

ANAR FAYYAD

**Profession** : Chemist /Environmental Specialist

**Address** : Chemistry Department/University of Jordan

Office Tel : + 962 6 5355000/22154

Office Telefax :+962 6 5160528

Home Telefax : +962 6 5154561

Mobile: +962796001115

P.O.Box 13797

Amman 11942- Jordan

e-mail: [m.fayyad@ju.edu.jo](mailto:m.fayyad@ju.edu.jo)

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**Key Qualification** :

Manar Fayyad is a Professor of Analytical and Inorganic Chemistry at the University of Jordan since 1978 to present. Her specialization is in Inorganic / Analytical Chemistry and Water Quality.

She was the director of the “Water and Environment Research and Study Center at the University of Jordan” from 1999-2007.

Her research interests lie in the areas of water quality, environmental pollution, and monitoring studies in the field of water, soil, wastewater treatment and reuse.

She was a member of the Higher Education Accreditation Council/ Ministry of Higher Education.

She is a member of the higher committee for Water Quality in Jordan/Ministry of Water and Irrigation.

She was a member for the water policy team who worked for the water quality conservation project funded by USAID.

Dr. Fayyad was a member in the “ National Selection Committee” for Global Environmental Facility Projects (small grants program/UNDP) in Jordan for seven years.

She was the Technical assesor for the accreditation of LEMA water quality labs.

She was the Jordanian coordinator of the USAID funded program “Skills Enhancement and Support to Decision-Makers in Jordan’s Water Sector”, funded by USAID and was carried out in collaboration with Washington State University, Purdue University, Hashemite University and Jordan University for Science and Technology.

She is the Jordanian coordinator of the bicultural master program on “Integrated water resources management”, executed in collaboration with Cologne University in Germany and funded by DAAD.

Also she is coordinating for the fourth year the training program on “Transboundary water management in the MENA Region” funded by the Swedish International Water Institut in Sweden.

She is the Regional Coordinator of the Futrure Water Leaders Program, component of the Blue Revolution Project funded by USAID.

For the time being she is a member of the board of the “ Scientific Research Fund” at the Ministry of Higher Education

Dr. Fayyad is involved in preparation and excution of Water and Environment related projects funded by national and international agencies including UNDP, US-AID, CIDA, SIDA, and EU.

Dr. Fayyad supervised more than 70 graduate students in the master and Ph.D. levels.

### **Education :**

Ph.D. Chemistry: University of Bonn-Germany 1978

M.Sc. Chemistry: University of Jordan 1974

B.Sc. Chemistry: University of Jordan 1972

### **Professional Experience:**

1978 till present : Professor of Analytical and Inorganic Chemistry,  
Chemistry Department, University of Jordan.

1999 till 2007: Director of Water and Environmnet Research and  
Study Center / University of Jordan.

1992-1999: Deputy director of Water and Environment Research and Study Center/ Lab Director.

1998-1999: Staff member at the Chemistry Department/ Applied Science University (Sabbatical year).

1993-1994: Staff member at the Chemistry Department at the Applied Science University (Sabbatical year)

### **Projects and Studies :**

She participated in coordination and execution of the following projects:

1. EU funded project within Avicenne initiative on “Water Resources Management in Urban and Semi-Urban Areas of the Mediterranean Region“ in collaboration with the Center for Research and Documentation-Rome, Water and Environment Research and Study Center(WERSC)-University of Jordan, Netherlands, and Morocco.
2. BIOSYSWAT project on “A System Approach to Wastewater Biotreatment for the Protection of Mediterranean Coastal Areas (BIOWATSYS)” funded by EU/DG XII B through INCO-DC initiative with participating institutes from Jordan (WERSC), Italy, Greece, Morocco, and Egypt. The project aims at using and testing low cost technologies for wastewater treatment through constructed wetland.
3. Using duckweed in wastewater treatment in collaboration with the Water Authority of Jordan . The project was funded from the Canadian International Development Agency (CIDA) from 1/7/96 for two years to study the possibility of using duckweed in further purification of treated wastewater.
4. The study of the effect of the treated wastewater plant on water resources in Kufrinja basin, and Tafeilah basin, funded by the

General Association for Environment Protection from 1/9/96 for 14 months. The purpose is to evaluate the springs of Kufrinja basins on qualitative and quantitative basis, to study the effect of treated wastewater plants on the quality of the basin water.

5. Collaboration with Washington State University, funded from USAID/University Development Linkages Program (UDLP) for 5 years from 1/10/92 and the project was extended for another year. The project aims at improving the management of the natural resources in Jordan and Washington State through cooperation in applied research, technology transfer, and graduate education funded by USAID.
6. Long-term Studies on Water Conservation and Management in Arid and SemiArid Regions (Al-Azraq Oasis Project) (1994-1997). This is a joint project involving the Ministry of Water and Irrigation, Ministry of Rural Affairs and Environment, Royal Society for the Conservation of Nature, and WERSC. The project has five components. WERSC was responsible for the component of the project that is related to enhancing groundwater artificial recharge by building desert dams and Gabions. Groundwater modeling and guidelines for water harvesting were developed. The project was funded by the United Nations Development Programme (UNDP) (Global Environmental Facility).
7. Purification and Reuse of Domestic Wastewater Using Low Cost Eco-Bi Technological Methods (1995-1998). Project goals were the optimization of design and construction of low cost Upflow Anaerobic Sludge Blanket reactors for anaerobic treatment of domestic wastewater in Jordan. Participants in the project were: Wageningen Agricultural University/The Netherlands, University of Valladolid/Spain, National Research Center/Egypt , Hebron University/WestBank, and WERSC/Jordan . The project was funded by the EC.
8. Removing Helminths from Wastewater by Using Solar Radiation, funded by EC through Avicenne Initiative for three years starting 1/1/95 and in collaboration with the Water Authority and the involvement of British Wallingford Institution, Portugal Ministry of Construction, and Tunisian Center for Water and Forestry. The

project aimed at testing methods for disposal of infectious germs and parasites from wastewater using solar energy.

She coordinated and worked on the following projects:

1. The Sail-Op project on' Capacity Building on Wastewater Valorization for Agricultural Production in the Middle East Area by using low cost technologies funded by the Dutch government. The project started in 1997 and was planned to finish in 2001 and was extended till 2004.
2. Development of Cost Effective Reclamation for Domestic Wastewater and the Appropriate Agricultural Use of Treated Effluent Under Semi-arid Climate Conditions. The project was funded by EU INCO-MED initiative and was carried out in cooperation with Wageningin University/Holland ,the National Research Center /Egypt, Beir Zeit University/Palestine, and Crete University. The project started in 1999 for three years.
3. Skills Enhancement and Support to Decision-Makers in Jordan's Water Sector, funded by USAID and is carried out in collaboration with Washington State University, Purdue University, Hashemite University and Jordan University for Science and Technology. The project involves preparation and delivery of training material in different water areas. Fifty different courses were delivered. Beside the training component, the project also involves evaluation of Zara/Maen waters in the Jordan valley for potential use for drinking purposes. The project started in March 2000, and was finished in 2005.
4. Water Resources Management under Drought Conditions: Criteria and Tools for Conjunctive Use of Conventional and Marginal Waters in Mediterranean Regions. Funded by the

EU, started 1997 and continued for three years. This Project was carried out in collaboration with Catania University/Italy, Ground Water Research Center /Egypt. Ministry of Agriculture/Cyprus.

5. Fate of disinfectants and their by-products in the Drinking Water Distribution Systems. The project is funded by the Higher Council of Science and Technology/Jordan . The duration of the project was two years.
6. Evaluation of Contamination with Organochlorine Pesticides in the Jordan Valley. Funded by the General Corporation for Environmental Protection. The project is extended on yearly basis.
7. Mediterranean Development of innovative Technologies for Integrated Water Management, Meditate, funded by the EU started May, 2004 continued for four years. The project is carried out in collaboration of the WERSC with Montpellier University/France, Cranfield University/England, St. Joseph University/Lebanon.
8. Coordinator of the Master program in integrated water resource management with Cologne University funded by Ministry of International Development in Germany, started 2006 and is still on-going.
9. Coordinating the International program on Integrated Management of Transboundary Water Resources for the MENA Region, In collaboration with SIDA, on-going.
10. Regional coordinator of the Future Water Leaders Program, component of the Blue Revolution Project funded by USAID, started 2007 and finished in 2009.

## **Scientific Publications :**

1. M.Fayyad, M. Tutunji, R. Krishna, and Z. Taha, "Simple rapid method for the determination of dissolved oxygen by potentiometric stripping analysis", *Analyst*, vol. 111, 471 (1986).
2. M.Fayyad, "Indirect trace determination of nitrilotriacetic acid in water by potentiometric stripping analysis", *Analytical Chemistry* vol. 59, 209, 1987.
3. M.Fayyad, M. Tutunji, R. Krishna, and Z. Taha, "Dissolved oxygen: Method comparison with potentiometric stripping analysis", *Analytical Letter*, 20(4), 529, (1987).
4. M.Fayyad, M. Tutunji, and Z. Taha, "Indirect trace determination of ethylenediaminetetracetic acid (EDTA) in water by potentiometric stripping analysis", *Analytical Letters*, 21(8), 1425, (1988).
5. M.Fayyad, M. Alawi, and T. El-Ahmed, "High performance liquid chromatographic determination of phenoxyalkonic acid herbicides using iron (II) 1,10-phenanthroline as a mobile phase additive; *Journal of Chromatography*, 481, 439, (1989).
6. M.Fayyad, M. Alawi, and T. El-Ahmed, "HPLC determination of the phenolic metabolites of phenoxy alkonic acid herbicides ", *Chromatographia*, Vol. 28, No. 9/10, 465, 1989.
7. M.Fayyad, M. Alawi, and I. Issa, "Differential pulse polarographic determination of organochlorine pesticides; *Analytical Letters*, 22(8), 1939, 1989.
8. M.Fayyad, "Determination of the dissociation potentials of metal complexes using flow injection potentiometric stripping analysis ", *Electroanalysis*, 2, 631, 1990.
9. M. Alawi, M. Fayyad, M. , and Issa I. , "A preliminary study of some organochlorine pesticides in the environment of the Jordan Valley, *Dirasat*, series B, Vol. 17, No.2, 83, 1990.
10. Fayyad, M., M., Tutunji, and L. Abdelnour, "Determination of phenols in water using the 4-Aminoantipyrine method", *Dirasat*, vol.X, No. 2, 107, 1983.

11. L.Abdelnour, M. Fayyad, and M. Tutunji, "Hydrochemical pollution of the Amman-Zarqa basin", *Dirasat*, vol. XII, No. 7, 27, 1985.
12. M. Tutunji, M.Fayyad, and L. Abdelnour, "Chemical studies of the quality of industrial wastewater along the Zarqa River", *Dirasat*, vol.XIII, No. 7, 167, 1986.
13. F.Khalili, and M. Fayyad, "Determination of bromide in Jordanian table salt by the chloramine-T method ", *Dirasat*, vol. XIII, No. 7, 179, 1989.
14. M.Fayyad, H. Holdali, and S. Al-Khatib " Determination of stability constants of bis(biacetyl monoxime) ethylenediamine and its o-methyl ether derivative with Pb(II) and Cd(II) using differential pulse anodic stripping voltammetry", *Asian Journal of Chemistry*, vol. 5, No.2, 421, 1993.
15. M.Fayyad, and K. Abu-Dari, "Determination of stability constants of N-methyl thioacetohydroxamic acid with lead(II) and cadmium(II) using differential pulse polarography", *Fresenius Environmental Bulletin* 2, 717, 1993.
16. T.Abu Sharar, M. Fayyad, and M. Zorba, "Distribution of N, Fe, and Mn ionic species in a treated sewage water system", *Journal of Environmental Geochemistry and Health*, vol. 16, 341, 1994.
17. M.Shatanawi. M, Nakshabandi. G, M.Fayyad., H Horani., and M. Saqqar, Experimental field studies on the use of As-Samra treated wastewater for irrigation in Jordan- Phase I. *Abhath Al-Yarmouk*, 5, 197, 1996.
18. T.Abu Sharar. K, Mashal, and M. Fayyad. Cadmium adsorption isotherm into clay separates of a Yermic Cambisol soil from central Jordan Valley. *Arid Soil Research and Rehabilitation*, 11, 23-34, 1997.
19. M.Shatanawi. M, Fayyad, Effect of Khirbet As- Samra treated effluent on the quality of irrigation water in the central Jordan Valley. *Water Research*, Vol. 30, No. 12, 2915- 2920, 1996.
20. M.Fayyad, Adsorption of O- chlorophenol into spent oil shale. *Fresenius Environmental Bulletin*, 5, 301- 307, 1996.

21. F.Esmadi, Fayyad. M. Reaction of sulfur dioxide with Halocarbonyls of Rhodium and Iridium. Synthesis and Reactivity in Inorganic Chemistry and Metal Organic Chemistry, 6, 1995.
22. G.Al-Nakshabandi, M. Saqqar, M. Shatanawi, M, Fayyad M, H. Al-Horani H, Some Environmental Problems Associated with the Use of Treated Wastewater for Irrigation in Jordan. Agricultural Water Management,34, 81-94,1996.
23. O.Rimawi, M.Shatanawi, and M. Fayyad, Effect of Ruseifa Landfill on Ground water. Abhath Al- Yarmouk, Vol. 8, No.1 , 73-92, 1999.
24. M.Fayyad, S. Oran, and M. Shatanawi , Use of Duckweed for Wastewater Treatment of Khirbet As-samra/ Jordan. Conference on “Options for Closed Water Systems”, Wageningen, The Netherlands, 1998.
25. M.Fayyad, A.Al-Sheikh,. Determination of N-Chloroamines in As-Samra Chlorinated Wastewater and their Effect on the Disinfection Process. Water Research, vol.35,pp1304-1310,2001.
26. Wendy Saunders, Grietje Zeeman, Rashed Al-Sa’ed, Manar Fayyad, Ghada Kassab, Andreas Angelakis, Fatma ElGohary, and Jules van Lier, Development of cost-effective reclamation technologies for domestic wastewater and the appropriate use of the treated effluent under semi arid conditions, Inco-Med Water Conference ,Amman,June,2001.
27. Ernst-Jan Martjin, Frans Huibers, Manar Fayyad, Ghada Kassab, Andreas Angelakis, and Jules van Lier, Appropriate agricultural use of treated effluent under semi-arid climate conditions, Inco-Med Water Conference, Amman, June,2001.
28. Abbass Al-Omari and Manar Fayyad,Treatment of domestic wastewater by subsurface flow constructed wetlands in Jordan, Desalination,vol 155, pp27- 39,2003.
- 29.O.Al-Lahham, Najib ElAssi, and Manar Fayyad, Impact of treated wastewater irrigation on quality attributes and contamination of tomato fruit. Agricultural Water Management, vol 61,pp51-62, 2003.
29. Halalsheh, M., Koppes, J., Den Elzen, J., Zeeman, G., Fayyad, M. and Lettinga, G., Effect of SRT and Temperature on Biological conversion and the related scum forming potential.

- Proceedings to the 9<sup>th</sup> world congress on Anaerobic Digestion, 2001.
30. Halalsheh, Z. Sawajneh, M. Zu'bi, M., G. Zeeman., J. Lier., M. Fayyad, and G. Lettinga. Treatment of Strong Domestic Sewage in a 96 m<sup>3</sup> UASB reactor operated at ambient temperatures. Two stage versus one stage UASB reactors. *Bioresource Technology* (96)577-585,2005.
  31. Halalsheh, M., Koppes, J., den Elzen, J., Zeeman, G., Fayyad, M. and Lettinga, G. Effect of SRT and temperature on biological conversions and the related scum forming potential. *Water research*, 39(2005)2475-2482.
  32. Halalsheh, M., Smit, T., Kerstens, S., Tissingh, J., Zeeman, G., Fayyad, M., and Lettinga, G. (2004). Characteristics and anaerobic biodegradation of sewage in Jordan. Proceedings of the 10<sup>th</sup> IWA Anaerobic digestion conference in Montreal, Canada between 28<sup>th</sup> August and 2<sup>nd</sup> September, 2004.
  33. Halalsheh M., Kerstens S., Zeeman, G., Lier, J., Fayyad, M., and Lettinga, G. (2004). Treatment of Domestic Sewage using a two stage AF/UASB system and a one stage UASB reactor. In proceedings of the 10<sup>th</sup> IWA Anaerobic digestion conference in Montreal between 28<sup>th</sup> August and 2<sup>nd</sup> September, 2004.
  34. Halalsheh M., Kerstens S., Zeeman, G., Lier, J., Fayyad, M., and Lettinga, G. (2004). Treatment of strong domestic sewage using a two stage AF/UASB system and a conventional UASB reactor: In proceedings of the 10<sup>th</sup> IWA Anaerobic digestion conference in Montreal between 28<sup>th</sup> August and 2<sup>nd</sup> September, 2004.
  35. Abbass Al-omari, Manar Fayyad and Abed AbdelAlqader. Modeling trihalomethane formation for Jabal Amman water supply in Jordan. *Environmental Modeling and Assessment* 9:245-252(2004).
  36. Abbass Al-Omari, Manar Fayyad and Aseel Al-Nimer, Modelling chlorine residuals at jabal Amman water supply. *Journal of Water Supply: Research and Technology-aqua*, vol 53 No.5 p351-358(2004).
  37. Abed Abdel Qader, Abbass Al-Omari, and Manar Fayyad ,Modelling of Trihalomethane formation in Jabal Amman

- Drinking Water Network, Dirasat, Pure Sciences, Volume 33, No.1,2006.
38. Sana Al-Aqqad, Mahmoud Alawi, and Manar Fayyad, Persistent Organic Pollutants(POPS) in Jordanian Mother's Milk from the Surroundings of Landfill Site at marka. Fresenius Environmental Bulletin :vol15-No.2,(118-124),2006.
  39. Abed Abed Qader,Abbass Al-Omari, and Manar Fayyad, Mathematical Modeling of the Different Trihalomethane Species for Zai Water treatment Plant, Dirasat,Pure Sciences, vol.33, No. 1, 2006.
  40. Kassab G., Alnaimat H., Mateo-Sagast J., Klapwijk A., Van Lier J.B., and Fayyad M. ,Adjusting Nitrogen Concentrations to Agricultural Demand in a UASB Reactor for Sewage Treatment, Proceedings of the 11<sup>th</sup> IWA Anaerobic digestion conference in Uruguay October,2005
  41. Kamal A.Sweidan and Manar K.Fayyad, Use of Duckweeds for removal of Heavy Metals and Organic Pollutants from Wastewater in AS-Samra, Fresenius Environmental Bulletin , vol. 15-No.5,354-359,2006
  42. Shammout M.,Oran S. ,and Fayyad M., The application of duckweed (Lemna SP.) in wastewater treatment in Jordan; International Journal of Environmental Technology and Management, vol.33, No.1, p110-120,2008
  43. Amal F. Al-Aboudi, Manar K. Fayyad, Musa H. Abu Zarga, Polarographic study of the complexation between the chemical constituents of Phragmitis Australis and heavy metals , Fresenius Environmental Bulletin vol.15, No. 10, 1271- 1275,2006.
  44. Halalsheh, M Kassab G., and Fayyad, M. Uses of treated sludge in agriculture: Organic pollutants perspective. Proceedings to the first international conference on sustainable urban wastewater treatment and reuse (SUWTR). September,15-16. Nicosia, Cyprus, 2005.

45. Manar Fayyad and Mohammed Alkhatib, Wastewater Reclamation in Jordan: an option or a must?, Water Intelligence Online © IWA Publishing 2002 .
46. A.A. Shehabi - J.F. Odeh - M. Fayyad ,Characterization of Antimicrobial Resistance and Class1 Integrons Found in *Escherichia coli* Isolates from Human Stools and Drinking Water Sources in Jordan, Journal of Chemotherapy, Vol. 18 - no. 5 (468-472) 2006.
47. O.Al-Lahamm, N.M.El Assi, M.Fayyad, Translocation of heavy metals to tomato (*Solanum lycopersicom* L.) fruit irrigated with treated waste water,Scientia Horticulturae, 113, p250-254,2007.
49. Michael Barber, Frank Loge, Abbas Al-Omari, and Manar Fayyad ,Water Quality and Quantity in Jordan's Dead Sea Wadis, Water International, Vol.33,No.3,p369-379,2008.
50. M. Barber, C. Pannkuk, M. Fayyad, A. Al-Omari, "Capacity Building within the Ministry of Water and Irrigation in Amman, Jordan: Successes, Failures, and Lessons Learned," Building Capacity for Future Challenges poster session, World Water Week, Stockholm , Sweden, August 2007.
51. Abbas Al-Omari, Manar Fayyad, and Ahmad Jamrah, Drinking Water Quality in Roof Storage Tanks in the City of Amman, Jordan, Water International, vol. 33, p189-201, 2008.
52. Maha Halasheh, Lina Abu Ghunmi, Nivin Al-Alami, and Manar Fayyad, Fate of Pathogens in tomato plants and soil irrigated with secondary treated wastewater, Chapter 7, p81 88"Efficient Management of Wastewater, Its Treatment and Reuse in Water-Scarce Countries, a book by Al-Baz etal, published by Springer –Verlag Berlin Heidelberg ,2008.
53. Ayat Bozeyya, Abeer Al-Bawab, and Manar Fayyad , Method Development for Analysis of Linear and Branched Alkyl

Benzene Sulfonates , Fresenius Environmental Bulletin, vol 18, No. 5, p590-600 (2009).

54. Othman Al-Musaimi, Manar Fayyad, and Adel Mishal, Novel Liquid Chromatographic Determination of Cystatin C in Human Urine, Journal of Chromatography B, p747-750, 877 (2009).

55. Mohammad Alrajoula, Maha Halalsheh, and Manar Fayyad, Anaerobic filter for polishing effluent of UASB reactor treating strong sewage at  $23^{\circ}\text{C}$ , Water Science and Technology, 59:10, 1975-1198(2009).

56. L.Abu Ghunmi, G. Zeeman, M. Fayyad, J.van Lier, Grey water treatment systems: A review. Critical Review in environmental Science and technology. (accepted).

58. L.Abu Ghunmi, G. Zeeman, M. Fayyad, J.van Lier, Quantitative and qualitative characteristics of grey water for reuse requirements and treatment alternatives: the case of Jordan. Water Science and Technology 58 (7), 1385-1396( 2008).

59. L.Abu Ghunmi, G. Zeeman, M. Fayyad, J.van Lier, Anaerobic treatment as a core technology for energy, nutrients and water recovery from source separated domestic waste water, Water Science and Technology, 57(8), 1207-1212 ( 2008).

60. L.Abu Ghunmi, G. Zeeman, M. Fayyad, J.van Lier, Grey water treatment in a sequencing anaerobic-aerobic system for irrigation, Bioresource Technology 101(1),41-50 (2010).

61. Reham Mahmoud Abu Shmeis, Manar Fayyad, Mahmoud Alawi, Predicting the Formation of Trihalomethanes and Haloacetic Acids in Water Treated with Chlorine Dioxide, Water Science and Technology 9-4,449-458(2009).

62. G. Kassab, M. Halalsheh, A. Klapwijk, M. Fayyad, J.B. van Lier ,. Sequential anaerobic–aerobic treatment for domestic wastewater – A review, *Bioresource Technology*, 101, 3299–3310, 2010

63. Reham Abu Shmeis, Manar Fayyad, Mahmoud Alawi, Disinfection Efficiency and Formation of Disinfection Byproducts in Jordanian Drinking Water Treated with Chlorine Dioxide, *Jordan Journal of Chemistry*, vol. 5, no. 1, 2010

64. Maha Mohammad Halalsheh, Hanan Noaimat, Haifa Yazajeen, Joel Cuello, Bob Freitas, Manar Fayyad, Seasonal septage characterization in Jordan, *Environmental monitoring and assesment*, DOI 10.1007/s , 10661-010-1344-4, 2010.

### **Training Material :**

1. Developed the Training course: Quality Control/ Quality Assurance in analysis. Submitted to Development Alternatives, Inc. (DAI). Ministry of Water and Irrigation, Nov. 1995.
2. Developed the training course : Dealing with International Agencies. Submitted to Development Alternatives Inc. (DAI). Ministry of Water and Irrigation, Nov. 1995.
3. Developed training course on” Characterization and analysis of physical and chemical parameters for Drinking water.

### **Books :**

1. Translation of a text book in Inorganic Chemistry into Arabic : (2 volumes) *Inorganic Chemistry / Reactivity and Structure* by J. Huheey. Manar Fayyad and Hamdallah Hodali.
2. *Analytical Chemistry / Natural Science Program* Al- Quds Open University, 1993.

3. Analytical Chemistry / Education Program. Manar Fayyad and Muhammad Zugul. Al- Quds Open University, 1994.
4. Participation in Preparing a Chemistry text book for high School. Ministry of Education, 1995.
5. Chemistry of the Elements/Natural Science Program, Al-Quds Open Univ., 2000.
6. Translation of Canadian Handbook on Health Impact Assessment, CEHA, WHO, 2005.
7. Conservation of water in the Gulf Region, a book prepared for the Arab Trust Fund, 2006.
8. Drinking Water Disinfectants, a book written in Arabic, University of Jordan, submitted 2009.

