of Thailand (CICT) and Department of Islamic Development (Jabatan Kemajuan Islam Malaysia) (JAKIM) in Malaysia. Crucially, such bodies should endeavour to clarify which food is "authentic" or better still "halal" and ensure accurate labelling in order to protect muslim consumers as well as promote fair trade (JAKIM, 2013).

### 1.2.3 Drug Information Definition and Background

Drug information is an area of pharmacy practice that deals with obtaining, managing, and evaluating information to prepare and disseminate it in a suitable format, wherever and whenever it is needed or in anticipation of need (DiPiro, 2003). The drug information specialist has not specifically been considered a documentation

specialist, as is a librarian, but was originally defined as a subject-oriented specialist in the area of drug knowledge (Francke, 1966).

Drug information is one of the early fields in clinical pharmacy. Drug information centres were established in the mid of 1960s. The decision to establish a drug information centre was made in 1959 at Ohio State University and 1960 at the University of Kentucky, with the latter one was the first to open in 1962 (Amerson & Wallingford, 1983). Pharmacists who work in drug information review, collect, organize, and analyze drug information and spread it to health-care professionals and consumers (Gong, Millares, & VanRiper, 1992).

Drug information centres and services work now in different fields such as pharmaceutical industry, health-care institutions, academic settings and universities, usually as functioning departments within the organization (Justice, 1993). Some centres work as independent centres especially with economic benefits from drug information software and internet services for health-care professionals and the public (Russello & Peterson, 1993). The activities of drug information centres or services have increased dramatically since they were first established. Usually health-care practitioners refers to drug information centres or services when assistance is required in handling a difficult clinical problem or when significant time or resource constraints exist (poison centres for example). Table 1.2 summarizes the medication information services provided by different drug information centres.

**Table 1.2:** Medication information services, (adapted from (Malone, Kier, & Stanovich, 2011)

| |
|---|
| Support for clinical services |
| Answering questions |
| Developing criteria/guidelines for medication use |
| Pharmacy and therapeutics committee activity |
| Development of medication use policies |
| Formulary management |
| Publications—newsletter, journal columns, websites |
| Education—in-services for health professionals, students, consumers |
| Medication usage evaluation/medication use evaluation |
| Investigational medication control |
| Institutional Review Board activities |
| Information for practitioners |
| Coordination of reporting programs, e.g., adverse medication reactions |
| Poison information |

Pharmacists working in the area of drug information should have some of the skills of a documentation specialist because these skills are necessary to manage information. The difference between drug information specialist and documentation specialists is that the drug information practitioner has the ability to adequately understand the initial problem and after locating the information can evaluate the information to formulate a solution to a particular pharmacy or medication-related issue. Because of this ability, drug information practitioners have occasionally been

referred to as the "ultimate generalist" in pharmacy (DiPiro, 2003). The drug information practitioner has the in depth knowledge of how to obtain the necessary information and use it to address specific problems or concerns in most areas.

The need for drug information practitioners is increased due to the rapid increases and improvements in information and the technology to manage it, particularly due to internet technology and information sources which produce millions of new articles and research every year. Finding information is only small part of the skills needed for drug information specialist and should have greater skills to handle larger and more complex information management situations (Malone et al., 2011). Table1.3 summarizes the skills needed for drug information specialist.

**Table 1.3:** Medication information skills, (adapted from (Malone et al., 2011)

| |
|---|
| Assess available information and gather situational data needed to characterize question or issue |
| Formulate appropriate question(s) |
| Use a systematic approach to find needed information |
| Evaluate information critically for validity and applicability |
| Develop, organize, and summarize response for question or issue |
| Communicate clearly when speaking or writing, considering the audience level |
| Anticipate other information needs |

Several factors play an important role in the evolution of the pharmacist's role as a medication information provider. These include the prevention of adverse drug events, the sophistication of medication therapy, the rapid growth of information technology due to the advance in computer and internet sciences, depending on the evidence-based medicine which focus on the evaluation of outcomes and finally the change in the patient personality who become a more knowledgeable patient (Hunt, Haynes, Hanna, & Smith, 1998).

Usually the term drug information is coupled with terms such as specialist, centre, or service. Some people use the words medication or biomedical instead of drug due to the negative connotation that the drug term has in society (Hunt et al., 1998). Some writers used the word informatics instead of information, to better acknowledge the increased role of computers in information management. Pharmacy or Medical Informatics is different than drug information now and it is more focus on the computer and programming side than the clinical pharmacy side (Shortliffe & Blois, 2006). Medical informatics has been defined as the rapidly developing science that deals with the storage, retrieval, and optimal use of biomedical information, data, and knowledge for problem-solving and decision-making (Allen, 2012).

Drug information or medication information is a term that indicates that people working in this area deal with information relating both to drugs (e.g., therapeutics, adverse drug reactions) and to pharmacy (e.g., how to perform various pharmacy tasks) this term is broadened to include both pharmaceutical and therapeutic knowledge (DiPiro, 2003).

A primary role of the pharmacist as a pharmaceutical care provider is to respond to drug information questions from other health-care professionals and patients and to help resolve drug therapy related problems. Pharmacists must also be able to assist patients in meeting their information needs with regard to drugs, therapies, and diseases (Malone et al., 2011). Figure 1.1 illustrate the basic logical steps to formulate answer or response regard any drug information question since receiving the question and until the formulating of the response or the answer.

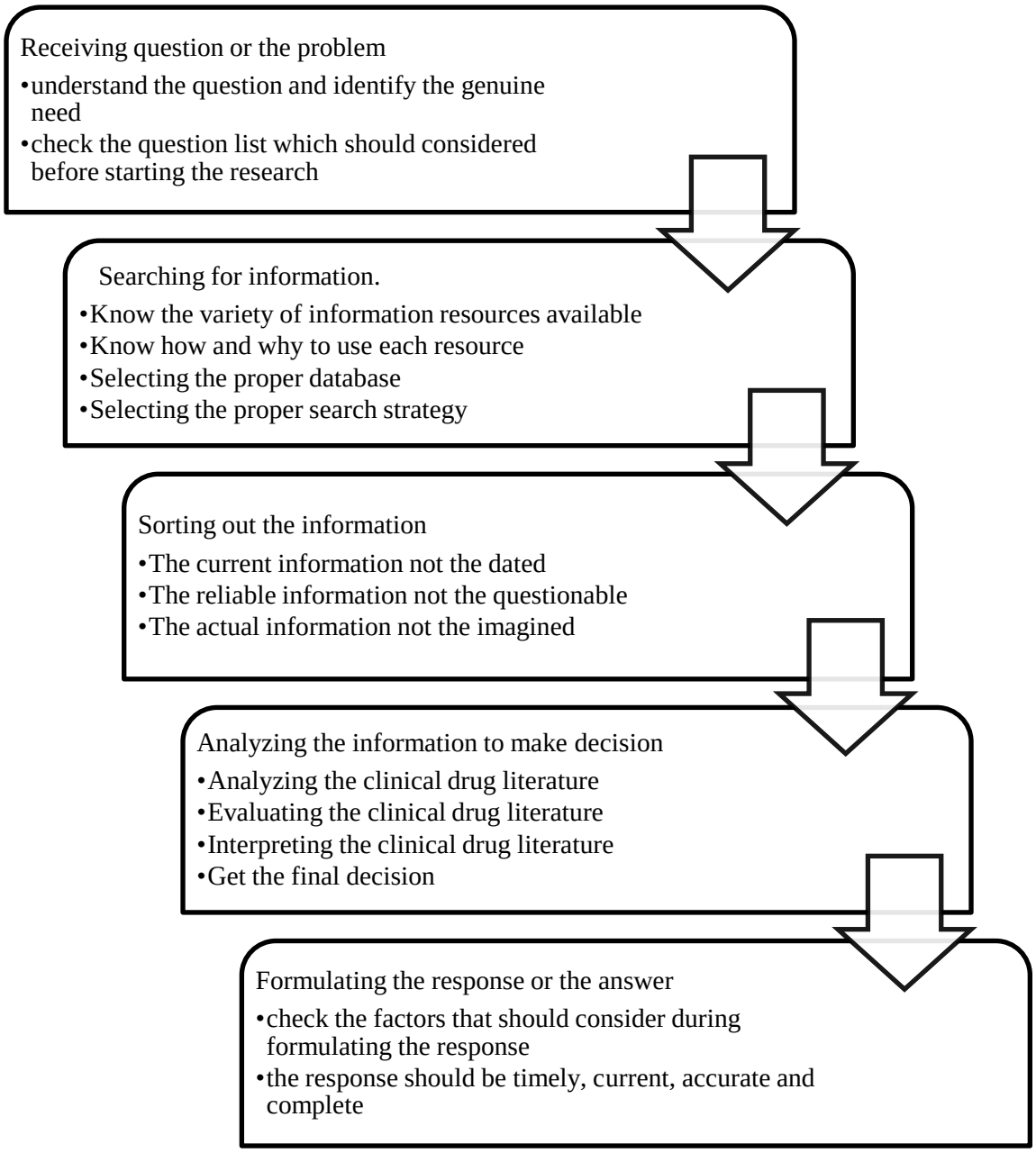


**Figure 1.1:** Illustration of the basic steps in response to medication information request.

There are many types of drug information needed by practicing pharmacists and other health-care professionals they are varied and include, but are not limited to:

1. Information about side / adverse effects,
2. Drug interactions,
3. Uses,
4. Teratogenicity,
5. Stability, and compatibility,
6. Product identification
7. Availability,
8. Dosages and administration,
9. Toxicity,
10. Pharmacokinetics,
11. Pharmacodynamics,
12. Pharmacogenomics,
13. Health-related quality of life,
14. Pharmacoeconomics; and
15. Efficacy, which include the comparative efficacy among
16. Drugs in the same chemical or pharmacological class
17. Drugs from different classes.

### 1.2.4 Halal Pharmaceuticals Systematic Literature Review

Systematic review resulted in the availability of 673 articles. Of these, 42 articles were excluded because the language of literature was other than English (Arabic, Malay Urdu & French), 146 being magazine articles (non-peer reviewed),

273 being conference proceedings and remaining were excluded because they were solely on halal food and not halal pharmaceuticals. Table 1.4 presents the summary of articles that matched all inclusion and exclusion criteria of this study and were included in this study.

**Table 1.4:** Systematic review of halal pharmaceuticals peer reviewed articles

| | Title of Article | Author | Year | Journal | Summary and Comment |
|---|---|---|---|---|---|
| 1 | Applying Islamic Principles of Halal and Haram to the Field of Pharmaceutical Sciences<br><br>(Iqbal, Saeed, Nasir, & Khuda, 2011) | zaki ullah, Zafar Iqbal, Muhammad Saeed, Fazli Nasir, Fazli Khuda, Abuzar khan | 2011 | PUTAJ SCIENCES | This article provides a comprehensive list of haram pharmaceutical ingrediants and their therapeutic uses<br><br>The article discusses diseases and available treatments in the light of Quran and Sunnah. This focus is more on the use of alcohol and gelatine for medicinal purposes. |
| 2 | Assessment of knowledge, attitude & perception among hospital pharmacists regarding Halal pharmaceuticals<br><br>(Sadeeqa & Sarriff, 2014) | Saleha Sadeeqa, Azmi Sarriff | 2014 | Journal of Applied Pharmaceutical Science | A cross-sectional study, to measure knowledge, attitude and perception (KAP) of halal pharmaceuticals. A total of 135 pharmacists from January 2013 to March 2013 were included in this structured, self-administered questionnaire study. Results revealed that the hospital pharmacists had a good knowledge and positive attitude and perception about Halal pharmaceuticals.<br><br>This article elaborates general perceptions of halal pharmaceuticals and does not assess KAP of any specific pharmaceutical. |

| | Title of Article | Author | Year | Journal | Summary and Comment |
|---|---|---|---|---|---|
| 3 | Development of clay liquid detergent for Islamic cleansing and the stability study<br><br>(Angkatavanich, Dahlan, Nimmannit, Sriprasert, & Sulongkood, 2009) | J. Angkatavanich,<br>W. Dahlan,<br>U. Nimmannit,<br>V. Sriprasert,<br>N. Sulongkood | 2009 | International Journal of Cosmetic Science | Clay liquid detergents (CLDs) were developed for cleansing religiously-prohibited dirt ('najis') according to Islamic law. Four types of clay were selected: marl, kaolin, bentonite and veegum. After product development trials, five CLD formulations with varying combinations of clays were qualified for stability testing. F2 (kaolin-based, with a white, creamy texture) was the best CLD formula. It had the highest surface activity, moderate lathering and pleasant physical appearance.<br><br>This is the only invention related to halal pharmaceuticals, all porcine detection kits were for food use only. Now there are five companies produced CLD formulations. |
| 4 | Evaluation of knowledge, attitude, and perception regarding Halal pharmaceuticals, among general medical practitioners in Malaysia<br><br>(Sadeeqa, Sarriff, Masood, Farooqi, & Atif, 2013) | Saleha Sadeeqa,<br>Azmi Sarriff,<br>Imran Masood,<br>Maryam Farooqi,<br>Muhammad Atif | 2013 | Archives of Pharmacy Practice | A cross-sectional study, to evaluate KAP with general medical practitioners (from Sep 2012 - Nov 2012), using a structured, self-administered questionnaire. Results revealed that general medical practitioners in Malaysia have a good knowledge and positive attitude and perception towards Halal pharmaceuticals. |

| | Title of Article | Author | Year | Journal | Summary and Comment |
|---|---|---|---|---|---|
| 5 | Exploring the Halal Status of Cardiovascular, Endocrine, and Respiratory Group of Medications<br><br>(Sarriff, 2013) | Azmi Sarriff, Hadeer Akram Abdul razzaq | 2012 | Malaysian Journal of Medical Sciences | Study aims to determine the Halal status of selected cardiovascular, endocrine, and respiratory medications stored in an out-patient pharmacy in a The proportions of Halal, Mashbooh, and Haram products were at 19.1%, 57.1%, and 23.8%, respectively.<br>Ethanol and magnesium stearate were found to be the common substances that were categorized as Haram and Mashbooh.<br>Thisstudy depends on the information obtained from the leafinserts and from MIMS to know the contents of the drugs.<br>This study focuses on highlighting the trade names and formulations instead of describing the origin of the active ingredients.<br>This study considers ethanol of all origins as haram for use in pharmaceuticals and does not specifically take into account the synthetic/denatured ethanol. |
| 6 | Factors associated with uptake of vaccination against pandemic influenza: A systematic review<br><br>(Bish, Yardley, Nicoll, & Michie, 2011) | Alison Bish, Lucy Yardley, Angus Nicoll, Susan Michie | 2011 | Vaccine | Study aims to examine the psychological and demographic factors associated with uptake of influenza vaccination during the 2009 pandemic. By making a systematic literature review searching Web of Science and Pub Med databases up to January 2011.<br><br>This research paper refers to a Malaysian study which emphasizes the need of halal vaccines. |

| | Title of Article | Author | Year | Journal | Summary and Comment |
|---|---|---|---|---|---|
| 7 | Fish gelatine and its applications in selected pharmaceutical aspects as alternative source to pork gelatine<br><br>(Elgadir, Mirghani, & Adam, 2013) | M. Abd Elgadir, Mohamed Mirghani, Aishah Adam | 2013 | Journal of Food, Agriculture and Environment | This review summarizes gelatine in four areas: (1) pig gelatine and halal issue, (3) selected methods used in fish gelatine extraction, (3) selected functional properties of fish gelatine and (4) selected pharmaceutical and medical application of fish gelatine |
| 8 | Fish Gelatine: A Versatile Ingredient for the Food and Pharmaceutical Industries<br>Book chapter in<br>Marine Proteins and Peptides: Biological Activities and Applications<br><br>(Gudipati, 2013) | Se-Kwon Kim, Venkateshwarlu Gudipati | 2013 | Book chapter | Mention fish gelatine sources, extraction method, properties, and challenges. The most important challenges of fish gelatine are its fishy odour and poor rheological properties, limiting its utility to a few products. Development of improved processes for eliminating the odour and enhancing the desirable functional and rheological properties by incorporating co-enhancers would certainly make fish gelatine a versatile ingredient for both the food and the pharmaceutical industry. |
| 9 | Halal market surveillance of soft and hard gel capsules in pharmaceutical products using PCR and southern-hybridization on the biochip analysis<br><br>(Sahilah, Norrakiah, Aminah, Wan Aida, & Ma'aruf, 2012) | Sahilah, A. M., Mohd. Fadly, L., Norrakiah, A. S. Aminah, A., Wan Aida, W. M. Ma'aruf, A. G Mohd. Khan, | 2012 | International Food Research Journal | The study was conducted to detect the porcine DNA in pharmaceutical products in local market using polymerase chain reaction (PCR) and southern-hybridization on the biochip. Of all samples tested, 37.2% (42/113) contained porcine DNA.<br><br>Other researches published in conferences (not in journals) regard the use of different analytical tools for fast porcine detection. |

| | Title of Article | Author | Year | Journal | Summary and Comment |
|---|---|---|---|---|---|
| 10 | Halal Nutraceutical Market: Issues and Challenges<br><br>(Ehsan, 2008) | Zhari Ismail, Abdul Halim Ehsan | 2010 | SEGi Review | The article studies the following issues: sourcing, handling, processing, manufacturing, labelling, control and registration of the products. The article is good source to gather different challenges which may face worker in this field like: standardizing procedures and generating acceptable parameter standards. |
| 11 | Immunisation and informed decision-making amongst Islamic primary school parents and staff<br><br>(Bray & Keating, 2012) | Matthew Bray, Daniel Keating | 2012 | Australian Medical Student Journal | This study aims to evaluate the information and knowledge with which Islamic parents and staff are equipped to make decisions about immunisation. 40.7% (n = 64) of respondents were not confident that they knew enough about vaccines to make good decisions, while 73.3% (n=115) respondents stated a personal desire for further education about vaccinations and vaccination schedules.<br><br>The study highlight the low knowledge about vaccines and how it made among non professionals, at the same time it highlight the increased awareness in the Muslim community regard the halal pharmaceuticals. |
| 12 | Investigation into the suitability and accessibility of catering practices to inpatients from minority ethnic groups in Brent<br><br>(Hartley & Hamid, 2002) | B. A. Hartley, F. Hamid | 2002 | Journal of Human Nutrition and Dietetics | Study aims to review accessibility and suitability of multicultural meals to minority ethnic communities across five hospital sites in Brent and determine the level of nursing staff knowledge of multicultural dietary competencies.<br><br>The study highlights the importance of providing halal meals for patient in hospitals and how to measure the patient satisfaction. |

| | Title of Article | Author | Year | Journal | Summary and Comment |
|---|---|---|---|---|---|
| 13 | Islamic Verdicts in Health Policy Discourse: Porcine-Based Vaccines as a Case Study<br><br>(Padela, 2013) | Aasim I. Padela | 2013 | Zygon Journal of Religion and Science | Study analysis the opinion of scholars from using porcine-based vaccine by studying in details the IOMS opinion and the MUI. Researcher tries to highlight the importance of the istihalah concept.<br><br>The study is one of other conference papers and newspaper articles which try to make using pig product halal without studying the in depth of Islamic issues. |
| 14 | Knowledge, attitude and perception regarding Halal Pharmaceuticals, among academicians in various universities of Malaysia<br><br>(Saleha Sadeeqa, Azmi Sarriff, Imran Masood, & Farooqui, 2013) | Saleha Sadeeqa, Azmi Sarriff, Imran Masood Maryam Farooqui | 2013 | International Journal of Educational Research and Development | This is a cross-sectional study, carried out between November 2012 and December 2012, using structured, self-administered questionnaires to evaluate the Knowledge, Attitude and Perception (KAP) regarding Halal pharmaceuticals, among academicians in various universities of Malaysia. The study was conducted on a sample of 170. Results show good KAP with positive attitude and fair correlation. |
| 15 | Knowledge, Attitude and Perception Regarding Halal Pharmaceuticals among General Public in Malaysia<br><br>(Sadeeqa, Sarrif, Masood, Saleem, & Atif, 2013) | Saleha Sadeeqa, Azmi Sarriff, Imran Masood, Fahad Saleem, Muhammad Atif | 2013 | International Journal of Public Health Science (IJPHS) | A cross sectional, self administered questionnaire based study that assessed knowledge, attitude & perception of general public of Penang, Malaysia regarding Halal pharmaceuticals, Study population of 458 Muslims, revealed that public has a good and positive attitude towards Halal pharmaceuticals |

| | Title of Article | Author | Year | Journal | Summary and Comment |
|---|---|---|---|---|---|
| 16 | New Technology for Preparation of Herbal Extracts and Soft Halal Capsules on its Base<br><br>(Shikov, Pozharitskaya, Makarov, & Makarova, 2009) | Alexander Shikov, OlgaPozharitskaya, Valery G. Makarov, Marina N. Makarova | 2009 | American-Eurasian Journal of Sustainable Agriculture | Original technology for halal soft capsules with herbal oil extracts was developed. Agar polysaccharides from Gracilaria species (Rhodophyta, Gracilariaceae) is used for formulation of soft capsules instead gelatine. |
| 17 | Novel Computerized Halal Pharmaceuticals Supply Chain Framework for Warehouse and Procurement<br><br>(binti Raja, bin Abdul, & Hasan, 2013) | Raja Rina binti Raja Ikram, Mohd Khanapi bin Abdul Ghani, Abdul Samad Hasan Basari | 2013 | International Journal of Computer Applications | The paper proposes a framework to manage the halal supply chain when computerized systems are being used for the warehouse and procurement module. The proposed framework is the outcome of a case study of a Malaysian pharmaceutical organization, Pharmaniaga Manufacturing Berhad in Bangi, Selangor.<br><br>The only article regard computer applications in halal pharmaceuticals, there are few conference proceedings which deal with the same idea. |
| 18 | Parental refusal to diphtheria vaccine: a fatal outcome<br><br>(Syafinaz et al., 2013) | Syafinaz Amin N; Faridah I; Rukman AH; Fathinul Fakri AS; Malina O; Fadzillah G; Ilina I; | 2013 | The Medical Journal Of Malaysia | A case of a four-year-old boy who succumbed to diphtheria following incomplete course of immunisation, which included diphtheria vaccine. This case report focuses on the issues of parental refusal to vaccines and the development of "halal" vaccines for the prevention of infectious diseases. |

| | Title of Article | Author | Year | Journal | Summary and Comment |
|---|---|---|---|---|---|
| 19 | Production of Halal Herbal Medicinal Products in Chanae Hospital: a Community Hospital in Narathiwas Province, Thailand<br><br>(Chaowalit Monton, Krisana Kraisintu, & Chankana, 2013) | Chaowalit Monton, Krisana Kraisintu, Natawat Chankana | 2013 | Thai Journal of Pharmaceutical Sciences | Article tells how the cooperation between an academic institute (Rangsit University) and community hospital (Chanae Hospital) can promote the production of herbal medicinal products. The mini-plant was set-up on the border of Thailand in an area of unrest, and five items of gamma irradiated herbal products have been produced following halal authentication. |
| 20 | Religious Values and Healthcare Accommodations: Voices from the American Muslim Community<br><br>(Padela, Gunter, Killawi, & Heisler, 2012) | Aasim I. Padela, Katie Gunter, Amal Killawi, Michele Heisler | 2012 | Journal of General Internal Medicine | Participants reported and identified three key healthcare accommodations to address Muslim sensitivities: the provision of (1) gender concordant care, (2) halal food and (3) a neutral prayer space. Halal food was deemed to be health-promoting and therefore integral to the healing process. |
| 21 | Vaccine Manufacturing in Islamic Perspective<br>(Mel & Ja'afar, 2009) | Maizirwan Mel, Ja'afar Nuhu Ja'afar | 2009 | Ethics of Engineering Education | The article deals more with the ethics and the concept of vaccination in Islam rather than setting the halal rules to manufacture the vaccine. |
| 22 | What the World's religions teach, applied to vaccines and immune globulins<br><br>(Grabenstein, 2013) | John D. Grabenstein | 2013 | Vaccine | This paper reviews the populous faith traditions including Hinduism, Buddhism, Jainism, Judaism, Christianity, and Islam. Subjects of concern such as blood components, pharmaceutical excipients of porcine or bovine origin, rubella strain RA 27/3, and cell-culture media with remote foetal origins are evaluated against the religious concerns identified.<br><br>Informative review to understand other religions opinion regard vaccine, at the same time it doesn't set all rules to manufacture the halal vaccine. |

| | Title of Article | Author | Year | Journal | Summary and Comment |
|---|---|---|---|---|---|
| 23 | Young multiethnic women's attitudes toward the HPV vaccine and HPV vaccination<br><br>(Wong, 2008) | Li Ping Wong | 2008 | International Journal of Gynaecology and Obstetrics | To investigate the acceptability of the HPV vaccine among a multiethnic sample of young women in Malaysia. Concerns were raised regarding the vaccine's safety, and whether the vaccine was halal. |

### 1.2.5 Halal Pharmaceuticals Current Situation

Muslims concern about the source of medicine and the halalness of its component begins from the beginning of Islam message. Many hadith books (books that contain the Sunnah of the prophet) contain special chapters called medicine chapter; these chapters include the prophet instructions regarding health and prohibited materials in medicine and also the materia medica which prescribed or used by the prophet.

Medicines in Arabia were simples and the main prohibited material was using the Khamar in medicine (alcoholic drinks). Using different parts from animals start to get into the Islamic civilization from the interaction with the Roman's materia medica. Muslims scholars started to study the opinion of use these parts from dead, makrooh and prohibited animals and produce different fatwa about this new issues to Islamic fiqh. Muslim pharmacists start search for alternatives for the suspected and prohibited materials; which lead them to replace or substitute these materials this help in improving the compounding techniques which improve pharmacy in general (Al-Fakii, 1995).

Due to the development in pharmacy many biological medicines are introduced and the majority of these drugs or excipients are not halal. The truth that all biological and the majority of active ingredients are made in non Islamic countries. These countries do not know and or have no regard on the halalness of the medicines (IOMS, 1995). The concern about halal medicines and pharmaceuticals are still in the beginning stage comparing to the food sector.

To the best of our knowledge, the first standard guideline for halal pharmaceuticals MS2424/ 2010 has been published in February 2011 in Malaysia (SIRIM, 2010). Prior to this a guideline of such standards was published in Brunei Darussalam that focussed the terms of reference for halal pharmaceuticals. The MS2424/2010 was revised in October 2012 as a more comprehensive version; MS2424/ 2012. It has been described as the first halal ecosystem for halal pharmaceuticals in the world ("HDC," 2013).

There is a great need to scientifically and more systematically assess different sectors of halal industry, especially the halal pharmaceuticals. Halal index (Ihsan & Ismail, 2011) is the first and only book published until now in this field. Plans to expand these reference works by the cooperation between HDC (Halal industry Development Corporation) and different Malaysian bodies and universities are underway. This plan includes producing the official guidelines for halal fatwa (JAKIM, PPUM), halal pharmacopoeia (USM), product specific halal standards (UPM), and halal professional auditing manual (USIM).

The concerns regarding halal pharmaceuticals are increasing among consumers and patients, which require more efforts from doctors, and pharmacists to answer patient's questions with regard to halal pharmaceuticals (Ismail & Ehsan, 2010). Producing different scientific reference materials suitable for doctors, pharmacists, health care providers, and factory workers will be a great service to more than one billion Muslim around the world (Ramli, Salleh, & Azmi, 2012).

This research will try to get the real size of the problem (by gathering information regard the real size of the haram and doubtful materials among pharmaceuticals). The problems related to halal pharmaceuticals have been well discussed, however, this thesis will propose standard operating procedures (SOPs) for factories, designing plan of halal pharmaceutical manufacturing and the need to write a halal pharmacopeia.

It is therefore important to prepare a comprehensive list which categorizes all pharmaceuticals according to their origin. This list may comprise of the red list that contains the haram pharmaceuticals, produced from prohibited sources, the grey list containing suspected pharmaceuticals which may be produced from both halal or haram sources and the green list containing pharmaceuticals from halal sources. This study uses drug information system methods and techniques to achieve the research objectives more accurately, effectively and timely. This will set the ground work based on which a halal pharmacopeia can be written.

## 1.3 Objectives and Scope of Research

The general objectives of this study are to:

1. To elucidate fiqh (Jurisprudence) for pharmaceuticals as espoused in Islamic teachings and its application to the current pharmaceutical context. (Chapter 2).
2. To gather and elucidate the issues related to halal pharmaceuticals (Chapter 3).
3. To formulate halal pharmaceuticals SOPs for worker in factories and drug production. (Chapter 4)
4. To propose and formulate the halal pharmacopoeia writing plan, which includes the drug information resources needed, examples for the comprehensive lists of natural and animal derived pharmaceutical substances, and model drugs monographs. (Chapter 5)

Action plan for this study was as follows:

1. The thesis written and organized according to the objectives; each chapter in the thesis study and discuss one of the objectives mentioned above.
2. Each chapter study and discuss one topic by setting the chapter objectives, methods and information report (which take the place of results in the experimental fields).
3. The information report will contain the current situation of the topic; it is main information resources, and how to use these resources to answer different questions from consumers or professionals.
4. All supporting documents, lists and bibliographies which help researchers in this field organized at the appendix.