السيرة الذاتية

الأستاذ الدكتور ضياء واجد عبود

١- العنوان:

- العنوان البريدي: قسم الهندسة المدنية / كلية الهندسة / الجامعة المستنصرية
ص. ب. ١٤١٥٠ / بغداد / العراق

- موبايل: ٠٧٩٠١٧٥٩٣٤١
٠٧٧١٢٥٠٥٧٧٦
٠٧٨٠٦١٣٦٢٣٥

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٢- المعلومات الشخصية:

- تاريخ الولادة: آب / ١٩٦١.
- محل الولادة: البصرة / العراق.
- القومية: عربي.
- الحالة الزوجية: متزوج.

٣- المستوى التعليمي:

- بكلوريوس هندسة ميكانيكية / كلية الهندسة / جامعة بغداد / ١٩٧٨ – ١٩٨٢.
- ماجستير هندسة ميكانيكية (طاقة) / كلية الهندسة / جامعة بغداد / ١٩٨٤ – ١٩٨٦.
- دكتوراه هندسة هيدروليك البيئة / كلية الهندسة / الجامعة المستنصرية / ٢٠٠٢ – ٢٠٠٥.
- ٤ شهادات بحثية بعد الدكتوراه/ جامعة فلوريدا الدولية FIU 2012.

٤- السجل الوظيفي:

- مساعد باحث علمي / مجلس الوزراء / مجلس البحث العلمي للفترة (١٩٨٣ – ١٩٨٦).
- مسؤول مختبرات العمارة والبيئة / مركز بحوث البناء.
- رئيس وحدة التصاميم الحرارية لمنظومات مجمعات التخصيب والبطانات / منظمة الطاقة الذرية العراقية للفترة (١٩٨٦ – ١٩٨٩).
- أستاذ جامعي / كلية الهندسة / الجامعة المستنصرية للفترة (١٩٨٩ – ولحد الآن).
- استشاري لدائرة الشؤون العلمية في مجال الطاقة وترشيد الاستهلاك للفترة (١٩٩٢ – ١٩٩٥).
- استشاري لوزراة الصناعة / ترشيد استهلاك الطاقة في المصانع للفترة (١٩٩٥ – ١٩٩٨).
- استشاري لهيئة الكهرباء / ترشيد استهلاك الكهرباء والحد من التلوث للفترة (١٩٩٨ – ٢٠٠٣).
- الإشراف على البحوث العلمية لطلبة الماجستير والدكتوراه.
- مناقشة رسائل وأطاريح الطلبة لنيل شهادات الماجستير والدكتوراه.
- مقيّم علمي لمجلات عالمية متخصصة.

٥- النشاطات الجامعية:

- ❖ تدريس أقسام المدني، الميكانيك، الكهرباء والبيئة بالدوام الصباحي والمسائي: (الموائع، انتقال الحرارة، ديناميك الحرارة، التحليلات الهندسية ،المنشأت الهايدروليكية، شبكات المياه، الرياضيات، هايدروليك البيئة، وتلوث المياه).
- ❖ تدريس الدراسات العليا (الماجستير والدكتوراه).
- ❖ الإشراف على طلبة الماجستير والدكتوراه في قسم المدني والبيئة ومنهم:
  - ➢ أياد صليبي مصطفى / دكتوراه هندسة هايدروليك / الجامعة المستنصرية
  - ➢ محمد ابراهيم بشير / دكتوراه هندسة هايدروليك / الجامعة المستنصرية
  - ➢ أحمد حسون / دكتوراه هندسة بيئة / جامعة بغداد
  - ➢ هدى طارق حمد / دكتوراه هندسة هايدروليك / الجامعة المستنصرية
  - ➢ حنان حسن عبود / دكتوراه هندسة هايدروليك / الجامعة المستنصرية
  - ➢ مي سمير صالح / دكتوراه هندسة هايدروليك / الجامعة المستنصرية
  - ➢ حيدر علي مهدي / دكتوراه هندسة هايدروليك / الجامعة المستنصرية
  - ➢ عامر حسن / دكتوراه هندسة هايدروليك / الجامعة المستنصرية
  - ➢ سلام جمعة جياد / ماجستير هندسة مدنية / الجامعة المستنصرية
  - ➢ علي احمد علي / ماجستير هندسة بيئة / الجامعة التكنولوجية
  - ➢ اعتزاز عويد جاسم / ماجستير هندسة بيئة / الجامعة المستنصرية
  - ➢ ريام حامد صبري / ماجستير هندسة بيئة / الجامعة المستنصرية
  - ➢ هديل عامر حسن / ماجستير هندسة بيئة / الجامعة المستنصرية
  - ➢ يوسف عبد المجيد / ماجستير هندسة بيئة / الجامعة المستنصرية
  - ➢ اسراء قاسم / ماجستير هندسة بيئة / الجامعة المستنصرية
- ❖ المساهمة في أيام الحصار في صيانة وتأهيل أبنية الكلية.
- ❖ تصميم وتنفيذ شبكة مياه الكلية.
- ❖ تأهيل وإعادة عمل مختبر الهايدروليك الذي تعرض للنهب والسلب.
- ❖ إنشاء مركز مقترح لبحوث البيئة والمياه والطاقة.
- ❖ إنشاء مختبر للدراسات العليا والبحوث.
- ❖ المساهمة في دورات التعليم المستمر في:
  - ➢ تصميم شبكات المياه للمدن.
  - ➢ التصاميم الاقتصادية لمنظومات التدفئة والتبريد.
  - ➢ صيانة المنظومات الهايدروليكية
  - ➢ تلوث الأنهار ووسائل الحد منها.
  - ➢ المنظومات الجديدة في الطمر الصحي.
  - ➢ انتاج المواد الصديقة للبيئة من الفضلات الصلبة.
  - ➢ تصميم منظومات معالجة مياه الفضلات االطبية باستخدام الأغشية.
  - ➢ تقنيات معالجة مياه فضلات المصافي والمنتجات النفطية.
  - ➢ ترشيد استهلاك المياه المنزلية باستخدام المياه الرمادي.
  - ➢ أساليب تحسين نوعية المياه الهامشية.

٦- الاشراف البحثي

- الإشراف على عدد كبير من تدريسيي الكلية بلقب مدرس في إجراء بحوث الترقية لمرتبة أستاذ مساعد، ومنهم:
  ١. عوض عويد عجيل — قسم هندسة الطرق والنقل
  ٢. لؤي خليل سلمان — =
- الإشراف على عدد كبير من تدريسيي الكلية بلقب مدرس مساعد في إجراء بحوث الترقية لمرتبة مدرس، ومنهم:

١. د. اسماء حسين	قسم الهندسة المدنية
٢. عامر حسن	=
٣. سناء عاجل	=
٤. هدى مهدي	=
٥. مي سمير	=
٦. مهند وليد	=
٧. شيرين فاضل	=
٨. واقد حميد	=
٩. ذو الفقار رزاق	=
١٠. صالح جعفر	=
١١. مهند صالح	=
١٢. حنان حسن	=
١٣. صائب فرمان	=
١٤. د.كريم رشيد	قسم هندسة البيئة
١٥. ياسر طالب	=
١٦. سرور عطاالله	=
١٧. صفاء ناصر	=
١٨. إيمان عبد	=
١٩. هدى طارق	=
٢٠. هادي غالي	=
٢١. حيدر علي	=
٢٢. زيدون ناجي	=
٢٣. سهى إبراهيم	=
٢٤. ختام عبد الحسين	=
٢٥. محمد ابراهيم	=
٢٦. نداء عادل	قسم هندسة الطرق والنقل
٢٧. توفيق كاظم	قسم هندسة المواد

٧- الدورات التدريبية في العراق

- التصميم المناخي للأبنية / مجلس البحث العلمي قسم العمارة والبيئة.
- التقنيات الحديثة في تدفئة وتبريد الأبنية / مجلس البحث العلمي مركز بحوث البناء.
- دراسة الجدوى الاقتصادية للمشاريع الصناعية / وزارة التخطيط.
- نظم وإدارة المشاريع الصناعية / وزارة الصناعة والمعادن.
- استخدام الفروقات المحددة في حسابات الاجهادات الحرارية / منظمة الطاقة الذرية العراقية.
- طرق الوقاية من الاشعاع وطرق السلامة الصناعية / منظمة الطاقة الذرية العراقية.
- طرائق التدريس / وزارة التعليم العالي والبحث العلمي.
- استخدام البرامجيات الهندسية / وزارة التعليم العالي والبحث العلمي.

٨- ورش العمل خارج العراق

- البحث العلمي للشبكة المعلومات الافتراضية / الشارقة / الامارات العربية المتحدة / ٢٠٠١.
- اعادة اعمار العراق / عمان/ الأردن / ٢٠٠٥.
- الطاقة والبيئة ووسائل انتاج الطاقة النظيفة / القاهرة / مصر / ٢٠٠٨.
- استخدام منظومة المعلومات الجغرافية في حوض مياه دجلة والفرات / حلب/ سوريا / ٢٠١٠.

٩- بعض من الخدمات الاستشارية

- تصميم شبكة مياه الناصرية.
- تقييم الأداء الصناعي لمعمل نسيج الناصرية.
- دراسة التلوث البيئي لمعمل الانسجة الصوفية في بغداد.
- دراسة واقع المياه والطاقة والبيئة لمعمل النسيج القطني في الموصل.
- دراسة ترشيد الطاقة الكهربائية وتحسين الاداء الصناعي لمعمل الحديد والصلب في البصرة.
- دراسة تاهيل الصناعات النسيجية في الحلة.
- تصميم منظومة معالجة المياه الناتجة من معمل النسيج القطني في بغداد.
- تصميم المسبح الاولمبي في ديالى.
- تصميم سد جم كاني ماران في كركوك.
- دراسة الاداء الصناعي وكفاءة استخدام الطاقة الكهربائية في معمل الملابس الجاهزة في النجف.
- دراسة تلوث نهر دجلة في بغداد.
- دراسة المخلفات الطبية لمجمع مدينة الطب في الرصافة في مدينة بغداد.
- دراسة الفضلات الصلبة لمدينة بغداد.
- المساهمة في تصميم شبكة مياه الرصافة.
- المشاركة في تاهيل كوادر محطة معالجة مياه الفضلات في الرستمية .
- دراسة تاهيل محطة معالجة مياه الفضلات لمستشفى الاطفال والولادة في بابل.
- دراسة واقع مياه الفضلات في مستشفى الجراحي العام ومستشفى مرجان في بابل.
- تصميم مشروع الطمر الصحي فيي الكوت.
- مراجعة وتدقيق المخططات والتصاميم المعمارية لمشروع دار الحنان للرعاية الخاصة في العامرية.
- مراجعة وتدقيق المخططات والتصاميم المعمارية لمشروع حضانة الأطفال في الحلة.
- مراجعة وتدقيق المخططات والتصاميم المعمارية لمشروع بناية معهد النور لرعاية المكفوفين في السماوة.
- تقييم بنايات دور إيواء المسنين في الرشاد / بغداد.

١٠- بعض البحوث المنشورة:

1. Effect of amount and position of thermal insulation on the roofs in Baghdad. Scientific research council, Baghdad, Iraq, 1985.
2. Experimental modeling of thermal pollution in the Tigris in Baghdad. Iraqi atomic commission, Baghdad, Iraq, 1986.
3. Effect of Thermal insulation on roofs on inside air temperature. XIV IAHS World congress on hosing, Berlin, October 13-17,1987
4. Experimental study of passive system in Baghdad .IV IAHS World congress on hosing, Singapore, December 9-11,1987
5. An Experimental Investigation of Production Thermal Insulation for Building Roofing Tiles. Jordan, Amman, October, 2001.
6. Crises of Water in Arab Homeland in Present and Future. Jordan, Amman, 2001.
7. Mathematical Modeling of Water Crises.19 – 20 march, Water resource, Baghdad. 2001

8. Conservation of water in building. The second symposium on scientific Research Technology development in the Arab world 24th – 27th March, Sharjah UAE. 2002.
9. Saving Water and Energy Consumption in Baghdad. Ministry of industry Symposium, Baghdad, 2002.
10. Production of Thermal Insulation Materials Using Industrial Waste. 4th International Chemical Engineering Conference, Jordan, Amman, 22-24 September. 2002.
11. Hydrodynamic Modeling of Porous Media, Pilot Study: Water Filter.
12. Hydrodynamic Modeling of Porous Media /2-Experimental model.
13. Gray Water Use in Buildings in Baghdad. Jordan, Amman, 2006.
14. Dhia, W. (2006)" Scientific Seminar with Advanced Technology 2.Water Purification and Environmental Remediation".25th - 29th June, Jordan Amman, 2006.
15. Mathematical Model of Submerged Biological Aerated Filter.
16. Hydrodynamic Models of Biological Filters.
17. The Effect of Hydraulic Parameters on Biofilm Thickness in Submerged Aerated Biological Filter. RecShow '08, Middle East Waste and Environmental Management Congress, Kempinski Ishtar Dead Sea Hotel, Feb. 17 -19, 2008.
18. Mathematical model of fixed growth biological systems. Iraq, Baghdad, 2006.
19. Hazardous Waste Characteristics in Baghdad Pilot Study: Hospital Waste. The RecShow '08 Conference, Kempinski Ishtar Hotel Dead Sea on February 17th – 19th, 2008.
20. Wars and sanctions effects on solid waste generated in Baghdad. "Waste, Environment and Health "Aula Magna, Palazzo Bo, Padua, Italy, June 4th -5th, 2008.
21. Characteristics and Compositions of Solid Waste in Baghdad. Venice, Italy, Second International Symposium on Energy from Biomass and Waste, 2008.
22. Water Tribulation in Baghdad.14th International Interdisciplinary Conference on the Environment in Edmonton, Alberta, Canada, June 30 - July 3, 2008.
23. Water War in Baghdad,19th Annual Conference of The International Environmetrics Society Kelowna, British Columbia, Canada, The University of British Columbia Okanagan, June 8-13, 2008.
24. Energy crises in Baghdad. YHTYMÄ: Globalization and Environmental Justice, 29-30 November, i Jyvaskyla Finland.
25. Improvement of gray water treatment using combination of trickling biofiltration and ozonation. Iraq, Baghdad, 2008.
26. Biofilm Characteristics and Compositions in Fluidized Porcelanite Bioreactors. The 3th International Conference of Environmental Research Division, Environmental Sciences and Technology, Cairo, Egypt, April 1-3, 2008
27. Hydrodynamic Modeling Using conductivity tracer of Fluidized Bed Bioreactor The 3th International Conference of Environmental Research Division, Environmental Sciences and Technology, Cairo, Egypt, April 1-3, 2008-10-22
28. Estimation of Hydraulic Conductivity based on Characteristics of porous Media. Case Study: Water filter. Iraq, Baghdad, 2008.
29. Effect of Biomass Growth on Pressure Drop in Submerged Biological Aerated Filters. AFM 2008, the New Forest, UK, 21 - 23 May, 2008.
30. Competitive Adsorption of Phenol and Lead from Synthetic Wastewater onto Granular Activated Carbon, Journal of Environmental Science and Engineering J.,

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31. Removal of Phenol and Lead from Synthetic Wastewater by Adsorption onto Granular Activated Carbon in Fixed Bed Adsorbers: prediction of Breakthrough Curves, Desalination and Water Treatment J., Taylor & Francis Publisher40 (2012) 244–253.
32. Reuse of Anaerobic Sludge for treating Synthetic Wastewater Containing Organic and Inorganic Pollutants in Fixed bed Adsorber, Journal of Environmental Science and Engineering J., David Publishing Company, A 1 (2012) 150-159.
33. Competitive Biosorption of phenol and lead from Synthetic Wastewater onto Live and dead microorganisms, Desalination and Water Treatment J., Taylor & Francis Publisher, 45 (2012) 331–342.
34. A Comparative Adsorption/ Biosorption for the Removal of Phenol and Lead onto Granular Activated Carbon and Dried anaerobic Sludge, Desalination and Water Treatment J., Taylor & Francis Publisher, 05 Nov (2012) 1–13
35. The Combination Effect of Night Ventilation and Thermal Insulation on Passive Cooling of Buildings in Baghdad, Journal of Energy and Power Engineering for publication. David Publishing Company, USA
36. Water Status in Baghdad, Journal of Environmental Science and Engineering, David Publishing Company, (USA) in No. 5, Vol. 1, T T2012.
37. Biological removal efficiency of Multimedia Biological Filter, Journal of Environmental Science and Engineering. David Publishing Company, (USA) in No. 6, Vol. 1, 2012.
38. Hospital Wastewater treatment Using Mixed Media Biological an Activated Carbon Reactor.
39. Hospital Wastewater Pretreatment for Biohazard Reduction.
40. Experimental Study on Properties of Lightweight Concrete Made with Plastic Waste.
41. Effect of Clay Percentage in Sandy Clay Soil on Saturated Hydraulic Conductivity
42. Evaluation the Performance of grey water treatment plant by cascade aeration and Biofiltration
43. Experimental Investigation of Hospital Wastewater treatment for Biohazard Reduction in the River.
44. Hospital Wastewater treatment Using Multi Media Biological Activated Carbon Reactor.
45. Hydrodynamic Biofilm Modeling for Steady State Trickling Biofiltration.
46. Characteristics and Compositions of Solid Waste in Baghdad
47. Biofilm Characteristics and Compositions in Fluidized Porecilenite Bioreactors: Experimental Work.
48. Effects of Carbonated Sand Characteristics On Water Biofilter Performance
49. Effect of Loading Rate on the Greywater Properties.
50. Greywater Disinfection Using Multi Stage Solar BioReactor.

١١- بعض من الندوات و النشاطات العلمية التي كنت فيها محاضراً

١. الندوة المتخصصة عن التقانات الحديثة لانتاج مياه الشرب ١٢/ حزيران ٢٠٠٢ / وزارة الصناعة والمعادن / الشركة العامة للتصاميم والانشاء الصناعي.

٢. دور البحث العلمي في الادارة المتكاملة والمستدامه للموارد المائية السلط/ جامعة البلقاء التطبيقية / ١٧- ١٩ آذار ٢٠٠٢.

٣. ندوة ترشيد استهلاك الطاقة في الابنية في العراق / ايلول ٢٠٠٢ / هيئة الكهرباء.

٤. الندوة الثانية لافاق البحث العلمي والتطوير التكنولوجي في العالم العربي / الشارقة / نيسان ٢٠٠٢.
٥. ندوة ترشيد الطاقة والحماية من التلوث البيئي- هيئة الكهرباء / كانون الاول ٢٠٠٢.
٦. مصادر الماء في بغداد، مشكلاتها وآفاق الحلول / محافظة بغداد /١٥حزيران ٢٠٠٩.
٧. مؤتمر الهندسة الكيميوي الاردني الدولي الرابع / ٢٢-٢٤ ايلول / عمان.
٨. المؤتمر الاردني الدولي الرابع للهندسة الميكانيكية JIMC 2001 / عمان – الاردن.
٩. المؤتمر العربي الاول للعلوم والتكنولوجيا البيئية / المؤسسة العربية للعلوم والتكنولوجيا / ١١-١٥ آذار ٢٠٠١ / كلية الاداب والعلوم / جامعة الشارقة.
١٠. المؤتمر العربي الاول لدور البحث العلمي في الصناعات الصغيرة / الجزائر / تموز ٢٠٠١.
١١. المؤتمر الرابع حول اقامة البحث العلمي والتطوير التكنولوجي في الوطن العربي / ١١-١٠ كانون الاول ٢٠٠٦ / سوريا / دمشق.
١٢. المؤتمر الدولي لاستدامة الطاقة والبيئة / مصر / تشرين الثاني ٢٠٠٧.
١٣. ندوة الطاقة وتاثيرها على البيئة / فنلندا / كانون اول ٢٠٠٧.
١٤. الندوة التخصصية الخامسة للبيئة / الكمياء الحياتية / المانيا / فرانكفورت / كانون الاول ٢٠٠٨.
١٥. المؤتمر العلمي الهندسي / كلية الهندسة / الجامعة المستنصرية / تشرين الاول ٢٠٠٨.

16. WORLD FILTRATION CONGRESS WFC11 – filtration and separation technologies, APRIL 16-20, 2012 in GRAZ, AUSTRIA.
17. Sixteenth International Water Technology Conference IWTC, International Water Technology Association (IWTA), May 7 - 10, 2012, Fatih University, Istanbul, Turkey.
18. 9th International Symposium on Persistent Toxic Substances (9th ISPTS), the symposium was organized by Florida International University at Miami Airport Marriott, USA, October 23-27, 2012.
19. 6th International Conference on Flotation for Water and Waste Water Systems, IWA, New York City, USA, October 29 – November 1, 2012.
20. FOURTH INTERNATIONAL CONFERENCE ON SCIENCE IN SOCIETY, Clark Kerr Conference Center and Great Hall, University of California Berkeley, California, USA, 15-17 November 2012.
21. 17th International Interdisciplinary Conference on the Environment in Kona, Hawaii, USA, June 28-July 3, 2012.

12. Abstract of Some Published Papers

1- Gray Water Use in Buildings in Baghdad

Water conservation and reuse in many areas of Iraq are issues that receive a great deal of public attention. The search for ways to responsibly use and reuse water is vital to the sustainability of the water supply and thus the future of these areas. Wastewater treatment and reuse is one of the best water conservation options available to communities located in many areas of Iraq. Treated shower, sink and bath gray water were reused for toilet flushing, outdoor irrigation and spraying water evaporation cooling of selected apartments building located in Baghdad. The study objectives include:-

1. Daily water consumption measurement for different quantitative samples of communities, families and persons in Baghdad.
2. Study the effective parameters that influence the water consumption such as climate, characteristic of population, an economic and psychological status of customer.
3. Design and construct double plumbing with simple gray water treatment unit for recycle water.

4. Regulate, daily water share and analysis the gray water samples (BOD5, COD, P, N, and TSS).
5. Measure the reductions in water consumption and study economic feasibility for new residential system.

Two separate aspects of gray water usage in the area must be studied:-

1. Aerobic pretreatment for facilities where the principal source of gray water is hand washing & showers without any food waste.
2. The residential filter of three stages to remove food waste from Kitchen (sinks receiving cooking grease & a fair amount of food residue) filter should be consisted of:
   - An aerobic treatment septic tank
   - Filtration unit (sand filter).
   - Aerobic unit

The final treatment stage leading to purified water of near potable quality that used in different purposes. The treatment systems must be effective, simple to maintain on safe treatment techniques available to day

Keywords: *Water Quality, End of pipe Technology and Cleaner Production, Water Conservation, Gray Water Use.*

2- Hospital Wastewater Pretreatment for Biohazard Reduction

Most hospitals in Hilla are not connected to any municipal treatment plant, and have not their own Sewage Treatment Plants. Currently the hospitals are facing problems in terms of high biomedical wastewater concentration and diseases such as cholera and typhoid. It was found that the chemical or toxic wastes generated by the Babylon's hospital were 9% from the wastewater. The goals of the study are to characterize the present wastewater and propose the suitable treatment systems and options.

Measurement for wastewater characteristics including *COD*, BOD_5, *TSS*, *TDS*, *pH*, NO_3, PO_4, SO_4, bacteria and virus tests were carried out periodically for different times to evaluate the chemical, biological and toxic waste concentration before and after pretreatment.

A lab scale pretreatment systems were designed and constructed for different processes to examine the efficient technique for a significant reduction pathogenic and bacteria. Four processes were tested separately included pre choleration, preozonation, preheating and increasing the acidosis of effluent. A set of experiments for different dosages of HCl, H2SO4, choler and ozone, heating to various temperatures and detention times were investigated.

The results show that the reduction of E coli was by pre chlorination, while the reduction was by preozonation .It was observed that the heating process was active for water temperature up to 60 ^{o}C, while the acidic technique was successful for pH lower than 4. The efficient pretreatment systems for removal pathogenic and bacteria for low-energy consumption and chemical additives were optimized and proposed.

Keywords: *Hospital, biohazard wastewater, pretreatment, prechloration, preozonation, preheating.*

3- Hospital Wastewater treatment Using Mixed Media Biological a Activated Carbon Reactor

The objective of hospital wastewater treatment to produce effluent suitable for agricultural or aquacultural reuse (or both), or to produce an effluent that can be safely discharged into inland or coastal waters.

Hospital wastewater poses a significant pollution threat to water-bodies and soil and hence the quality of the effluents must be controlled, especially with regards to the two variables, the first are polluting parameters such as BOD, TOC, suspended solids and COD and the others are nutrients such as phosphate, nitrate, and ammonium. Toxins are also controlled depending on the type, and these would include solvents, heavy metals, phenols, chlorinated compounds. Microbial pathogens which can be potentially present in wastewater can be divided into four separate groups: viruses, bacteria, the protozoans and helmiths. Hospital wastewater associated infections generally include diarrhoea, dysentery, dysentery-like infections, *Leptospira interrogans* infections, typhoid, human enteritis, legionellosis, melioidosis, stomach ulcer and cancer.

Lab scale model of mixed media biological activated carbon reactor of 1600mm length and 300mm diameter was designed and constructed as compact bioreactor with two supplementary tanks. The first tank was used for preaeration or preozonation before biofiltration while the other was used for ozonation as disinfection. Sand, Porcelinaite, bentonaite, Granular activated carbon and ceramic were selected as Medias of biofilter.

Treatment system consists of integrated anaerobic-aerobic units which are designed to improve biofiltration processes by:

- increasing the available biomass at constant retention time.
- improving hydraulic efficiency by maximizing the flow path.
- extending the biomass carrier material surface area.

The release of pharmaceutical chemicals from hospital into the environment without sweeping changes to wastewater treatment systems or to medicine manufacture and design; a wide array of changes in each of the many aspects of pharmaceutical disposal has been proposed for reducing the introduction of pharmaceuticals to the river environment. There is currently insufficient information to determine the relative quantities of medicines reaching the environment from each of the various sources in Iraq. The goals of the study are to characterize the present wastewater and propose the pre suitable treatment systems and options. Measurements for wastewater characteristics including *COD, BOD_5, TSS, TDS, pH, NO_3, PO_4, SO_4,* .Microbiological tests are carried out periodically for different times intervals to evaluate the chemical, biological and toxic waste concentration before and after pretreatment.

Anaerobic pond as a wastewater treatment facility is a biological process ideally suited for the pretreatment of high strength hospital wastewaters.

It was observed that the septic pond as an anaerobic processes was very effective and economical for removing high concentrations of BOD5 and COD especially in warm climates (24-32^{o}C); around 64% BOD removal and 41% COD removal at 24^{o}C and as much as 81% and 52% for BOD5 and COD removal respectively at 32^{o}C.Mixed media bioreactor with aeration tank removed 93%- 97% of dissolved organic matter from wastewater.

Keywords: *Hospital, Biohazard wastewater treatment, Mixed media, preozonation, aeration.*

4- Experimental Study on Properties of Lightweight Concrete Made with Plastic Waste

The aim of this study is the production of cheap building elements from plastic waste. In the same time, they are environmentally friendly and of good insulation.

The study depends on the addition of plastic waste as aggregates to the mixes of concrete at different percentages by weight (13 percentages) to produce lightweight aggregate concrete that has the density (1095 - 1911) kg/m^3.

The experimental work includes 234 specimens of concrete as 39 cubes (150*150*150)mm, 117 cylinder (150*300)mm, 39 prisms (50*100*200)mm and 39 prisms (100*100*500)mm.

In this study, the mechanical and thermal properties determined were (compressive strength, static modulus of elasticity, flexural strengths, Splitting tensile strength, density, thermal conductivity(k), specific heat capacity(C_p), thermal expansion (α)) after (28) days of curing at 20 ºC. The increase in amount of plastic waste decreases the density of concrete which leads to decrease in the mechanical and to improvement in thermal properties.

The average measured static modulus of elasticity and splitting tensile strength are found less than the predicted static modulus of elasticity and splitting tensile strength (ACI 318-2008 and ACI 213R-2003), while the measured average value of modulus of rupture is found more than the predicted modulus of rupture (ACI 318-2008 and ACI 213R-2003). Lightweight aggregate concrete is about 25% lighter than normal concrete in dead load. The results obtained for concrete were for local raw materials without any additional materials or treatment.

5- Effect of Clay Percentage in Sandy Clay Soil on Saturated Hydraulic Conductivity

Hydraulic properties of sandy clay soil are very important for filtration, seepage and irrigation; so set of experiments were carried out for different samples of sandy clay in Baghdad. Measurements include bulk density, particle size distribution, clay percentage and hydraulic conductivity using constant head system. The aims of this study were to estimate equivalent saturated hydraulic conductivity (K_s) for different clay percentages and predict porosity of sandy clay as function to clay percentage and porosity of sand and clay. Nine samples of sandy clay soil have been tested in a hydraulic and soil laboratory (Mustansiriyah University.). Semi-empirical model was correlated to evaluate saturated hydraulic conductivity from clay percentage and results were compared with five empirical models selected from published literature were also used to predict K_s. These empirical models were (Puckett, 1985), (Ryjov and Sudoplatov, 1990), (Dane, 1992), (Dheyaa, 2006) and (Shevnin, 2006).

Keywords: *soil, sandy clay, hydraulic conductivity, porosity*

6- Hazardous Waste Characteristics in Baghdad Pilot Study: Hospital Waste

Hospital waste or infectious waste is considered hazardous as they may contain highly toxic substances to humans, animals, and plants; highly inflammable, or explosive; and react when exposed to certain things e.g. gases**.** Biomedical waste contaminated by chemicals used in hospitals is considered hazardous. These chemicals include formaldehyde and phenols, which are used as disinfectants, and mercury, which is used in thermometers or equipment that measure blood pressure. Most hospitals in Iraq do not have proper disposal facilities for

these hazardous wastes. Hospital wastes are generated during the diagnosis, treatment, or immunization of human beings or animals or in research activities in these fields or in the production or testing of biological. It may include wastes like sharps, soiled waste, disposables, anatomical waste, cultures, discarded medicines, chemical wastes, etc. These are in the form of disposable syringes, swabs, bandages, body fluids, human excreta, etc. This waste is highly infectious and can be a serious threat to human health if not managed in a scientific and discriminate manner. It has been meanly determined that of the 100 kg of waste generated in a hospitals in Baghdad at range 16-28 kg would be infected.

During 2002 and 2004, Six governmental hospitals in Baghdad were covered, included Baghdad teaching, Al-Shaheid Adnan, Al-Mansor, Al-Qadsiya, Al-Amam Ali and Ibn Al-baldi hospital, Not only the annual medical waste generation rate and its composition but also generation of some indicators correlating waste generation and hospital capacity were the objectives of the study. Therefore, the number of beds, occupancy rate of the beds, number of employees and staff, amount of medical waste and household waste generated per day, fuel consumption for heating, collection, deposition, transportation, and disposal of wastes, recycling applied, incineration plant capacity if available were questioned during the survey. In the composition research, amount and type of wastes generated were quantified together with number of patients per day, number of surgeries per day, number of births, number of x-ray photography and number of laboratory tests.

The main conclusion from this study is no system of hospital waste management in Baghdad, a lack of knowledge among health staffs, a lack of necessary supplies and facilities and a lack of connections among different ministries.

Keywords: *Solid Waste Management, Hazardous waste, Hospital waste, Baghdad Hospitals*

7- Crises of Water in Arab Homeland in Present and Future

Arabic Homeland is facing a serious challenge concerning water security and this challenge is represented by the Zionist greedy ambitions and the strategic water projects of the neighboring countries (Turkey and Ethiopia) in addition to pollution and waste problems.

The mathematical model is prepared to simulate the present water state so that the role of major parameters affecting the crises can be evaluated over a period of (25) years beginning from year (2000) in a (5) year interval the main parameters included population, volume of renewable water resources, annual share per capita, water gap and the expected demand.

Three Coefficients were used to evaluate the severity of the crises (water stress, water poverty line, and water balance), emphasis is made on the water balance coefficient for its accuracy and globility and choice for possible solutions were tabulated.

The results may be summarized as follows, the annual water share per capita will decrease from (924) m^3 /capita/annual in year 2000 where the population is (315.4 million) to (442) m^3 /capita/annual in the year (2025) where the expected population is (663) million.

The water gap volume expected will be (135.3) billion meter cube annually and the water balance coefficient will be (-0.46) which describes the Arabic water state of need . This describes the scarcity end edge of the drought following the water states some solution were suggested.

These included family regulation, urban planning, reduction in water consumption, using the modern technology such as sprinkler irrigation and complementary irrigation, construction of rain water storage ponds, appliance of individual water share and limit fare salty water sweetening and treatment of industrial waste water.

8- Evaluation the Performance of grey water treatment plant by cascade aeration and Biofiltration

In Iraq with population growth increasing and development, conventional groundwater and surface water sources are becoming increasingly vulnerable to anthropogenic, industrial and natural pollution. There is a need to critically look at alternative approaches to ensure water availability and to minimize water losses and for its reuse after treatment. A combination of cascade aeration and biofiltration systems are one of the successful ecological treatments to reduce the concentration of pollutants in grey water and resolve the problem of acute water crisis supply in Iraq, the best solution found for covering the daily consumption of householders is to apply this pilot plant, which is a combination of natural and physical operations such as primary settling with cascaded water flow, natural & passive aeration, agitation and filtration, hence called as hybrid treatment process. Samples from the influent and effluent grey water for pilot plant were analyzed for pH, Chemical oxygen demand (COD), Total Suspended solids (TSS), Total Dissolved solids (TDS), Phosphates ($PO4^{-3}$), Nitrates ($NO3^{-2}$), Nitrites (NO^{-2}), Oils & grease, Sulfates ($SO4^{-2}$), Chlorides (Cl^{-1}), Sodium (Na^{+}), Potassium (K^{+}), Magnesium (Mg^{+2}), Calcium (Ca^{+2}), Ammonia- Nitrogen (NH3-N). The range of organic loading in grey water found (516 - 390) mg/l for COD. The solids in grey water were found to have a range (76% - 83%) dissolved and (17% - 24%) suspended. All the parameters found in grey water were reduced and found the better performance of the natural system.

The average 82% of organic load was removed and the 72% anions and 62% cations were found to be adsorbed by the natural adsorbents used in filtration.

The economical performance of the plant were investigated for treatment of grey water and collected in Al- Mustansiriyah university college of Engineering during period from October 2011 to June 2012. The water reuse or recycling systems collected, treated and reused bathroom water for no potable usage, car washing, floor washing, evaporative cooler, gardening and irrigation.

Keywords: *Grey water, water reuse, hybrid treatment, irrigation.*

9- Hospital Wastewater treatment Using Multi Media Biological Activated Carbon Reactor

The daily average wastewater generated in three large hospitals in Babylon (Surgery, children and Merjan hospital) which offers treatment to 17681 patients with 1427 beds is of 3144 m^3/d.

Hospital wastewater poses a significant pollution threat to water-bodies and soil and hence the quality of the effluents must be controlled, especially with regards to the two variables, the first are polluting parameters such as biochemical oxygen demand over 5 days BOD5, total organic carbon TOC, suspended solids TSS and chemical oxygen demand COD and the others are nutrients such as phosphate, nitrate, and ammonium. Toxins are also controlled depending on

the type, and these would include solvents, heavy metals, phenols, chlorinated compounds. Microbial pathogens which can be potentially present in wastewater can be divided into four separate groups: viruses, bacteria, the protozoans and helmiths. Hospital wastewater associated infections generally include diarrhoea, dysentery, dysentery-like infections, *Leptospira interrogans* infections, typhoid, human enteritis, legionellosis, melioidosis, stomach ulcer and cancer. Lab scale model of multimedia biological activated carbon reactor of 1800mm length and 300mm diameter was designed and constructed as compact bioreactor with two supplementary tanks. The first tank was used for preaeration or preozonation before biofiltration while the other was used for ozonation as disinfection. Four different medias of 350mm height include Sand, Porcelinaite, Granular activated carbon and granite was selected as good separated Medias of biofilter.

Treatment system consists of integrated anaerobic-aerobic units are designed and processed to improve biofiltration processes by increasing the available biomass at constant retention time and improving hydraulic efficiency by maximizing the flow path.

The objectives of hospital wastewater treatment is to produce effluent suitable for agricultural or aquacultural reuse (or both), or to produce an effluent that can be safely discharged into inland or coastal waters.

The results show that the wastewater generated 817 L /bed per day typical and 47 L/employee per day and the chemical or toxic wastes generated by the Babylon's hospital were 9% from the wastewater. Wastewater characteristics of hospitals in Babylon were in the range (TDS (993-9080), NO_3 (3.2-10.9), PO_4 (8.2-19.2), SO_4 (225-280), pH (7-8.6), COD (100-920), BOD_5 (86-744) and TSS (23-361) mg/L. Experimental results showed that multimedia biological activated carbon systems MMBACS perform better than conventional treatment systems under similar conditions of wastewater quality and environmental conditions. The tested locally available materials can be effectively used as basic treatment media with run greater than 148 d.

Keywords: *Hospital, Biohazard wastewater treatment, Multimedia, preozonation,*

10- Hydrodynamic Biofilm Modeling for Steady State Trickling Biofiltration

Mathematical and experimental modeling of trickling filter were constructed and tested to optimize filter dimensions, operation conditions, and aeration techniques for different selected materials of filter media.

A pilot plant of ($2m^3$) trickling filter was used and fed with actual textile wastewater from five textile factories in Iraq. Six different bed materials (crushed thermostone, crushed granite, crushed porcelinaite, polystyrene, plastic and wood) with diameter (45-52mm) were selected for testing total loading of filter media. Several sets of experiments at steady inflows with large fluctuations in wastewater characteristics were made to study the effect of different material bed depths (0.5,0.8,1.1 and 1.5m) and various materials bed at constant filter media depth(0.8m) and constant effective diameter (45-52mm) .

Four tracks were used to construct the trickling bioiltration model. These models are Mass Transport and Biochemical Reactions Model, Dispersion- Advection Transport Model, Dispersion Flow Hydraulic Model and Monod- Type Biological Kinetics, and Moving Liquid Layer Method (Axial Dispersion).

Measurements for influent wastewater and effluent are made including SS (mg/l), BOD5 (mg/l), COD (mg/l), pH and the effective parameters kilograms of O_2 / kg BOD_5 eliminated, and organic load or BOD_5 as volumetric load (kg BOD_5 / m^3 / d) are calculated. Predicted and measured removal efficiency for (0.8m depth) trickling filter filled graphite (45-52mm)diameter, at temperature 24-26 ^oC for four tracks for different hydraulic loads are compared and empirical models were correlated.

Dynamic simulations for trickling biofiltration tend towards the steady-state solution that the results can be unique for a given set of conditions for the biofilm.

Keywords: *Biofilm Modeling, Textile wastewater, Trickling filter, Removal efficiency*

11- Effects of Biomass Growth on Pressure Drop in Submerged Aerated Bioreactors

A semi-empirical model was developed to predict biomass-affected porosity, specific surface area and pressure drop as a function of the biomass concentration in two selected Submerged Aerated biorectors (SABRs). Under similar conditions two bench-scale SABRs (1m long and 100mm diameter) were operated to treat an industrial wastewater, the first packed with porcelinaite rocks and the other with polystyrene grains at hydraulic loading rates of (0.1–3.2 m/h) and with BOD_5 concentration of (110- 436 mg/L) .

Typical constant that can be used to estimate pressure drop for some of the most common design of SABRs were correlated. The proposed equations in porosity and specific surface area caused by biomass accumulation in SABR bed are based on macroscopic estimates of average biomass concentrations. In comparison to biofilm-based models, the macroscopic models are relatively simple to implement and are computationally more efficient.

The effects of biomass accumulation and distribution on pressure losses and removal efficiency of biological load in SABRs were experimentally studied.

Localized biomass accumulation in the SABR beds is the key factor increasing the pressure drop, which was caused by local bed clogging due to biomass growth. The highest pressure drops in the beds (porcelinaite rocks: 2,150 N/m^3 and polystyrene grains: 1115 N/m^3) occurred where there were high biomass levels. The pressure drop varied nonlinearly with the amount of accumulated biomass and the amount of oxygen consumed.

Porcelinaite rocks caused greater pressure drops, on average 2 times higher than the polystyrene grains. Compaction, as a consequence of biomass growth and porcelinaite rocks degradation increased the pressure drop in the porcelinaite rocks bed.A comparison of the experimental and the predicted pressure drops showed that the model provided good estimates of biomass-affected porosity and pressure drop in the SABRs packed with spherical grains with even biomass distribution.

Keywords: *pressure drop, aerated submerged bioreactor, biomass growth, porcelinaite rocks*

12- Characteristics and Compositions of Solid Waste in Baghdad

Solid waste data survey for the period from 1977 and 2000 has been collected and analyzed, while the solid waste generated in six regions in Baghdad, which were selected and estimated to be 1435 houses and 28643 households for the period 2000-2005 was studied. The growth of Baghdad's population, increasing urbanization and rising standards of living have all contributed to an increase in both the amount and the variety of solid domestic wastes.

The amounts of waste generated and their sources, the type of materials in each waste stream, their properties, potential toxicity, and the hazards are evaluated which affect to human health and environment. The lack of reliable time series on solid waste streams and rapid changes in the composition of waste streams are a serious impediment to setting priorities in solid waste management in Baghdad. The basic conclusions from this study are:-

– The waste generated per capita in Rusafa, Kerkh and Baghdad increased from 0.32, 0.46 and 0.354 kg/day in 1977 to 0.98, 1.37 and 1.11 kg/day respectively in 2002.
– Municipal wastes in Baghdad have a higher proportion of organic matter and ash, higher moisture content and lower paper content. Organic matter and ash may account for between 76-89% of all wastes in low income settlements. The percentage of organic waste decreased from 91.17% in 1977 to 64% in 2002, while plastic, paper, textile, metal, wood and glass wastes increased slightly at the same period.
– Collected solid wastes are less than evaluated solid waste during the period from 1977 to 2005because of war and economic sanction.

Keyword: *Solid Waste management, Waste composition and characteristics, Baghdad city*

13- Experimental Investigation of Hospital Wastewater treatment for Biohazard Reduction in the River Pilot study: Hila's Hospitals

Hospitals in Hilla are not connected to any municipal treatment plant, and have not their own Sewage Treatment Plants. Effluent bio-medical wastes are thrown to the Uphart River causing environmental risk and diseases as cholera.

This study was conducted in all Hospitals in Hila which offer treatment to 17681 patients with 1427 beds .Currently the hospitals are facing problems in terms of high biomedical wastewater concentration. The daily average wastewater generated is 13261 m^3/d.

In view of chemical or toxic wastes generated, it has been found that the hospital generated around 57 *mL/bed/d*. It was noted that approximately 37 percent of total chemical wastes discharged to sewers was contributed by laundry section which led to be the largest generator of chemical wastes.

Wastewater characteristics (*COD, BOD_5, TSS, TDS, pH, NO_3, PO_4, SO_4* and bacteria and virus tests) were analyzed for different times to evaluate the chemical, biological and toxic waste concentration.

A pilot-scale system was designed and constructed as integrated anaerobic-aerobic fixed film reactor for hospital wastewater treatment.

The aim of the study was the elimination of organic compounds and a significant reduction of bacteria.

The objectives of the study are to:

1- Study the present wastewater characteristics and its management;
2- Prepare detail Environmental Action Plan (EAP) for the hospital.
3- Quantify wastewater discharges and their flow variability and characterize every waste stream for their physical and chemical characteristics.
4- Identify each wastewater stream leaving the hospitals premises, using a flow diagram.
5- Establish how and where each wastewater stream is generated.
6- Propose the suitable treatment systems and options;

Bioreactor exposed to solar heating was chosen to reduce infectious waste, which was left in the sun for different sun exposure time (6, 8,1and 10hr).

The results show that:

- Wastewater characteristics of hospitals in Hila were in the range (TDS (993-2340), NO_3 (3.2-10.9), PO_4 (8.2-18.5), SO_4 (225-280), pH (7-7.4), COD (100-832), BOD_5 (86-144) and TSS (23-269) mg/L.
- The proposed treatment system is efficient for removal of COD, BOD_5, TDS, TSS and bacteria; and low-energy consumption.

Keywords: *Hospital, biohazard wastewater, Secondary treatment, anaerobic-aerobic bioreactor*

14- Biofilm Characteristics and Compositions in Fluidized Porcelanite Bioreactors: Experimental Work

Two Fluidized Porcelanite Bioreactors (FPBR) were design and constructed at Al-Rustamiyah Sewage Treatment Plant in Baghdad. The first system consists of upflow expanded bed reactor (UEBR) which is connected in sequence with aerated fluidized bed reactor (AFBR), while the other system is composed of two identical upflow expanded

Reactors which are operated in parallel. To evaluate the biofilm formation on Porcelanite rocks surfaces the investigation is directed to experimentally measure the biofilm thickness using the light microscopy in fixed media. . The operation of system consists of various distinct phases and the influent substrate concentrations are taken from primary sewage and clarifier effluent of AL-Rustamiyah Sewage.

Three effective parameters that influence the rate of biofilm growth such as superficial velocity, substrate and biomass concentration were studied .The rate of biofilm growth in two types of aeration were tested, the first system aerated directly compared with other systems operated by indirect aeration.

The rate of biofilm losses for different influent flow rates, substrate concentrations, and the locations of packing bed in the reactor and the periods of operation were evaluated. The main conclusions are:

- The Physical, chemical and biological analyses depend on the environmental conditions to which the attachment surface is exposed. The large portion of composition is water 90.4% and the small value of volatile fraction 9.2%, while the fixed fraction is composed of 0.4% of total biofilm by mass.
- The organic and chemical composition of fixed fraction of biofilm is obtained from the laboratory experiments emphasizing, the primary constituents' carbon C (58%), and nitrogen N (15%), and phosphorus P (2%), while the fixed solid composition is 25%.
- The inorganic composition of fixed fraction of biofilm varies with chemical and organic properties of bulk water, chemical and physical properties of media and its structure is silica composes (45%), while Fe composes (20%), Mn (14%), Al (10%), Ca (6%) and Mg (5%).

15- Hydrodynamic Biofilm Modeling for Steady State Trickling Biofiltration

Mathematical and experimental modeling of trickling filter were constructed and tested to optimize filter dimensions, operation conditions, and aeration techniques for different selected materials of filter media.

A pilot plant of ($2m^3$) trickling filter was used and fed with actual textile wastewater from five textile factories in Iraq. Six different bed materials (crushed thermostone, crushed granite, crushed porcelinaite, polystyrene, plastic and wood) with diameter (45-52mm) were selected for testing total loading of filter media. Several sets of experiments at steady inflows with large fluctuations in wastewater characteristics were made to study the effect of different material bed depths (0.5,0.8,1.1 and 1.5m) and various materials bed at constant filter media depth(0.8m) and constant effective diameter (45-52mm) .

Four tracks were used to construct the trickling bioiltration model. These models are Mass Transport and Biochemical Reactions Model, Dispersion- Advection Transport Model, Dispersion Flow Hydraulic Model and Monod- Type Biological Kinetics, and Moving Liquid Layer Method (Axial Dispersion).

Measurements for influent wastewater and effluent are made including SS (mg/l), BOD5 (mg/l), COD (mg/l), pH and the effective parameters kilograms of O_2 / kg BOD_5 eliminated, and organic load or BOD_5 as volumetric load (kg BOD_5 / m^3 / d) are calculated. Predicted and measured removal efficiency for (0.8m depth) trickling filter filled graphite (45-52mm)diameter, at temperature 24-26 ^oC for four tracks for different hydraulic loads are compared and empirical models were correlated.

Dynamic simulations for trickling biofiltration tend towards the steady-state solution that the results can be unique for a given set of conditions for the biofilm.

Keywords: *Biofilm Modeling, Textile wastewater, Trickling filter, Removal efficiency*

16- Water Management Challenge in Baghdad

Both the 1991 Gulf War and the 2003 Iraq War have affected and used the water resources. Most of the water in Baghdad comes from Tigris River. Baghdadis need abundant water supplies to live and survive in the desert environment. The wars and economic sanctions have left the people in a state of drought, with the water largely contaminated and few resources available to clean it.

Baghdad has arid climate with extremes of heat and cold, temperatures also vary greatly with time, the mean January temperature is 7 ^oC and the mean July temperature is 35°C.High temperatures in the capital city of Baghdad, which lies in the central part of the country, is 51°C have been recorded. Analyses were conducted from 2005 to 2010 and the results for percent of electricity consumption by end use show that 10 percent is for evaporative cooling.

In addition to water policies of Turkey, Syria and Iran which affects strongly the water availability in Iraq, the lack of water for irrigation is the major reason of failure of agricultural policy in Iraq. Water shortage in Baghdad occurs. More than one out of three Baghdadi's people lack access to safe drinking water, and more than one out of six lack adequate sanitation. Wide attention are required for starting national water conservation programs .In arid areas of Baghdad, water conservation and reuse are issues that receive a great deal of public attention in the last decade. The search for ways to responsibly use and reuse water is

vital to the sustainability of the water supply and thus the future of these regions. Treated gray water in houses can be reused for toilet flushing, outdoor irrigation and spraying water evaporation cooling of selected apartments building located in Baghdad. Treated wastewater also can be used for irrigation and streets cleaning by municipal institutes. Several experiments in Baghdad have been achieved for small scale to reuse graywater for toilet flushing, irrigation, outside house cleaning and evaporative cooling. The basic goal of this project proposal is to apply the graywater for wide range as solution of water crises in Baghdad.

Baghdad's Water demand is estimated to 3.2 Million m^3/day, the quantity of produced water is (66%) of the required needs.

-The Average daily use is about 18% lower than the annual daily average in Winter, while it is 38% higher than the annual daily average ,that cause wide variation in water demand during the year.

- For selected communities the maximum daily use is about 205% of the average daily use.
- Although electrical energy have decreased significantly during the past decade, Increased use of evaporative cooling make residential water use was continued to rise approximately 5% per year.

Keywords: *water resource management, greywater reuse, Baghdad*

17- Grey Water Reuse for Irrigation

Grey water is water that is used for washing dishes, laundering clothes, or bathing. Essentially, any water, excluding toilet wastes. Reusing grey water serves two purposes: it reduces the amount of freshwater needed to supply a household, and reduces the amount of waste water entering sewer or septic systems. Treated gray water were reused for toilet flushing, outdoor irrigation and spraying water evaporation cooling of selected apartments building located in Baghdad.

Water shortage may occur. Water prices may rise sharply. Grey water use then might be viewed as a worthy water resource possibility. The study objectives include:-

1. Design and construct double plumbing with different gray water treatment systems for recycle water.
2. Analysis the grey water samples (BOD_5, COD, P, N, and TSS).
3. Measure the reductions in water consumption and study economical feasibility for new systems.

Three treatment systems were designed and constructed for gray water reuse in the Iraq area must be studied:-

- The first system consists of slow sand filter (granular-media gravity filter).
- The second system consists of a coal-sand dual filter with chlorination unit, and
- The third system consists of settling tank, pressure filter with mixed-media beds, activated carbon reactor and ozonation unit.

Results in this study show that:-

- The final treatment system leads to purified water of near potable quality that is used in different purposes.
- This treatment system was effective, simple to maintain on safe treatment techniques available today.

- Grey water is a part of the fundamental solution to many ecological problems that enables to reduce 36% of fresh water use, strain 39% of treatment plant, decrease 29% of energy, 27% of chemical use wasted nutrients and pollutant .

Keyword: *Water Quality, End of pipe Technology and Cleaner Production, Water Conservation, Grey Water reuse.*

18- Environmental Risk from Biohazard Wastewater on Aquatic Ecosystem. Case Study: Baghdad Hospital

Hospitals wastewater represents an incontestable release source of many chemicals, physical and biological compounds which may have an impact on the environment and human health. Some of the substances found in wastewater are genotoxic and are suspected to be a possible cause of the killing diseases such as cancers which observed in the last decades. The bacteriological and physiochemical qualities of wastewater from University of Baghdad Teaching Hospital discharged into the Tigris were studied to assess the influence of the hospital wastewater in the river environment. These parameters include pH, DO, TSS, TDS, EC, BOD_5, COD, TH, Alk, Ca, Mg, Na, K, SO_4, PO_4, NO_3, oil and grease. The samples were taken for periods between May 2003 and January 2009 from two stations. The first station on the upstream before the hospital whiles the other on the downstream. This study aims at presenting both data on the biological, physico-chemical and ecotoxicological characterization of the hospital wastewater before their discharge in Tigris River or the municipal sewage system and their effects as well as those of the pharmaceuticals and disinfectants on the urban wastewater systems and on the environment. The investigation shows that Baghdad hospital generates daily on average 810 liters of wastewater per bed and 61 m liters of toxic substances per bed. This effluent is loaded with pathogenic microorganisms, pharmaceutical partially metabolized, radioactive elements and other toxic chemical substances. The hospital wastewater samples are very genotoxic, the response intensity being inflected seasonally by rain levels, temperature and wind speed. Hospital pollutants risk being present for a long time in the natural environment and can representing a risk in short, middle and long terming for the living species of the ecosystems.

Large degree of variation of the physiochemical parameters among the sampling stations and the concentrations of all parameters in the downstream sampling point were high.

19- Effects of Carbonated Sand Characteristics on Water Biofilter Performance

Typically granular activated carbon (GAC) is used in a packed bed or is combined into a filter media. To incorporate these carbon granules into a filter media requires adhesives or a starch additive to keep the carbon from washing out; alternatively, the carbon granules can be formed into a composite material system. Compared to media containing sand unit and powdered activated carbon unit, high-efficiency Carbonated Sand (CS) offers a much greater external surface area, resulting in much more rapid adsorption of soluble contaminants.

Carbonated Sand has been prepared by mixing ordinary sand, Coal Powder and Back bitumen S125 with volume percentage 20:1:6 respectively and treated thermally at vacuum furnace at temperature ranged between 420 ^{o}C and 460 ^{o}C for 2 hours. Activation has been achieved by different dosages and rates of ozonation Various effective sizes of Carbonated Sand were separated from sieving and different biofilter grain sizes were tested to optimize

the removal performance of BOD, COD, Turbidity, TDS, TSS, EC, SO_4^{-2}, PO_4^{-2}, Cl^{-1} and heavy metal such as P_b, Hg, Cu, Fe, Cd. A further advancement in carbonated sand filter media has come in the form of combination high-efficiency particulate filtration with this high-efficiency of activated carbon.

Contaminants that can be removed with Carbonated Sand Biofilter include phenol and soluble organics such as pesticides or volatile organic compounds that may be highly toxic or may cause unpalatable taste and odor.

Results show that the Carbonated Sand media of effective particle size (D_{10}) should range from 0.3 - 0.7 mm along with a uniformity coefficient less than 4, and, the design hydraulic loading rate should be adjusted down to 40 Lpd/m^2 for wastewater (or 240 Lpd/m^2 for surface water) and the volume of wastewater applied per dose decreased to help compensate for media's grain size distribution.

It can be used in high-purity water systems, drinking water production in treated secondary wastewater and greywater for reuse it for no potable use.

Keywords: *Biofiltration, Sand, Activated Carbon, Composite Media, effective size, Water Treatment*

20- Improvement of Gray Water Treatment Using Combination of Trickling Biofiltration and Ozonation

The chief goal of this study is improvement of the hygienic quality of the gray water using combination of trickling biofiltration based on aeration as pretreatment and ozonation as disinfection process. The improvement includes reduction of organic matter, removal of total solids, ammonia and nutrients. By contrast, it chiefly aims at removing oils, grease and heavy metal such as iron and manganese.

A set of experiments for different surface loading rate (0.1 to 0.6 m^3 grey water /h per 1 m^2 of biofilter), various water temperature (5 ºC to 45 ºC) and multimedia (sand, garnet, coal and porcelinaite) were investigated. Chemical analyses and microbiological examinations of gray and treated water are carried out. Conducted chemical analyses on a routine basis in the laboratory during treatment were achieved to ensure proper ozone dosages and that the product water is potable Water quality parameters for influent and effluent includes BOD_5, COD, pH, TSS, EC NH_3, N_2, Na, Sulfate, Phosphorus, Color, and Turbidity have been measured for period extended to 11 months. Result showed that-Pretreatment of gray water biofiltration is capable of removing a major portion of organic matter and nitrogen.

- Biofiltration processes remove microorganisms and other suspended matter from the treated water
- Ozontion of graywater reduces the carbon dioxide content of the water and removes methane and hydrogen sulfide that degrade the smell and taste of water.

Keywords: *Water Quality, Graywater Treatment, Trickling Biofilter, Biofiltration, Ozonation*

21- Distance Experimental Education Using Simulated Information Net

Experimental education in hydraulic and fluid labs of four Engineering departments in Al-Mustansiriyah University (Mechanical, Civil, Environmental, transportation and High way) are studied using Simulated Information Net for five years. Parameters include number of staffs, number of experiments ,number of students in groups, education

method and time are considered using periodic equationier and evaluation with independent exam for random groups and different experiments. In order to the modify experimental education, experiments are designed in computers net and simulated the laboratory experiments. Results show that the distance education improves the performance of students, increase the skills of teachers, and decrease the time consumed. Simulated Experiments Net make higher flexibility to meet students' needs than traditional techniques.

Keywords: *distance education, experimental study, simulated experiments*

22- The last Hiroshima in Baghdad - The Suicidal Uranium Wars

The 1991 Gulf War was the first conflict in which depleted uranium (DU) munitions were used extensively. A total of about 300 tons and 800 tons of DU in 2003 were fired by the US and the UK during this war, with DU remaining in the environment as dust or small fragments. Based on available information, much of the DU expenditure used during the 2003 conflict appears to be in or near urban areas, where people live, work, draw water and grow food.

Tuwaitha Nuclear Research Facility was the main site for the Iraqi nuclear programme is a complex of more than 100 buildings spread over a 56 km2 site located 18 km south-east of Baghdad built in the 1960s. Activities included several research reactors, plutonium separation and waste processing, uranium metallurgy, neutron initiator development and work on a number of methods of uranium enrichment. The nuclear materials in Tuwaitha were 1.8 tons of low-enriched uranium and 500 tons of natural uranium that had been under IAEA seal since 1991.

All stocks of nuclear material at this site were removed under International Atomic Energy Agency (IAEA) monitoring since 1991, and equipment linked directly to the nuclear weapons programme was destroyed on site. All other radioactive materials, including uranium, remained in place and were stored insealed barrels at the facility.

The US and UK failed to safeguard dangerous nuclear material, secured at Tuwaitha, and highly radioactive materials have ended up in local communities where they are threatening people's health and environment.

Hundreds of Iraqis living near the country's largest nuclear plant fear for their lives as dozens of radioactive barrels from the site looted at the end of the war a year ago remain there. An environmental radioactivity monitoring programme has been established around the Tuwaitha nuclear site, Baghdad, Iraq, to ensure the safety of the public living around the site of 5 000 residents. Gamma spectrometric analysis of environmental samples (soil, air and water) was carried out to ensure that radionuclides expected to be released from the site are not concentrated in the environment. The results of the monitoring programme indicated that:-

1- Radioactivity in a series of houses (including one source measuring 10 000 times the normal level) and outside a primary school (measuring 3000 times the normal level).
2- Villages surrounding Tuwaitha's nuclear complex, are contaminated with "deadly radiation" yet remain off limits to international inspectors.
3- Dangerous radioactive source abandoned in a nearby field and discovered that some locals are still storing radioactive barrels and lids in their houses.

4- Unusual sickness after coming into contact with material from the Tuwaitha plant and found several objects carrying radioactive symbols discarded in the Community.

5- The soil of the areas covered by the study is polluted with uranium isotopes; the increase in concentrations of radioactive reached 65,200 becquerel/kg for Thorium-234. It was shown that 61 out of a total of 124 soil samples contained high concentrations of this isotope. The clearest indication of soil pollution with U-238 is the presence of high concentrations of Radium-226 which normally does not exceed 70 becquerel/kg in Iraqi soil; laboratory tests showed a maximum level of 36,205 becquerel/kg and a minimum of 955 becquerel/kg. Out of a total of 124 samples, 65 samples indicated an increase in the concentration of this isotope.

6- There is radioactive pollution in the deposits of water canals in the areas of Diylah River involving in particular the isotope Radium-226.

7- Laboratory tests proved the existence of concentrations of the isotopes Thorium-234 and Radium-226 in some Stipa Capensis and Haloxyion Salicornicom in the areas covered by the study. There is also an increase in the concentrations of Bismuth-214 and Lead-214. The samples which showed concentrations of isotopes of the Uranium-238 chain constituted 37 per cent of the total number of samples collected and tested.

8- All these locations have now become a source of radioactive pollution. Therefore, contaminated areas need to be identified and assessed and the population should be tested and monitored.

9- Clean-up and remediation measures need to be undertaken where localized contamination can be measured. In addition, public awareness of the risks associated with contamination need to begin immediately.

10- There is radioactive pollution in the most of Iraq; air detection measures are much higher than the normal background radiation in these areas prior to the aggression against Iraq.

11- Urgent steps need to be taken to raise awareness of the potential risks and to introduce protection measures, including posting of warning signs and restricting access at contaminated locations and storage sites.

Keywords: *Atomic energy , Environment, Toxic Pollution, Radiation*

23- Effects of Hydraulic Parameters on Multimedia Biological Activated Carbon Performance

Currently, the BAC process (preozonation tank, sand filter and activated carbon with ozonation) is a common practice for drinking water treatment and considered an alternative method for dissolved organic carbon (DOC) removal and disinfection by-products (DBPs) control.

An increase in biodegradable organic carbon leads to bacterial growth in drinking water distribution systems. The growth of microorganisms in a distribution system promotes water quality deterioration through increased corrosion, produces taste and odor causing compounds, and increases the amount of disinfectant demand to maintain residuals in the distribution system. Biological activated carbon filters have been effective in removing significant amounts of biodegradable organic matter.

Lab scale of multimedia biological activated carbon is designed to install in Hydraulic lab of Mustansiriyah University and the performance of the BAC is monitored for six months to study the effect of hydraulic parameters on the BAC reactors.

Multimedia filtration with sand-BAC filters is more efficient than conventional biological activated carbon (BAC) filters for the removal of biodegradable organic carbon and ammonia.

Granular activated carbon, a highly porous material capable of supporting a large bacterial population, is placed above a supporting layer of sand in a multimedia filter. When macro porous activated carbon is used, a large number of attachment sites, protected from the abrasive action of backwashing, are present for biomass fixation.

Most studies to date have not considered operation parameters such as head losses (HL), empty bed contact time (EBCT), hydraulic loading rate (HLR), backwash cycles related to particles, DOC leakage, behavior of microorganisms, microbial species, and the removal of trihalomethanes (THMs) species regarding empty bed contact time (EBCT) and hydraulic loading rate (HLR), systematically.

The objective of this study is to

1-Understand a multimedia BAC process for DOC removal and DBP control through examining DOC removal efficiency as a function of EBCT and HLR.

2- Estimate biomass concentration and identify microorganisms attached to activated carbon in a BAC reactor.

3- Optimize a multimedia BAC (biological activated carbon) process for DOC removal and DBPs (disinfection by-products) control.

4- Evaluate pressure drop in each stage of BAC.

5- Correlate semi empirical formula of pressure drop as function to biofilm formed during the processes.

6- Investigate the effect of biomass on porosity, surface area and hydraulic conductivity of the reactor's bed.

7- Exmaine microorganisms isolated from interstitial waters and GAC particles that are Achromobacter, Acinetobacter, Aeromonas, Alcaligenes, Bacillus, Clavibactor, Chromobacterium, Corynebacterium, Micrococcus, Microcyclus, Paracoccus, Pseudomonas and Coliform bacteria.

8- Monitor microbial populations in the influent and effluent waters and on the GAC particles by means of total plate counts and ATP assays .Three enteric pathogens Yersinia enterocolitica, Salmonella typhimurium, and enterotoxigenic Escherichia coli should be examined.

9- Measure the water characteristics such as TOC, DOC, TSS, TDS, BOD5, COD, Turbidity, EC, pH, Cl, SO_4, PO_4, NO_3, DO, hardness, Alkaline and heavy metal.

24- An Experimental Study for Wastewater Treatment Using Fluidized Bed Bioreactor

The most important hydrodynamic and biological factors in the fluidized bed systems are studied through modeling processes and an experimental examination .The extent of the systems efficiency to achieve the removal of organic pollutants in the domestic wastewater is investigated. In addition the factors that influence the performance of the systems including

superficial velocity, required aeration and volumetric flow discharge, and organic and hydraulic substrate loading are tested.

To characterize the biological and hydraulic performance of fluidized bed reactors, a set of experiments have been conducted starting from controlled laboratory test to field demonstration using two different systems. Two reactors with 10cm diameter are constructed as a laboratory scale model, where first field pilot scale system consists of upflow expanded bed reactor (UEBR) with 27cm diameter, connected in sequence with aerated fluidized bed rector (AFBR) with 10cm diameter. The second system is composed of two identical expanded bed reactors with 27cm diameter which operated in parallel.

The experimental work involves the long-term operation of laboratory and field experiments under control and various environmental conditions using primary and secondary wastewater effluent of Rustamiyah Sewage Plant. . Many different parameters are examined during (eight) months of continuous operation period of the laboratory system. The field work comprised an evaluation of the efficiency of the expanded and fluidized bed system during a period more than (fourteen) months of operation of the two systems.

25- Hospital Wastewater Pretreatment for Biohazard Reduction

Iraqi hospitals are facing problems in terms of high biomedical wastewater concentration and diseases such as cholera and typhoid. It was found that the chemical or toxic wastes generated by the Babylon's hospital were 9% from the wastewater. The goals of the study are to characterize the present wastewater and propose the suitable treatment systems and options.

Measurement for wastewater characteristics including COD, BOD_5, TSS, TDS, pH, NO_3, PO_4, SO_4, bacteria and virus tests were carried out periodically for different times to evaluate the chemical, biological and toxic waste concentration before and after pretreatment.

A lab scale pretreatment systems were designed and constructed for different processes to examine the efficient technique for a significant reduction pathogenic and bacteria. Four processes were tested separately included pre choleration, preozonation, preheating and increasing the acidosis of effluent. A set of experiments for different dosages of HCl, H_2SO_4, choler and ozone, heating to various temperatures and detention times were investigated.

The results show that the reduction of E coli was by pre chlorination, while the reduction was by preozonation. It was observed that the heating process was active for water temperature up to 60 ^oC, while the acidic technique was successful for pH lower than 4.

The efficient pretreatment systems for removal pathogenic and bacteria for low-energy consumption and chemical additives were optimized and proposed.

Keywords: *Hospital, biohazard wastewater, pretreatment, prechloration, preozonation, preheating.*

26- Energy Crises in Baghdad

The residential energy consumption survey includes most housing units occupied in the selected six regions in Baghdad, which was estimated to be 515 houses and 8753 households. Local daily, monthly and yearly measurements for solar energy, air temperature and relative humidity were carried out.

Electrical energy and fuel consumption during 2000, 2002and 2005 for three quantitative samples of (communities, families and persons) were recorded. Baghdad on 2005 had around 1.6-2 MW of available, operable power generating capacity. As a result, Baghdadis are likely to face shortages in summer, which increases by the 1.9 MW, besides fuels are unavailable. The shortage of electric generating capacity in Baghdad has been caused by numerous problems, including sabotage, looting, lack of security for workers, disruptions in fuel supplies for the plants, difficulty in procuring replacement parts at the aging stations, lack of training for workers, and obsolete technology.

Although Iraq's unemployment rate remains high (27-40 %), the overall Iraqi economy appears to be recovering after more than a decade of economic stagnation, sanctions, and war. However, it is important to note that estimates of economic growth vary widely. For instance, Iraqi real GDP growth is estimated by *Global Insight* at 34 % growth for 2005 and 22 % for 2006. Although Iraq contains large oil and natural gas reserves (115 billion barrels of proven oil reserves, the third largest in the world (behind Saudi Arabia and Canada) and Iraq contains 110 trillion cubic feet (Tcf) of proven natural gas reserves, along with roughly 150 Tcf in probable reserves), but the energy consumption is less than the most countries in the Middle East.

Baghdad has a continental climate with extremes of heat and cold, temperatures also vary greatly with time, the mean January temperature is 7 ºC and the mean July temperature is 35°C.High temperatures in the capital city of Baghdad, which lies in the lower, central part of the country, is 51 ºC have been recorded. Analyses were conducted from 2000 to 2005 and the results for percent of electricity consumption by end use.

Analyses of data collected found an increase in the number of households using certain appliances in 2000. The appliances that showed increased use included window or ceiling fans, personal computers, color televisions, Air conditioner, ovens, and clothes washers. The energy consumption survey in Baghdadi residential sector on 2000 estimates are air-conditioning 24 % space heating 10 %, water heating 29 %, refrigerant18%, lighting 9.4% and appliances 9 %. Changes in the percentages on 2004 reflect actual changes in the percentages, changes in the methodology used to estimate the amount of electricity used for the various end uses. Lighting accounted for 9.4 % of all electricity consumption in Baghdad households in 2000, less than air conditioning, water heating, space heating, or refrigeration.

27- Experimental Investigation of Hospital Wastewater treatment for Biohazard Reduction in the River

Most hospitals in Hilla are not connected to any municipal treatment plant, and have not their own Sewage Treatment Plants. Effluent bio-medical wastes are thrown to the Uphart River causing environmental risk and diseases as cholera.

This study was conducted in all Hospitals in Hila which offer treatment to 17681 patients with 1427 beds. Currently the hospitals are facing problems in terms of high biomedical wastewater concentration. The daily average wastewater generated is 13261 m^3/d.

In view of chemical or toxic wastes generated, it has been found that the hospital generated around 57 mL/bed/d. It was noted that approximately 37 percent of total chemical wastes discharged to sewers was contributed by laundry section which led to be the largest generator of chemical wastes.

Wastewater characteristics (COD, BOD_5, TSS, TDS, pH, NO_3, PO_4, SO_4 and bacteria and virus tests) were analyzed for different times to evaluate the chemical, biological and toxic waste concentration.

A pilot-scale system was designed and constructed as integrated anaerobic-aerobic fixed film reactor for hospital wastewater treatment.

The aim of the study was the elimination of organic compounds and a significant reduction of bacteria.

The objectives of the study are to:

1- Study the present wastewater characteristics and its management;
2- Prepare detail Environmental Action Plan (EAP) for the hospital.
3- Quantify wastewater discharges and their flow variability and characterize every waste stream for their physical and chemical characteristics.
4- Identify each wastewater stream leaving the hospitals premises, using a flow diagram.
5- Establish how and where each wastewater stream is generated.
6- Propose the suitable treatment systems and options;

Bioreactor exposed to solar heating was chosen to reduce infectious waste, which was left in the sun for different sun exposure time (6, 8,1and 10 hr).

The results show that:

- Wastewater characteristics of hospitals in Hila were in the range (TDS (993-2340), NO_3 (3.2-10.9), PO_4 (8.2-18.5), SO_4 (225-280), pH (7-7.4), COD (100-832), BOD_5 (86-144) and TSS (23-269) mg/L.
- The proposed treatment system is efficient for removal of COD, BOD_5, TDS, TSS and bacteria; and low-energy consumption.

Keywords: *Hospital, biohazard wastewater, Secondary treatment, anaerobic-aerobic bioreactor*

28- Hazardous Waste Characteristics in Baghdad. Pilot Study: Hospital Waste

Hospital waste or infectious waste is considered hazardous as they may contain highly toxic substances to humans, animals, and plants; highly inflammable, or explosive; and react when exposed to certain things e.g. gases**.** Biomedical waste contaminated by chemicals used in hospitals is considered hazardous. These chemicals include formaldehyde and phenols, which are used as disinfectants, and mercury, which is used in thermometers or equipment that measure blood pressure. Most hospitals in Iraq do not have proper disposal facilities for these hazardous wastes. Hospital wastes are generated during the diagnosis, treatment, or immunization of human beings or animals or in research activities in these fields or in the production or testing of biological. It may include wastes like sharps, soiled waste, disposables, anatomical waste, cultures, discarded medicines, chemical wastes, etc. These are in the form of disposable syringes, swabs, bandages, body fluids, human excreta, etc. This waste is highly infectious and can be a serious threat to human health if not managed in a scientific and discriminate manner. It has been meanly determined that of the 100 kg of waste generated in a hospitals in Baghdad at range 16-28 kg would be infected.

During 2002 and 2004,Six governmental hospitals in Baghdad were covered, included Baghdad teaching, Al-Shaheid Adnan, Al-Mansor, Al-Qadsiya, Al-Amam Ali and Ibn Al-

baldi hospital, Not only the annual medical waste generation rate and its composition but also generation of some indicators correlating waste generation and hospital capacity were the objectives of the study. Therefore, the number of beds, occupancy rate of the beds, number of employees and staff, amount of medical waste and household waste generated per day, fuel consumption for heating, collection, deposition, transportation, and disposal of wastes, recycling applied, incineration plant capacity if available were questioned during the survey. In the composition research, amount and type of wastes generated were quantified together with number of patients per day, number of surgeries per day, number of births, number of x-ray photography and number of laboratory tests. The main conclusion from this study is no system of hospital waste management in Baghdad, a lack of knowledge among health staffs, a lack of necessary supplies and facilities and a lack of connections among different ministries.

Keywords: *Solid Waste Management, Hazardous waste, Hospital waste, Baghdad Hospitals*

29- The Effect of Hydraulic Parameters on Biofilm Thickness in Submerged Aerated Biological Filter

The hydraulic parameters such as water velocity, air pressure and velocity, media porosity and density affect the biofilm thickness in Submerged Aerated Biological Filter and then the organic removal efficiency. Experimental model was designed and constructed to investigate the microbial uptake of oxygen and a carbon source substrate for biofilms growing on SBAF with different water velocity and aeration techniques for similar geometry. The tracer technique was used to predicate wetted surface area and biofilm thickness .Acidic red dye color (Carmoisine (E-122)) was mixed with water and pumped to biofilter model which is used as chemical indicator for evaluation the biofilm thickness.

The fluid velocity affects the boundary layer thickness and the effective liquid film mass transfer coefficient, whereas the bulk concentration determines the concentration gradient for diffusive transport. For low substrate concentrations and low velocity, an increase in either substrate concentration or fluid velocity will increase substrate flux and removal efficiency.

30- Wastewater Characteristics of Babylon's Hospital

This study was conducted in three large hospitals in Babylon (Surgery, children and Merjan hospital) which offers treatment to 17681 patients with 1427 beds .The daily average wastewater generated is of 13261 m^3/d.

In view of chemical or toxic wastes generated, it has been found that the hospital generated around 61 mL/bed/d. It was noted that approximately 37 percent of total chemical wastes discharged to sewers was contributed by laundry section which led to be the largest generator of chemical wastes.

Wastewater characteristics (COD, BOD_5, TSS, TDS, pH, NO_3, PO_4, SO_4 and bacteria and virus tests) were analyzed for different times to evaluate the chemical,

The objectives of the study are to:

- study the present wastewater characteristics and its management;
- Prepare detail Environmental Action Plan (EAP) for the hospital.

Propose the suitable treatment systems and options; Total water consumption in Children's hospital is 2 to 3 times higher than the other reported findings. Hospital wards including laboratories were to be the largest consumer of water (331m3/d). About 7% of tap water was used inefficiently. The results show that the proposed treatment system is efficient for removal of COD, BOD_5, TDS, TSS and bacteria; and low-energy consumption.

Key words: *Hospital wastewater, Chemical and physical, biological characteristics*

31- Modification of Trickling Filter for Reusing Treated Industrial Wastewater Case Study: Optimization of Trickling Filter Characteristics

Experimental modeling of trickling filter is constructed and tested to optimize filter dimensions, operation conditions, and aeration techniques for different selected materials of filter media.

A pilot plant of ($2m^3$) trickling filter is used and fed with actual industrial wastewater from five textile factories in Iraq. Six different bed materials (crushed thermostone, crushed granite, crushed porcelinaite, polystyrene, plastic and wood) with diameter (45-52mm) are selected for testing total loading of filter media. Bed depths, ranging from (0.5 m) to (1.5 m) are tested. Several sets of experiments at steady inflows with large fluctuations in wastewater characteristics were made to study the effect of:-

1- Different material bed depths (0.5, 0.8, 1.1 and 1.5m) for constant diameter (45-52mm) of crushed granite trickling filter.
2- Various materials bed at constant filter media depth (0.8m) of crushed granite with (45-52mm) diameter.
3- Recirculation ratio of treated wastewater in 0.8m depth crushed granite with (45-52mm) diameter. Optimization the process in order to increase the biologic removal rate is experimented using different recirculation ratio of the treated wastewater (R=0, 0.5,1,2 and 3).
4- Aeration with several techniques (parallel flow, counter flow and cross flow) in (0.8m) depth granite with (45-52mm) diameter.

Measurements for influent wastewater and effluent are made including SS (mg/l), BOD5 (mg/l), COD (mg/l), pH and the effective parameters kilograms of O_2/kg BOD_5 eliminated, and organic load or BOD_5 as volumetric load (kg BOD_5/m^3/d) are calculated. Dissolved oxygen sensor is calibrated and used to estimate the concentration of (DO) at the solid/biofilm interface. The oxygen flux data from the experiments are compared with the mathematical model prediction for biofilm thickness of 50 to 500$^{\mu m}$.

32- Water Tribulation in Baghdad

Both the 1991 Gulf War and the 2003 Iraq War have affected and used the water resources. Most of the water in Baghdad comes from Tigris River. Baghdadis need abundant water supplies to live and survive in the desert environment. The wars and economic sanctions have left the people in a state of drought, with the water largely contaminated and few resources available to clean it.

During the first Gulf War, Allied bombings targeted eight multi-purpose dams which wrecked flood control, municipal and industrial water storage, irrigation and hydroelectric

power. Four of seven major pumping stations were destroyed, as were 31 municipal water and sewage facilities (20 in Baghdad) resulting in sewage pouring into the Tigris.

Tigris River water is a concentrated cocktail of pesticides, fertilizers, sewage water with oil, gasoline and heavy metals. Adding to the hazards, very few sewage treatment plants in Baghdad are operational. Wastes from factories, hospital, garbage and most of raw waste from the city of six million residents can be pumped through the sewer system, completely bypassing any treatment, and flow right into the river.

Eight stations for monitoring and samples collection are chosen in different positions on the Tigris River and various analyses are carried out. Samples are prepared as two types:

Type one include: Inorganic compounds / poisonous and heavy elements, Organic compounds, Radiated materials and Herbicide and insecticide.

Type two include:- Bacteriological test, Physical and Chemical tests like (COD, Turbidity, Color, pH, Electrical Conductivity, Magnesium, Calcium, Bicarbonate, Sodium, Potassium, Iron, sulfates, Chlorides, Completely solute materials, Completely suspending materials, Nitrogenous compounds, Phosphate, Fluorides). Water sector in Baghdad suffers from problems which are represented as follows:

- Exiguity of the financial appropriations in the operational balance & investment balance which will not cover the disability in the product capacities and which will not help to complete new projects on the short period, but for long years exceeds (10) years.
- Exiguity or the financial specialization absence for importing materials and requirements which the sector need them in continuing operation and maintenance the water projects, water compact units and networks such as (pumps with their different types, different electrical systems sterilization systems, clarification systems, and pipes with their different types (plastic ,ductile, poly ethylene. etc)
- Weakness in the operating cadres and intermediate cadres which work in this sector, which they need training and rehabilitation and enhance their efficiency.

33- Production Thermal Building Elements from Solid Waste

Modernization and progress has had its share of disadvantages and one of the main aspects of concern is the pollution it is causing to the earth – be it land, air, and water. With increase in the global population and the rising demand for food and other essentials, there has been a rise in the amount of waste being generated daily by each household. This waste is ultimately thrown into municipal waste collection centers from where it is collected by the area municipalities to be further thrown into the landfills and dumps.

The solid waste management hierarchy is reinforcing the focus away from land filling and towards waste prevention, recycling, composting, and Energy-from-Waste in that order of priority.

Emphasis is concentrated on walls, roofing tiles, blocks and lightweight intersections which form the basic element in building system to improve its thermal insulation .Several admixtures are added to the mixture of this building element prior to forming then in moulds. The admixture consists of insulation materials taken from municipal wastes (scrap plastic and rubber…etc).

A program for adding these materials with various treatments to the mixture of building element include different percentage by mass. Several variables shall be studied such

as thermal conductivity, heat capacity, density, thermal diffusivity, water absorption and compressive strength.

Results from first experimental tests show that the overall heat transfer coefficient and density may be reduced significantly.

Adding the environmental effect (since using waste material help keeping the environmental clean); we have added reasons to believe in the effectiveness and benefits of this work if applied on large scale.

The objective of this study is:

- Production cheap building elements.
- Comparison the results of mechanical, thermal and chemical tests for different samples with the conventional building elements.
- Determination the best manufactures techniques for production high thermal insulation materials.
- Utilization of solid waste and improvement the solid waste management.

34- GrayWater Use in Buildings in Baghdad

Water conservation and reuse in many areas of Iraq are issues that receive a great deal of public attention. The search for ways to responsibly use and reuse water is vital to the sustainability of the water supply and thus the future of these areas. Wastewater treatment and reuse is one of the best water conservation options available to communities located in many areas of Iraq. Treated shower, sink and bath gray water were reused for toilet flushing, outdoor irrigation and spraying water evaporation cooling of selected apartments building located in Baghdad. The study objectives include:-

1. Daily water consumption measurement for different quantitative samples of communities, families and persons in Baghdad.
2. Study the effective parameters that influence the water consumption such as climate, characteristic of population, an economic and psychological status of customer.
3. Design and construct double plumbing with simple gray water treatment unit for recycle water.
4. Regulate, daily water share and analysis the gray water samples (BOD_5, COD, P, N, and TSS).
5. Measure the reductions in water consumption and study economical feasibility for new residential system.

Two separate aspects of gray water usage in the area must be studied:-

1- Aerobic pretreatment for facilities where the principal source of gray water is hand washing & showers without any food waste.

2- The residential filter of three stages to remove food waste from Kitchen (sinks receiving cooking grease & a fair amount of food residue) filter should be consisted of:

- An aerobic treatment septic tank. - Filtration unit (sand filter). - Aerobic unit

The final treatment stage leading to purified water of near potable quality that is used in different purposes. The treatment systems must be effective, simple to maintain on safe treatment techniques available to day

Keyword: *Water Quality, End of pipe Technology and Cleaner Production, Water Conservation, GrayWater Use.*

35- An Analytical Model Study for Flow through Porous Media

Hydrodynamic modeling of viscous flow through porous media was investigated for five selected filter media crushed silica, crushed coal, glass beads, crushed porcilinaite and crushed garnet. Typical constant that can be used to estimate head loss for some of the most common design of granular media filters were correlated.

An experimental set-up has been specially conceived to generate Reynolds number between 100 and 800. A capillary-type flow model was constructed to determine structural parameters of media and predict pressure gradients.

Using one dimensionless equation of the capillary-type flow model with set of experiments, friction coefficient can be correlated as function to pore Reynolds number in transition zone.

Empirical relationships were developed using a plot of friction vs. Reynolds number similar to those that had been successfully used for the pipes flow. Analytical models were constructed to develop an equation for friction factor in transition zone(Inertial flow with increasing random irregular) in porous media as function to flow type from first hydraulic principle**s** and semi-empirical equation of head loss in porous media for (100 <Re <800) was evaluated **.**

Keywords: *porous media, water filter, friction coefficient,, pressure head loss*

36- Estimation of Hydraulic Conductivity based on Filter Media's Characteristics in Darcy's Regime

Hydraulic conductivity of different materials, which are commonly used in gravity filters were determined by carefully, conducted experiments in the laboratory. Four selected natural material including sand, garnet, coal, porcelinaite were experimented.

Several empirical equations to evaluate hydraulic conductivity using media characteristic were used in this study. Results showed that all the nine empirical formulas (Hazen, Kozeny-Carman, Breyer, Slitcher, Terzaghi, Vukovic & Soro, Alyamani & Sen, Dhia and USBR) reliably estimated hydraulic conductivity of filter medias well within the known ranges. However, some of the formulae underestimated or overestimated hydraulic conductivity; even of the same medias. Most importantly, all these empirical formulae are to be used strictly within their domains of applicability. The hydraulic conductivity depends extremely on water filter media size, the structure of the media matrix, the type of soil fluid, and the relative amount of soil fluid (saturation) present in the media matrix.

The important properties relevant to the media matrix of the media include pore size distribution, pore shape, tortuosity, specific surface, and porosity. In relation to the media fluid, the important properties include fluid density, and fluid viscosity.

Keywords: *Darcy regime, Hydraulic Conductivity, water gravity filter, porous media, porosity, Grain-size analysis.*

37- Effects of Biomass Growth on Pressure Drop in Submerged Aerated Bioreactors

A semi-empirical model was developed to predict biomass-affected porosity, specific surface area and pressure drop as a function of the biomass concentration in two selected Submerged Aerated biorectors (SABRs). Under similar conditions two bench-scale SABRs (1m long and

100mm diameter) were operated to treat an industrial wastewater, the first packed with porcelinaite rocks and the other with polystyrene grains at hydraulic loading rates of (0.1–3.2 m/h) and with BOD5 concentration of (110- 436 mg/L).

Typical constant that can be used to estimate pressure drop for some of the most common design of SABRs were correlated. The proposed equations in porosity and specific surface area caused by biomass accumulation in SABR bed are based on macroscopic estimates of average biomass concentrations. In comparison to biofilm-based models, the macroscopic models are relatively simple to implement and are computationally more efficient.

The effects of biomass accumulation and distribution on pressure losses and removal efficiency of biological load in SABRs were experimentally studied.

Localized biomass accumulation in the SABR beds is the key factor increasing the pressure drop, which was caused by local bed clogging due to biomass growth. The highest pressure drops in the beds (porcelinaite rocks: 2,150 N/m^3 and polystyrene grains: 1115 N/m^3) occurred where there were high biomass levels. The pressure drop varied nonlinearly with the amount of accumulated biomass and the amount of oxygen consumed. Porcelinaite rocks caused greater pressure drops, on average 2 times higher than the polystyrene grains. Compaction, as a consequence of biomass growth and porcelinaite rocks degradation increased the pressure drop in the porcelinaite rocks bed. A comparison of the experimental and the predicted pressure drops showed that the model provided good estimates of biomass-affected porosity and pressure drop in the SABRs packed with spherical grains with even biomass distribution.

Keywords: *pressure drop, aerated submerged bioreactor, biomass growth, porcelinaite rocks*

38- An Experimental Model for Flow through Porous Media Using Water Filter

An Experimental study was conducted to examine several selected water filter's Medias such as crushed silica, crushed anthracite coal, glass beads crushed porcilinaite and crushed garnet. A large spread of particle size (0.5mm - 2mm), porosity (35% - 60%) and physical temperature (20 ºC – 80 ºC) were tested in order to validate the experimental modeling of both Darcy's and Forchheimer's law parameters. Typical constants of head loss in porous media as function to velocity using Forchheimer,s model has been correlated by using hydraulic conductivity coefficients a, b which are experimentally evaluated at based conditions (Tw = 25 ºC), (n = 50%), (d=1mm). Empirical equations for different selected porous media and filter's characteristics were approximate to use Forchheimer's model.

Keywords: *porous media, Forchheimer regime, water filter, pressure loss head*

39- Hospital Solid Waste Characteristics in Baghdad

Hospital waste or infectious waste is considered hazardous as they may contain highly toxic substances to humans, animals, and plants; highly inflammable, or explosive; and react when exposed to certain things e.g. gases.

During 2002 and 2004, Six governmental hospitals in Baghdad were covered, included Baghdad teaching, Al-Shaheid Adnan, Al-Mansor, Al-Qadsiya, Al-Amam Ali and Ibn Al-baldi hospital, Not only the annual medical waste generation rate and its composition but also generation of some indicators correlating waste generation and hospital capacity were

the objectives of the study. Also, Data were collected through a questionnaire given to 528 health staff. Therefore, the number of beds, occupancy rate of the beds, number of employees and staff, amount of medical waste and household waste generated per day, fuel consumption for heating, collection, deposition, transportation, and disposal of wastes, recycling applied, incineration plant capacity if available were questioned during the survey. It has been meanly determined that of the 100 kg of waste generated in a hospitals in Baghdad at range 16-28 kg would be infected. The total hospitals in Iraq are 139, 90 governmental and 49 nongovernmental hospitals. 79 hospitals in Baghdad which represent 58%, completely segregation for medical was achieved in 39.6 % and partial segregation was observed in 55.4% of the hospitals; only 63.2% were collected in special sharp boxes. Transport of medical waste was made in thin plastic bags and there were no color-coded bags. The same kind and color of domestic waste bags is used for medical waste. There were generally no storage places; and medical waste was stored with domestic waste .Most of hazard solid waste is stored in the outdoors are incinerators. As for disposal, medical waste was disposed of with domestic waste where municipality trucks collect medical and non-medical waste together.

54% of hospital contains incinerators while 46% of the hospital s burned manually in the open air. In hospitals, it was incinerated but without any control or protection measures for workers.

Liquid medical waste was disposed of in the same pipelines as domestic waste. As regards knowledge of medical waste, 78% of the study group declared that they knew about medical waste. About 66% of the participants knew that they were exposed to occupational hazards as a result of improper management of medical waste. Concerning environmental hazards, 77% of the medical workers knew that medical waste could pollute the environment. It is essential to know only 16.5% of hospital administration weight the solid waste and record the amounts of waste generated and their sources, the type of materials in each waste stream, their properties, potential toxicity, and the hazards they pose to human health and the environment.

The largest component of the organic waste stream from hospitals is food wastes, and paper at 24.8% represent the second highest percentage of the hospital solid waste stream that is composed of cardboard, high-grade paper, newspaper, magazines, directories, and other mixed paper. Plastics, at 15.2%, represent the third highest percentage of the hospital solid waste stream.

40- The Effect of Solid Waste Percentage on Production Lightweight Aggregate Concrete

Case Study: Glass, Rubber, Plastic and Concrete Waste

A waste management plan directs the construction activities towards an environmentally friendly process by reducing the amount of waste materials and their discard in landfills.

The waste materials considered to be recycled in this proposal consist of glass, plastics, rubber and demolished concrete. Such recycling not only helps conserve natural resources, but also helps solve a growing waste disposal crisis. Plastics, rubber and glass were used to replace up to 24% of fine aggregates in concrete mixes, while crushed concrete was used to replace up to 22% of coarse aggregates. To evaluate these replacements on the properties of the ordinary

portland cement concrete OPC mixes, a number of laboratory tests must be carried out. The first set of tests included workability, unit weight, compressive strength, flexural strength, and indirect tensile strength (splitting). The main findings of this proposed investigation revealed that the four types of waste materials can be reused successfully as partial substitutes for sand or coarse aggregates in concrete mixtures to produce lightweight building elements such as roofs, walls and partitions by different structural techniques such as slabs, beams, panels and blocks.

In Baghdad more than 24% of the building construction waste consists of glass, plastic, rubber and concrete (Dheyaa 2008). Therefore, introducing another means of disposal by recycling is nationally required in Iraq.

Large quantities of this waste cannot be eliminated. However, the environmental impact can be reduced by making more sustainable use of this waste. Many studies have been conducted to examine the possibility of using plastics, rubber and glass powder in various civil engineering projects in the construction field (Chanbane et al., 1999; Rindl, 1998; Shayan et al., 1999). Rindl (1998) reported many uses of waste glass, which included road construction aggregate, asphalt paving, concrete aggregate, and many other applications. Shayan (1999, 2002) studied the use of the waste glass aggregates in concrete. These research efforts try to match society's need for safe and economic disposal of waste materials. The use of recycled aggregates saves natural resources and dumping spaces, and helps to maintain a clean environment. This study concentrates on those waste materials, specifically glass waste, rubber waste, plastics waste and building construction waste to be used as substitutes for conventional materials, mainly aggregates, in ordinary portland cement concrete mixes.

Recycling concrete as aggregate introduces a solution to the problems encountered with the quarrying of natural aggregates and the disposal of old concrete. As these substitutes require extensive studies about their effect on the properties of concrete, Yang et al. (2001) concluded in their research that the use of rubberized concrete should be limited to secondary structural components such as culverts, crash barriers, sidewalks, running tracks, sound absorbers, etc. Huang et al. (2004) treated the rubberized concrete as a multiphase particulate filled composite material, and built a model to predict the factors affecting the strength of the rubberized concrete. A parametric analysis was conducted using finite element analysis. Based on their analysis, they concluded that the strength of rubberized concrete can be increased by reducing the maximum rubber chip size; using stiffer coarse aggregate; employing uniform coarse aggregate size distribution; and using harder cement mortar if it has a high strength or using softer cement mortar if it has high ductility. In addition, they concluded that rubber chip content should be limited to a certain range in order for it to be used in practice. Sukontasukkul and Chaikaew (2006) used crumb rubber to replace coarse and fine aggregates in concrete pedestrian blocks. This has produced softer blocks that provided softness to the surface. In addition, crumb rubber blocks performed quit well in both skid and abrasion resistance tests. Krammart and Tangtermsirikul (2004) investigated the use of municipal solid waste incinerator bottom ash and calcium carbide waste as part of the cement raw materials. They found that the chemical composition of the cement produced from raw materials containing the used wastes was similar to the control cement. They also noted the superiority of the newly produced cement over the control cements in the sodium sulfate solutions.

The main objective of this study is to investigate the performance of the OPC mix under the effect of using recycled waste materials, namely glass, plastics, and crushed concrete as a fraction of the aggregates used in the mix. This will be demonstrated through experimental laboratory tests, using fine glass and plastic aggregates to substitute a certain percentage of the fine aggregates (sand), whilst using crushed concrete to substitute a certain percentage of coarse aggregates in OPC concrete.

The used aggregates in the prepared concrete mixes are local natural materials. Coarse aggregate can be taken from crushed gravel, and fine aggregate from natural sand. Tap water or treated greywater can be examined at room temperature and used in all of the mixes. Different percentages of cement, water, fine aggregates, and coarse aggregates can be combined in order to produce concrete of the required workability and strength suitable. Mixes of up to 25% of plastic particles can be proportioned to partially replace the fine aggregates. Fresh mix property tests, such as slump and unit weight tests, must be performed immediately after mixing. Cubes of 10x10x10 cm, cylinders of 15 cm diameters by 30 cm height, and beams of 10x10x40 cm can be prepared from each mix for hardened-state property testing. Tests were performed after 3, 14 and 28 days of continuous water curing in accordance with ASTM C192.

The major goals in this study are to study the:

- Effects of the different percentages of glass, and plastic, rubber particles on slump results on strength of concrete.
- The optima percentage of replacing fine aggregates with glass or plastic or together which varies from 0% to 25%, each waste can be applied in an individual concrete mix.
- The effect of different percentages of crushed glass, rubber and plastic on slump and on the strength of concrete.
- Crushed concrete can be used to substitute up to 24% (mass ratio) of the conventional natural coarse aggregates used in the mix. The recycled aggregates (crushed concrete) can be produced by crushing the old concrete waste that can be collected from distorted buildings. The crushed concrete must be then screened using the sieve analysis method.
- The effect of different percentages of recycled concrete on slump results and strength of concrete.
- The reduction in the slump value with the increase of the replacement percentage of the coarse aggregates with recycled crushed concrete.
- The reduction of slump for recycled concrete aggregates replacement that is due to the fact that absorption of crushed concrete is higher than that of coarse aggregate. Therefore, higher the percentage of recycled concrete aggregates, higher the absorption percentage, the lower is the slump.
- The irregularity of the surface of the recycled concrete aggregates that affects the workability of concrete.
- The concrete mixes with recycled concrete aggregates exhibited reduction in compressive, flexural and splitting-tensile strengths compared to normal concrete.
- The acceptable reduction in compressive strength with a 20% substitute of recycled crushed concrete.
- When up to 25% of plastic, rubber, glass and crushed concrete can be used in concrete, the lowering of compressive and splitting.

41- Hospital Wastewater Treatment Using Multimedia Bioreactor with Ozonation

The objective of hospital wastewater treatment is to produce effluent suitable for agricultural or aquacultural reuse (or both), or to produce an effluent that can be safely discharged into inland or coastal waters.

Hospital wastewater poses a significant pollution threat to water-bodies and soil, hence the quality of the effluent must be controlled, especially with regards to the two variables, the first are polluting parameters such as BOD_5, TOC, suspended solids and COD, the others are nutrients such as phosphate, nitrate, and ammonium. Toxins are also controlled depending on their types, and these would include solvents, heavy metals, phenols, chlorinated compounds. Microbial pathogens which can be potentially present in wastewater can be divided into three separate groups: viruses, bacteria, the protozoans and helmiths.

Hospital wastewater associated infections generally include diarrhoea, dysentery, dysentery-like infections, *Leptospira interrogans* infections, typhoid, human enteritis, legionellosis, melioidosis, stomach ulcer and cancer.

Lab scale model of multimedi biofilter of 900mm length and 200mm diameter was designed and constructed with two supplementary tanks. The first tank was used for pre - aeration or preozonation before biofiltration while the other was used for ozonation as disinfection. Sand, Porcelinaite, bentonaite, Granular Activated Carbon and granite were selected as medias of biofilter. Various processes before biofiltration such as aeration, preozonation were carried out.

It was observed that the septic tank (an anaerobic processes) was very effective and economical for removing high concentrations of BOD5 and COD especially in warm climates (24-30 ºC); a properly designed and not significantly under loaded anaerobic pond will achieve around 64% BOD removal and 41% COD removal at 24 ºC and as much as 81% and 52% for BOD_5 and COD removal respectively at 30 ºC. Multimedia bioreactor with aeration tank removed 93% of dissolved organic matter from wastewater.

Keywords: *Hospital, Biohazard wastewater treatment, Multimedia, preozonation, aeration.*

42- Conservation of Water in Building

A building rapid population growth makes increasing demands on finite resources including fresh water, energy and living spaces that requires energy and water conservation program. Local daily measurements for water consumption during (1998, 2000) for three quantitative samples of (communities, families and persons) were carried. The effective parameters that influence the consumption such as (climate, characteristic of population, building and gardens area, cooling technique, an economic and psychological status of customer) were investigated. Residential looped network have been designed and constructed with self-treatment for recycled water. Daily water share was regulated and supplied to compartment. Measurements may be summarized that the reductions in water consumption approach to (58%) from the conventional consumption.

Measurements may be summarized that the reductions in water consumption approach to (58%) from the conventional consumption

Keywords: *Water Conservation, Passive Cooling and Heating System*

43- Water Recycling In Textile Industry Using Biological Activated Carbon Treatment System

Bio-treatment is efficient and simple process that involves the use of naturally occurring micro-organisms in the wastewater to improve water quality. Under optimum conditions, including enough oxygen, the organisms break down materials in the water such as Dissolved Organic Carbon (DOC), Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Turbidity, Total Suspended Solid (TSS) and Nutrient levels and thus improve water quality. Sand or carbon filters are used to provide a place on which these micro-organisms grow. Wastewater samples from a number of textile facilities and measurements (pH, COD, BOD_5, COND, SO_4^{-2}, NO_3^-, Cl^-, PO_4^{-2}, TSS, Hardness and heavy metal) were analyzed. A combined chemical-biological treatment of industrial wastewater using Preozonation,

Aerated Biofilter, Ozonation and Activated Carbon AC are tested. Because of the low price of biotreatment, the combination with AC may reduce the overall treatment cost. The final goal of the BAC treatment is to degrade the industrial wastewater in a fast and inexpensive way. Two types of laboratory biological activated carbon (BAC) systems for waste water treatment in five factories in Iraq were studied as part of consult work to recycle 80% of the treated water in the factory and reusing the 20% for secondary uses. The first biological activated carbon treatment system has three parts:

- Preozonation reactor (5mg/L ozone for 1250 to 1800sec) to raise dissolved oxygen and remove ammonia.
- A slow sand filter to remove suspended matter;
- A biological activated carbon (BAC) filter (activated carbon as granular) to reduce dissolved organic matter and remove color (20 to 30 mg/L ozone for 0.5 to 1 hour).

While the second biological activated carbon treatment system has three parts:

- Preozonation reactor (5mg/L ozone for 1250 to 1800sec).
- Porceliniate bioreactor to remove suspended and organics matter;
- A biological activated carbon filter (BAC) (activated carbon as flexible clothes) to reduce dissolved organic matter (20 to 30 mg/L ozone for 0.5 to 1 hour).

44- Effect of Loading Rate on the Greywater Properties

As global water resources decline, reuse of domestic greywater for the irrigation of home gardens is quickly becoming requested in many parts of Iraq. Greywater reuse for irrigation was attempted because of its amount (more than 65% of Baghdadi household wastewater) and its quality (it is considered to be only weakly contaminated by pathogenic organisms and other potentially dangerous substances).

The effects of greywater irrigation on four commonly used agricultural soils and models were studied. Sand, sandy loam, sandy clay, and light clay soils were selected as common Iraq soils. Soil's chemical and physical properties under different irrigation regimes were daily measured during period extended from February 2011 to April 2012) in Baghdad city and plant growth was monitored.

A lab scale models of four acrylic columns of 100mm diameter and 750mm height were designed and constructed in environmental hydraulic lab at Mustansiriyah University and tests were run concurrently with the characterization study to assess the effect of soil

depth and loading rate on treatment efficiency. Soil samples were carried out in a site that had been drained with greywater for over 14 months. Measurements of greywater and treated greywater had been achieved which contains BOD_5, COD, pH, EC, TDS, Turbidity, Cl^{-1}, SO_4^{-2}, NO_3^{-1}, Na^{+1}, Ca^{+2}, Mg^{+2}, E Coli and Coliform.

The results showed that the nutrients supplied by the greywater are beneficial to the irrigated lawn but are not sufficient to sustain its growth. Consequently, the lawn requires the addition of fertilizer to supplement growth.

Data showed a considerable variation both within different sites. Passing raw greywater through the columns resulted in a reduction of BOD_5 by a factor of 16.5 to 7.9 mg/L in sand, a factor of 25.5 to 5.1 mg/L in sandy loam, a factor of 16 to 8.1 mg/L in sandy clay, and a factor of 26.5 to 4.9mg/L in light clay -textured material of Baghdad's soil. TSS values were reduced from 56 to 6.2 mg/L for the sand, 5.8 mg/L for the sandy loam, 7.1 mg/L for the sandy clay, and 9.8 mg/L for the light clay. Nitrate values were much higher in the column effluent than in the raw greywater with mean values of 11mg/L for the sand, 13.5 mg/L for the sandy loam, 10.3 mg/L for sandy clay, and 12.9 mg/L for light clay that refers to a significant amount of nitrification occurred. The impact of greywater reuse on plants and soils is highly dependent upon site-specific characteristics crop type, soil type, and Iraqi climate (dry and hot in summer, wet and cold in winter).

Keyword: *Greywater reuse, Soil contaminated, Sand, Light Clay, Sandy Loam, Sandy Clay.*

45- Greywater Disinfection Using Multi Stage Solar BioReactor

Solar disinfection is an efficient method for reusing treated greywater for non-potable use. Solar disinfection is affected by numerous variables such as the wavelengths of solar radiation, water temperature, turbidity, and reactor characteristics, Laboratory Models of Solar Biocolector were designed and constructed at Environmental Hydraulic in Mustansiriyah University/ College of Engineering. The first model consists of four independent Acrylic reactors of 100mm diameter and 1300mm length, filled with different materials for biofiltration and disinfection. The first reactor was filled with sand of effective grain size of 0.7mm and uniformity factor of 1.4, the second reactor was filled with black granite of effective size of 1.2mm and uniformity coefficient of 1.8. The third reactor was filled with granular activated carbón of effective size of 2.2 mm and uniformity coefficient of 2.4, while the fourth reactor was filled with mixture of granular activated carbónand black granite of effective size of 1.2 mm and uniformity coefficient of 2.4. The second model is vertical panal consists of three independent Acrylic reactors of 100mm diameter and 650mm length, filled with different materials for biofiltration and disinfection. The first reactor was filled with sand of effective grain size of 0.7mm and uniformity factor of 1.4, the second reactor was filled with granular activated carbón of effective size of 2.2 mm and uniformity coefficient of 2.4, while the third reactor was filled with mixture of granular activated carbónand black granite of effective size of 1.8 mm and uniformity coefficient of 2.6. Hourly measurments of influent and effluent were carried out during period March 2009 to May 2011. Measurements include pH, TDS, TSS, BOD_5, COD, Cl, E. coli, Faecal Coliforms,

The objective of this research is to test the inactivation of different bacteria by solar disinfection using new technology of Solar Biocolector. The variables tested have to be water matrix, reactor size, turbidity, and exposure time. Solar disinfection experiments must be

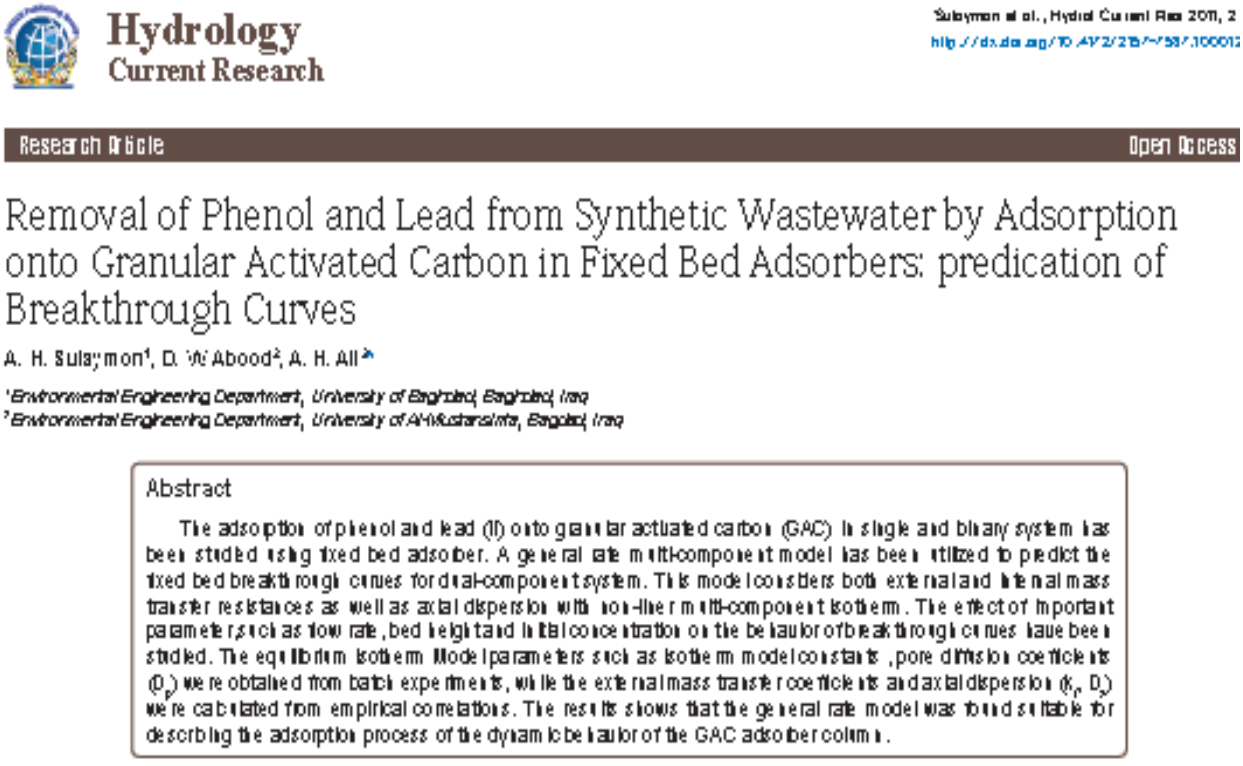
conducted in which samples are exposed to sunlight and allowed to heat. The inactivation of E. coli in the samples is quantified over time. The effects of heating only are tested to determine the importance of temperature in the solar disinfection process. These results are compared with the results of the solar disinfection experiments.

For each experiment, the test reactors are prepared and spiked with E. coli in the laboratory. The initial temperature and turbidity of each test is recorded and samples must be taken to enumerate the starting concentration of bacteria. The test is then exposes to sunlight and samples have to be collected at predetermined intervals to determine the bacteria concentration. During each sampling time, air temperature, relative humidity, wind speed, water temperature, and solar irradiance are measured and the log inactivation of bacteria is calculated over time.

Keywords: *Solar disinfection, greywater treatment, biofiltration, Baghdad city*

46- Current Research:
Removal of Phenol and Lead from Synthetic Wastewater by Adsorption onto Granular Activated Carbon in Fixed Bed Adsorbers: Predication of Breakthrough Curves

Sulaymon et al., Hydrol Current Res 2011, 2:4
http://dx.doi.org/10.4172/2157-7587.1000120



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Research Article Open Access

Removal of Phenol and Lead from Synthetic Wastewater by Adsorption onto Granular Activated Carbon in Fixed Bed Adsorbers: predication of Breakthrough Curves

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Abstract

The adsorption of phenol and lead (II) onto granular activated carbon (GAC) in single and binary system has been studied using fixed bed adsorber. A general rate multi-component model has been utilized to predict the fixed bed breakthrough curves for dual-component system. This model considers both external and internal mass transfer resistances as well as axial dispersion with non-liner multi-component isotherm. The effect of important parameters such as flow rate, bed height and initial concentration on the behaviour of breakthrough curves have been studied. The equilibrium isotherm Model parameters such as isotherm model constants ,pore diffusion coefficients (D_p) were obtained from batch experiments, while the external mass transfer coefficients and axial dispersion (k_f, D_z) were calculated from empirical correlations. The results shows that the general rate model was found suitable for describing the adsorption process of the dynamic behaviour of the GAC adsorber column.

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Abstract:

The adsorption of phenol and lead (II) onto granular activated carbon (GAC) in single and binary system has been studied using fixed bed adsorber. A general rate multi-component model has been utilized to predict the fixed bed breakthrough curves for dual-component system. This model considers both external and internal mass transfer resistances as well as axial dispersion with non-liner multi-component isotherm. The effect of important parameter, such as flow rate, bed height and initial concentration on the behavior of breakthrough curves has been studied. The equilibrium isotherm Model parameters such as isotherm model constants, pore diffusion coefficients (D_p) were obtained from batch experiments, while the external mass transfer coefficients and axial dispersion (k_f, D_z) were calculated from empirical correlations. The results show that the general rate model was found suitable for describing the adsorption process of the dynamic behavior of the GAC adsorber column.
Keywords: *Adsorption; GAC; phenol; lead; fixed bed*

٤٧ ـ أزمة المياه في الخليج العربي، واقعها ،مستقبلها وسبل تقديرها

تواجه بلدان الخليج العربية تحديا خطيرا في أمنها المائي متمثلة بتضخم سكاني مطرد، قلة الموارد المائية بالإضافة إلى مشاكل التلوث والهدر مما يستدعي إنشاء مجلس طوارى لأدارة الموارد المائية لتحديد مستوى الازمة وسبل التعامل معها. أعد نموذج رياضي لمحاكاة الواقع المائي لبلدان مجلس التعاون الخليجي (السعودية، الكويت، البحرين، الامارات، قطر، عمان) والعراق لغرض تخمين المتغيرات الأساسية المؤثرة في تحديد الأزمة المائية لمدة (٢٠) سنة من سنة (٢٠١٠) ابتدأ ولكل (٥) سنوات وبالاعتماد على البيانات المتداولة لسنتي ٢٠٠٠و ٢٠٠٥. شملت العوامل المؤثرة في النموذج الرياضي، عدد السكان، حجم الموارد المائية المتجددة التقليدية وغير التقليدية، حصة الفرد السنوية من المياه، معدلات الاستهلاك، مقدار الفجوة المائية وكمية الطلب المتوقعة على المياه). استخدمت (٣) معاملات في تحديد شدة الأزمة، الإجهاد المائي (Water Stress)، خط الفقـــر المائـــي (Water Poverty Line) والمـــــوازنـة المائيـــــــة (Water Balance).

أعتمد معامل الاتزان المائي كمؤشر لتحديد أزمة المياه وشدتها لدقته وشموليته وجُدولت الخيارات المتاحة للحل مع إعداد جداول لمستويات الاجهاد المائي وحدود الاستهلاك الحرجة. أظهرت الدراسة انخفاض حاد في حصة الفرد الخليجي عام (٢٠٣٠) الى أقل من النصف المتاح في (٢٠٠٥) حيث تقدر حصة الفرد السنوية من المياه عام (٢٠٣٠) دون (٤٠٠ م^3)، حيث عدد السكان المتوقع (١٢٨,٦ مليون نسمة) ويبلغ حجم الفجوة المائية المتوقعة (١١٨,٥ مليار م^3/سنة)، عندها يكون معامل الاتزان المائي (٠,٤٦-) الذي يحدد ويصف الموقف المائي العربي بالندرة والاقتراب من حافة الجفاف. اقترحت برامج حلول تبعا للموقف المائي شملت تنظيم الأسرة وأعتماد النموالسكاني الصفري، تطوير في تخطيط المدن، تخفيض استهلاك الماء واستخدام الماء الرمادي، استخدام التقنيات الحديثة بالري كالرش والتنقيط والري التكميلي، إنشاء محطات خزن مياه الأمطار، اعتماد نظام الحصة المائية والتسعيرة الحدية، ازدياد في انتاج المياه المحلاة والمياه المعالجة من مياه ألصرف الصحي والزراعي وأعادة استخدام المياه الصناعية.
الكلمة الدليلية: *ادارة الموارد المائية، النمذجة الرياضية، مقياس الازمة المائية.*

٤٨ - إنتاج بلاطات تسطيح عازلة حراريا لتقليل الحمل الحراري في لأبنية

يهدف البحث الى ترشيد استهلاك الطاقة اللازمة لأغراض التدفئة والتبريد عن طريق استحداث بلاط تسطيح خفيف وتحسين خواصه الحرارية لتقليل التسرب الحراري من خلال الوحدة البنائية للسقف بالإضافة الى تخفيف الاحمال الميتة المسلطة على الأعضاء الإنشائية.

استخدمت ستة انواع من العوازل الحرارية كمواد مضافة الى خليط الاسمنتي لانتاج انواع جديدة لبلاط التسطيح وهي:

- منتجات من المصانع البتروكيمياوية مثل حبيبات البولستارين الكروية ذات اقطار (٢ملم-٤ملم)، شرائح المايكا ذات ابعاد (٢ملم*٤ملم*٤ملم)، والاسفلت ذو النفاذية (٤٠-٥٠).
- فضلات صناعية مثل قشور الرز (السبوس)، احجار الثرمستون المتكسرة، مفروم البلاستك المعاد.

ولغرض الوصول الى النسب الحجمية المثلى للمواد العازلة المضافة الى الخليط الاسمنتي تم خلط بنسب حجمية مختلفة (٢٥%، ٥٠% و ٧٥%) قيست الخواص الحرارية للبلاط المستحدث (الكثافة، الموصلية الحرارية، السعة الحرارية، ومقاومة الانضغاطية).

أعدت معادلات تجريبية لتخمين الموصلية الحرارية والكثافة لاي بلاط منتج بالاعتماد على النسبة الحجمية للعازل الحراري ونوعه.

مقدار الانخفاض في معامل انتقال الحرارة الكلي يصل الى (٢٤%) ومقدار التناقص في الحمل الميت للبلاط المستحدث يصل الى (٦١%) عند إضافة (٧٥%) حجماً من حبيبات البولستارين الى الخليط الاسمنتي.

يساهم البلاط المستحدث في ترشيد استهلاك الطاقة بالاضافة الى حفظ البيئة كون المضافات هي مواد تالفة ناتجة من عمليات صناعية.

49- Reduction of Pollutant from Grey Water Using Modified Hydraulic Structure Case Study: Multi – Layer Cascade Weir

An experimental system to treat grey water has been constructed and installed at Al-Mustansiriyah University, College of Engineering during the period from August 2013 to July 2014. The performance of the treatment schemes has been evaluated by monitoring the quality of the raw grey water and effluent for some parameters, which are: Chloride Cl^-, Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD_5), Iron Fe^{+2}, and Manganese Mn^{+2}. The removal efficiencies for grey water grey water pollutants COD, and BOD_5 was measured which ranged between (12 % to 34 %), while the reduction of Fe^{+2}, Mn^{+2}, and Cl^- were (11 % - 23%), (12 % - 26 %), and (16 % - 24 %) respectively.

50- Treatment of Marginal Water by Combination of Two Layers of Stepped Cascade Weir and Trickling Filter

The main objective of this study is to treat marginal water of the main drain river in Iraq (of 600 km long and 200 m^3/sec discharge) without danger to human health or unacceptable damage to the natural environment, and to solve the problem of the water shortage for irrigation, industrial, and domestic uses in Iraq. An experimental model for marginal water treatment system has been designed and constructed at Al- Mustansiriyah University, College of Engineering in Environmental lab. The performance of the treatment schemes has been evaluated by monitoring hourly the quality of the raw marginal water and effluent. Measurements have been included: pH, EC, TDS, Chemical oxygen demand (COD), Toxicity, Turbidity, red color density, detergents, chlorine, chlorine dioxide and heavy metals (copper, chromium, molybdenum, potassium, bromine, manganese, and iron).

Keywords: *Marginal water, Main drain, Stepped Cascade weir, trickling filter*

51- Marginal Water Treatment by Combination of Two Stages of Stepped Cascade Weir and Spray Aerator

A combination of stepped cascade weir with spray aerator systems is one of the available ecological treatments to reduce the concentration of pollutants in marginal water and to solve the problem of the water shortage for irrigation and industrial uses in Iraq. An experimental treatment system for marginal water has been constructed and installed at Al-Mustansiriyah University, College of Engineering during the period from August 2013 to July 2014. The performance of the treatment schemes has been evaluated by monitoring the quality of marginal water and effluent for some parameters such as pH, Cl^-, BOD_5, COD, Fe^{+2}, and Mn^{+2}**.** Results indicate that the removal efficiencies for COD and BOD_5 is ranged from (43% to 51%), and (44% - 52%), that the removal efficiency of ions concentrations such as Fe^{+2}, Mn^{+2} , are (30% - 48%) %, and (33% - 48%), respectively, while for Cations such as Cl-, the removal efficiency is (31% - 42%).

Keywords: *Marginal water, spray aerator, bio-treatment, stepped cascade weir.*

52- Reduction of Toxic Matter from Marginal Water Using Sludge Recycling from Combination of Stepped Cascade Weir with Thermestone Trickling Filter

The aim of this investigation is to confirm the activity of a sludge recycling process in trickling filter filled with thermestone as an alternative biological process over conventional high cost treatment process with regard to toxic matter reduction from marginal water. The combination system of stepped cascade weir with thermestone trickling filter has been designed and constructed in Environmental hydraulic laboratory, Al-Mustansiriyah University, College of Engineering. A set of experiments have been conducted during the period from August 2013 to July 2014. For four days of continuous operation with different continuous flow rates ($0.4m^3$/hr, 0.6 m^3/hr. 0.8 m^3/hr, and 1 m^3/hr) after ten days of acclimatization experiments were carried out. Results indicate that the concentrations of toxic matter were decreasing with increasing of operation time, sludge recirculation ratio, and flow rate. The pollutants measured included toxic matter used in these experiments were ranged between (0.074 nm - 0.156 nm), and the overall reduction efficiency after 4, 28, 52, and 76 hours of operation were (63%, 71%, 79%, and 86%).

53- Biological Removal Efficiency of Multimedia Biological Filter

The Multimedia biofilter (MMBF) consists of four independent units of filtration materials, the top first unit is sand, second unit is Granular activated carbon, third unit is crashed porcelanite, and the Final bottom unit is crashed garnet. A set of experiments were planned and achieved to study the biological removal efficiency of the MMBF units under different hydraulic conditions. The results show that the participation of the first ten-centimeter layer of sand in the biological removal was high comparing with the lower layers of sand. Activated carbon played a significant role in the biological removal and such role was increased when using the ozone supply through the activated carbon, and this applies also when it is followed up the bacterial removal for E. coli, and the Total Coliform. However the maximum removal efficiencies were 89.9 % for COD, 88.9 % for BOD_5, while both E. coli and Total Coliform reaches 94 % and 91% removal efficiency respectively and increases to 100 % for both of them when using Ozonation.

54- Effects of Biomass Growth on Pressure Drop in Submerged Aerated Bioreactors

A semi-empirical model was developed to predict biomass-affected porosity, specific surface area and pressure drop as a function of the biomass concentration in two selected Submerged Aerated biorectors (SABRs). Under similar conditions two bench-scale SABRs (1m long and 100mm diameter) were operated to treat an industrial wastewater, the first packed with porcelinaite rocks and the other with polystyrene grains at hydraulic loading rates of (0.1–3.2 m/h) and with BOD_5 concentration of (110- 436 mg/L).

Typical constant that can be used to estimate pressure drop for some of the most common design of SABRs were correlated. The proposed equations in porosity and specific surface area caused by biomass accumulation in SABR bed are based on macroscopic estimates of average biomass concentrations. In comparison to biofilm-based models, the macroscopic models are relatively simple to implement and are computationally more efficient.

The effects of biomass accumulation and distribution on pressure losses and removal efficiency of biological load in SABRs were experimentally studied.

Localized biomass accumulation in the SABR beds is the key factor increasing the pressure drop, which was caused by local bed clogging due to biomass growth. The highest pressure drops in the beds (porcelinaite rocks: 2,150 N/m^3 and polystyrene grains: 1115 N/m^3) occurred where there were high biomass levels. The pressure drop varied nonlinearly with the amount of accumulated biomass and the amount of oxygen consumed.

Porcelinaite rocks caused greater pressure drops, on average 2 times higher than the polystyrene grains. Compaction, as a consequence of biomass growth and porcelinaite rocks degradation increased the pressure drop in the porcelinaite rocks bed.A comparison of the experimental and the predicted pressure drops showed that the model provided good estimates of biomass-affected porosity and pressure drop in the SABRs packed with spherical grains with even biomass distribution.

Keywords: *pressure drop, aerated submerged bioreactor, biomass growth, porcelinaite rocks*

55- Optimum Dimensions of Hydraulic Structures Foundation and Protections Using Coupled Genetic Algorithm with Artificial Neural Network Model

A model using the artificial neural networks and genetic algorithm technique is developed for obtaining optimum dimensions of the foundation length and protections of small hydraulic structures. The procedure involves optimizing an objective function comprising a weighted summation of the state variables. The decision variables considered in the optimization are the upstream and downstream cutoffs lengths sand their angles of inclination, the foundation length, and the length of the downstream soil protection. These were obtained for a given maximum difference in head, depth of impervious layer and degree of anisotropy. The optimization carried out subjected to constraints that ensure a safe structure against the uplift pressure force and sufficient protection length at the downstream side of the structure to overcome an excessive exit gradient. The Geo-studio software was used to analyze 1200 different cases. For each case the length of protection and volume of structure required to satisfy the safety factors mentioned previously were estimated. An ANN model was developed and verified using these cases input-output sets as its data base. A MatLAB code was written to perform a genetic algorithm optimization modeling coupled with this ANN model using a formulated optimization model. A sensitivity analysis was done for

selecting the cross-over probability, the mutation probability and level, the number of population, the position of the crossover and the weights distribution for all the terms of the objective function. Results indicate that the most factors that affects the optimum solution is the number of population required. The minimum value that gives stable global optimum solution of these parameters is (30000) while other variables have little effect on the optimum solution.

Keywords: *Inclined cutoff, Optimization, Genetic Algorithm, Artificial Neural Networks, Geo-Studio, Uplift Pressure, Exit Gradient, Factor of Safety.*

56- BioHazardous Waste Characteristics in Baghdad Pilot Study: Hospital Waste

Hospital waste or infectious waste is considered hazardous as they may contain highly toxic substances to humans, animals, and plants; highly inflammable, or explosive; and react when exposed to certain things e.g. gases.

During 2002 and 2010, Six governmental hospitals in Baghdad were covered, included Baghdad teaching, Al-Shaheid Adnan, Al-Mansor, Al-Qadsiya, Al-Amam Ali and Ibn Al-baldi hospital, Not only the annual medical waste generation rate and its composition but also generation of some indicators correlating waste generation and hospital capacity were the objectives of the study. Also, Data were collected through a questionnaire given to 982 health staff. Therefore, the number of beds, occupancy rate of the beds, number of employees and staff, amount of medical waste and household waste generated per day, fuel consumption for heating, collection, deposition, transportation, and disposal of wastes, recycling applied, incineration plant capacity if available were questioned during the survey.

In the composition research, amount and type of wastes generated were quantified together with number of patients per day, number of surgeries per day, number of births, number of x-ray photography and number of laboratory tests.

Results show that completely segregation is done only in 37.4% of hospitals and there are no color-coded bags. Medical waste is stored and disposed of with domestic waste in 49% of hospitals and it is incinerated in 51%hospitals, but there are no emission control or safety measures. It has been meanly determined that of the 104 kg of waste generated in a hospitals in Baghdad at range 19.4-29.8 kg would be infected.

Keywords: *Hazardous solid waste management, Hospital waste, Baghdad Hospitals*

57- Modification of Trickling Filter for Reusing Treated Industrial Wastewater Case Study: Optimization of Trickling Filter Characteristics

Experimental modeling of trickling filter was constructed and tested to optimize filter dimensions, operation conditions, and aeration techniques for different selected materials of filter media.

A pilot plant of ($2m^3$) trickling filter was used and fed with actual industrial wastewater from five textile factories in Iraq. Six different bed materials (crushed thermostone, crushed granite, crushed porcelinaite, polystyrene, plastic and wood) with diameter (45 - 52mm) are selected for testing total loading of filter media. Bed depths, ranging from (0.5 m) to (1.5 m) are tested. Several sets of experiments at steady inflows with large fluctuations in wastewater characteristics were made to study the effect of different

material bed depths (0.5, 0.8, 1.1 and 1.5m) and various materials bed at constant filter media depth (0.8m) and constant effective diameter (45 - 52mm) .

Process optimization was experimentally investigated to increase the biologic removal rate by using different recirculation ratio of the treated wastewater (R= 0, 0.5, 1, 2 and 3) and several techniques of aeration with (parallel flow, counter flow and cross flow).

Measurements for influent wastewater and effluent are made including SS (mg/l), BOD_5 (mg/l), COD (mg/l), pH and the effective parameters kilograms of O_2/kg BOD_5 eliminated, and organic load or BOD_5 as volumetric load (kg $BOD_5/m^3/d$) are calculated. Dissolved oxygen sensor is calibrated and used to estimate the concentration of (DO) at the solid/ biofilm interface.

Keywords: *Water reuse, Textile wastewater, Trickling filter, Removal efficiency*

58- Social Investigation of Greywater Reuse in Baghdad

Both the 1991 Gulf War and the 2003 Iraq War have affected and used the water resources. Most of the water in Baghdad comes from Tigris River. Baghdadis need abundant water supplies to live and survive in the desert environment. The wars and economic sanctions have left the people in a state of drought, with the water largely contaminated and few resources available to clean it. Baghdad has arid climate with extremes of heat and cold, temperatures also vary greatly with time, the mean January temperature is 7 °C and the mean July temperature is 35°C.High temperatures in the capital city of Baghdad, which lies in the central part of the country, is 51°C have been recorded. Analyses were conducted from 2005 to 2010 and the results for percent of electricity consumption by end use show that 10 percent is for evaporative cooling.

In addition to water policies of Turkey, Syria and Iran which affects strongly the water availability in Iraq, the lack of water for irrigation is the major reason of failure of agricultural policy in Iraq. Water shortage in Baghdad occurs. More than one out of three Baghdadi's people lack access to safe drinking water, and more than one out of six lack adequate sanitation. Wide attention is required for starting national water conservation programs.

In arid areas of Baghdad, water conservation and reuse are issues that receive a great deal of public attention in the last decade. The search for ways to responsibly use and reuse water is vital to the sustainability of the water supply and thus the future of these regions .Treated gray water in houses can be reused for toilet flushing, outdoor irrigation and spraying water evaporation cooling of selected apartments building located in Baghdad. Treated wastewater also can be used for irrigation and streets cleaning by municipal institutes. Several experiments in Baghdad have been achieved for small scale to reuse graywater for toilet flushing, irrigation, outside house cleaning and evaporative cooling. The basic goal of this project proposal is to apply the graywater for wide range as solution of water crises in Baghdad. Baghdad's Water demand is estimated to 3.2 Million.m^3/day, the quantity of produced water is (66%) of the required needs.

The Average daily use is about 18% lower than the annual daily average in Winter, while it is 38% higher than the annual daily average ,that cause wide variation in water demand during the year. For selected communities the maximum daily use is about 205% of the average daily use. Although electrical energy have decreased significantly during the past

decade, Increased use of evaporative cooling make residential water use was continued to rise approximately 5% per year.

Keywords: water resource management, greywater reuse, Baghdad

59- Water Recycling In Textile Industry Using Biological Activated Carbon Treatment System

Bio-treatment is efficient and simple process that involves the use of naturally occurring micro-organisms in the wastewater to improve water quality. Under optimum conditions, including enough oxygen, the organisms break down materials in the water such as Dissolved Organic Carbon (DOC), Chemical Oxygen Demand COD, Biochemical Oxygen Demand BOD, Turbidity, Total Suspended Solid (TSS) and Nutrient levels and thus improve water quality.

Sand or carbon filters are used to provide a place on which these micro-organisms grow. Wastewater samples from a number of textile facilities and measurements (pH, COD, BOD5, COND, SO_4^{-2}, NO_3^-, Cl^-, PO_4^{-2}, TSS, Hardness and heavy metal) were analyzed.

A combined chemical-biological treatment of industrial wastewater using Preozonation, Aerated Biofilter, Ozonation and Activated Carbon AC is tested. Because of the low price of biotreatment, the combination with AC may reduce the overall treatment cost. The final goal of the BAC treatment is to degrade the industrial wastewater in a fast and inexpensive way.

Two types of laboratory biological activated carbon (BAC) systems for waste water treatment in five factories in Iraq were studied as part of consult work to recycle 80% of the treated water in the factory and reusing the 20% for secondary uses.

The first biological activated carbon treatment system has three parts:

- Preozonation reactor (5mg/L ozone for 1250 to 1800sec) to raise dissolved oxygen and remove ammonia.
- A slow sand filter to remove suspended matter;
- A biological activated carbon (BAC) filter (activated carbon as granular) to reduce dissolved organic matter and remove color (20 to 30 mg/L ozone for 0.5 to 1 hour).

While the second biological activated carbon treatment system has three parts:

- Preozonation reactor (5mg/L ozone for 1250 to 1800sec).
- Porceliniate bioreactor to remove suspended and organics matter;
- A biological activated carbon filter (BAC) (activated carbon as flexible clothes) to reduce dissolved organic matter (20 to 30 mg/L ozone for 0.5 to 1 hour).

CRDF GLOBAL

January 28, 2013

Dear Sir/Madam,

Since 2004, CRDF Global has implemented a broad array of science- and technology-based programs in Iraq, including the Dr. Maged Hussein Memorial Grant Competition in Iraq Soil Salinity and Water Management (ISSWM). Through the ISSWM grant competition, CRDF Global and the Arab Science and Technology Foundation (ASTF) awarded and administered year-long research grants focused on water management and soil salinity topics to seven project teams of Iraqi scientists and engineers. Proposals were competitively selected for funding on the basis of peer reviews that evaluated technical merit, soundness of research plan, personnel capacity, research impact, and long-term benefit to Iraq.

Dr. Dheyaa Wajid Abbood's proposal, entitled "Water Conservation in Baghdad Using Treated Gray Water for Irrigation," was selected for funding under the ISSWM competition. His project focused on graywater treatment and reuse as a means of conserving water and meeting water demand, particularly in arid areas. The project's major goals included characterizing physical, chemical and biological characteristics of domestic graywater in Baghdad; using different techniques to treat graywater; evaluating the quality of food crops grown using graywater for irrigation; measuring heavy metals and pathogenic microorganisms in graywater samples and mature crops; and selecting appropriate and economic methods for reusing graywater in Baghdad.

As part of his grant, Dr. Abbood submitted quarterly progress reports detailing the project's methods and results. He collaborated with his project team, including two co-investigators, over the course of his grant. Dr. Abbood successfully completed his project and submitted his final project report in July 2012.

Sincerely,

Anne C. Peckham

Project Manager
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Modification of Grey Water Treatment Using Combination of Cascade Aeration and Biofiltration

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Abstract: A combination of cascade aeration and biofiltration systems is one of the available ecological treatments to reduce the concentration of pollutants in grey water and resolve the problem of acute water crisis supply in Iraq. An experimental constructed grey water treatment system has been installed at Al-Mustansiriya University, College of Engineering during the period from January to December 2012. The performance of the treatment schemes has been evaluated by monitoring the quality of the raw grey water and effluent on these samples which are: pH, COD (chemical oxygen demand), TSS (total suspended solids), TDS (total dissolved solids), PO_4^{3-} (phosphates), NO_3^{2-} (nitrates), NO^- (nitrites), oils & grease, NH_3-N (ammonia-nitrogen) and some anions and cations. The average removal rate of COD was more than 60% that of NH_3-N, NO_3-N, NO_2-N, TDS and TSS that were 55%-89%, 59%-74%, 79%-98%, 17%-52% and 51%-87%, respectively. Also the results indicate that the removal efficiency of ions concentrations such as Ca^{2+}, Mg^{2+}, Na^+, K^+ were 78%-96%, 73%-97%, 14%-47% and 44%-64%, respectively, while for cations such as SO_4^{2-}, Cl^- and PO_4^{3-}, the removal efficiencies were 33%-79%, 27%-61% and 81%-99%, respectively. Finally oils & grease was 79%-88%.

Key words: Grey water, water reuse, biofiltration, cascade aeration, irrigation.

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Greywater Reuse Assessments on Different Soil Types in Baghdad City

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Abstract: The effects of greywater irrigation on four commonly used agricultural soils and models were studied. Sand, sandy loam, sandy clay and light clay soils were selected as common Iraq soils. Soil's chemical and physical properties under different irrigation regimes were daily measured during period extended from February 2011 to April 2012 in Baghdad city and plant growth was monitored. A lab scale models of four acrylic columns of 100 mm diameter and 750 mm height were designed and constructed in environmental hydraulic lab at Mustansiriya University and tests were run concurrently with the characterization study to assess the effect of soil depth and loading rate on treatment efficiency. Soil samples were carried out in a site that had been drained with greywater for over 14 months. Measurements of greywater and treated greywater had been achieved which contains BOD_5, COD, pH, EC, TDS, turbidity, Cl^{-1}, SO_4^{-2}, NO_3^{-1}, Na^{+1}, Ca^{+2}, Mg^{+2}, E coli and coliform.

Key words: Greywater reuse, soil contaminated, sand, light clay, sandy loam, sandy clay.

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Evaluation of Water Quality Index in the Main Drain River in Iraq by Application of CCME Water Quality

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Abstract
Water Quality Index in the Main Drain River in Iraq by Application the Canadian Council of Ministers of the Environment Water Quality Index(CCME WQI) has been achieved .Fifteen water quality parameters (pH, alkalinity, phosphate(PO_4) , nitrate(NO_3), sulfate(SO_4), chloride(Cl), total hardness(TH), calcium(Ca), magnesium(Mg), total dissolved solids(TDS), biological oxygen demand(BOD), dissolved oxygen(DO), electrical conductivity(EC), sodium (Na) and potassium(K) measured at ten stations along the main drain river (Baghdad, Babylon, Qadiysiah, ThiQar and Al-Basrah). The field work was conducted during the years 2004 until 2011. Based on the results obtained from the index the water quality of main outfall drain river ranged between 26.6- 35.5 which indicate that river has the worst quality due to effect of various pollutant sources.
Keywords: Water quality index, Iraq, Main drain, CCME WQI

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Performance of Combination of PreOzonation and Membrane Biological Reactor on Greywater Characteristics

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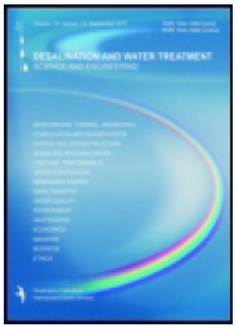
Abstract
an ozone-biological aerated filter process was operated for ten months to evaluate its feasibility in polishing Greywateras primary treatment. The reduction efficiency of BOD_5, COD, and TSS were 44%,27%, and 41.1% respectively. The average ranged effluent of PH, NH^3-N,T-N, Total Phosphorous were (6.5-8.5), (19-61)mg/l, (9.1-34.7)mg/l, and (2.8-18.2)mg/l respectively.
Main operational parameters were: Ozone rate 2 gm/hr for 6 hr from April to July and 8 hr from October to march.All results showed excellent performance of the ozone-biological aerated filter process. Experiences proved that the operation parameters such as dosage of ozone should be changed with the influent quality to acquire the best quality of the effluent.



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Removal of phenol and lead from synthetic wastewater by adsorption onto granular activated carbon in fixed bed adsorbers: prediction of breakthrough curves

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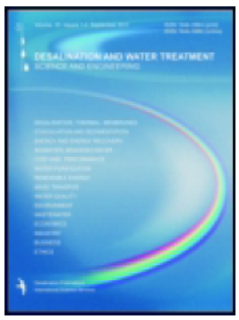

Desalination and Water Treatment
Publication details, including instructions for authors and subscription information:
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Competitive biosorption of phenol and lead from synthetic wastewater onto live and dead microorganisms

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الأكاديمية العربية للعلوم والتكنولوجيا والنقل البحري
Arab Academy for Science and Technology and Maritime Transport

International Conference

On

Sustainable Energy: Technologies, Materials & Environmental Issues

And Workshop on Concentrator Photovoltaic Technology

Oct., 29 – Nov.1st, 2007

Cairo, EGYPT - Cairo Marriott Hotel

Dear Dr. Dhia Wajid Abud

It is a distinct pleasure of the organizing committee to let you know that your abstract titled:

" Energy Crises in Baghdad "

Has been accepted for presentation at the above mentioned conference.

Please note that full papers are due on or before Sept. 21st, 2007.

We also encourage you to register for the conference as early as possible. Knowing who is attending will help us to finalize the technical program schedule.

Please note that you can save money on the conference fees if you register before September 21th 2007.

Thank you very much and looking forward to seeing you in Cairo.

Prof. Dr. Fuad Abulfotuh

Conference Chairman

For more information on conference participation and registration, please visit:
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Central Connecticut State University
Robert Vance Academic Center, 1615 Stanley Street, New Britain, CT 06050-4010, USA

TRN381

April 4, 2012

Dheyaa Wajid Abbood
Bab Mutheem
P.O.14150
Baghdad
Iraq

Dear Dr.Ayad:

RESEARCH TITLE
Grey Water Reuse in Baghdad:Social Survey

AUTHOR/S:	Prof. Dr. Dheyaa Wajid Abbood and Dr. Ayad Sibi Mustafa
RESEARCH ID:	TRN381
REGISTRATION FEE:	$360 (if one registers for the full conference); $560 (if two co-authors register)

I am pleased to inform you that on the basis of your submission the reviewers accepted the above for presentation at the International Journal of Arts & Sciences' (IJAS) *International Conference for Academic Disciplines* which will be held at Ryerson University's International Learning Center at 240 Jarvis Street, Toronto (May 21-24, 2012). The conference follows the multidisciplinary TED format (http://www.ted.com/).

In order for IJAS to remain in compliance with Canadian immigration laws, it is imperative that delegates enter Canada in an appropriate non-immigration status. American, Australian and EU citizens do not need a visa to enter Canada for the conference. If you require a visa to enter Canada, please present this letter at a Canadian Embassy or Consulate with your non-immigrant visa application and passport.

For your submission to appear in one of our refereed ISSN-numbered CD-ROMs, please format your work in line with this template http://www.InternationalJournal.org/template.html. There is no limit on the number of pages. Email your properly formatted abstract/paper only to ManuscriptSubmission@gmail.com. Please make sure that it is in Microsoft Word and that the above "Research ID" number is included in all your future emails' Subject line.

The registration fee does not include food and lodging.

We look forward to your participation, and we hope that you will find our program fully rewarding.

Sincerely,

Professor Joseph Bonnici, PhD, JD
IJAS Conferences Coordinator

INTERNATIONAL JOURNAL
OF ARTS AND SCIENCES

55 Farm Drive
Cumberland, Rhode Island 02864-3565
USA

H4V183

December 17, 2013

Prof.Dr. Deyaa Wajid Abbood
Bab Mutheem
Baghdad P.O. 14150
Iraq

Dear Prof.Dr. Deyaa Wajid Abbood:

RESEARCH TITLE
Greywater Reuse For Irrigation In Suburban Area In Baghdad

AUTHOR/S:	Deyaa Wajid Abbood, Faris Hamoodi AL-Ani & Ali Ahmed Ali
RESEARCH ID:	H4V183
REGISTRATION FEE:	$365 (if one registers for the full conference); $565 (if two co-authors register)
REGISTRATION:	9 April 2014

We are pleased to inform you that on the basis of a double-blind review of your submission, the reviewers have accepted the above for presentation at the *International Journal of Arts & Sciences (IJAS)* conference for academic disciplines. Conference presentations will be held at the conference center at Harvard Medical School, 77 Avenue Louis Pasteur, Boston, Massachusetts. The conference will run from 26 to 30 May 2014.

The conference follows the multidisciplinary TED format at http://www.ted.com. The program for our 2013 conference on the Harvard campus will give you an idea of what to expect for 2014: http://ijas2013harvard.sched.org.

In order for IJAS to remain in compliance with the American immigration laws, it is imperative that you enter the USA in an appropriate non-immigration status. For example, if you're a citizen of Australia, Canada or the EU, you may not need a visa to enter for the conference. If you require a visa to enter the United States, please present this letter at an American Embassy or Consulate with your non-immigrant visa application and passport.

For your submission to appear in one of our refereed ISSN-numbered publications, please format your work in line with this template http://www.internationaljournal.org/template.html. There is no limit on the number of pages. Email your properly formatted abstract/paper only to ManuscriptSubmission@gmail.com. Please make sure that it is in Microsoft Word and that the above "Research ID" is included in all your future emails' Subject line.

The registration fee does not include food and lodging.

As a professor at Central Connecticut State University, I witness firsthand the benefits of international education emanating from study abroad programs. Our conference will highlight these benefits while offering you a forum to share your specialized research with international professors.

We look forward to your presentation.

Sincerely,

Professor J. Bonnici, PhD, JD
***IJAS* Conferences Coordinator**

INTERNATIONAL JOURNAL
OF ARTS AND SCIENCES

55 Farm Drive
Cumberland, Rhode Island 02864-3565
USA

H5V213

December 27, 2014

Dheyaa Wajid Abbood
Bab Mutheem Mustansiriya
University College of Engineering
P.O.14150
Iraq

Dear Prof. Dr. Abbood:

RESEARCH TITLE
Decolonization of Carmoisine-E112 Using Different Types of Porous Media

AUTHOR/S: Dheyaa Wajid Abbood, Ayad Sleibi Mustafa & Huda T. Hamed
RESEARCH ID: H5V213
REGISTRATION FEE: $375 (if one registers for the full conference); $575 (if two co-authors register)
REGISTRATION DATE: 7 April 2015

I am pleased to inform you that your submission was subjected to a double-blind review process, and the reviewers accepted the above for oral presentation at the International Journal of Arts & Sciences' (IJAS) International Conference for Technology and Science which will be held at Harvard Medical School, 77 Avenue Louis Pasteur, Boston, Massachusetts. The conference will run from 26 to 30 May 2015.

The conference follows the multidisciplinary TED format at http://www.ted.com. The program for our 2014 conference on the Harvard campus will give you an idea of what to expect for 2015: http://ijas2014harvard.sched.org/.

In order for IJAS to remain in compliance with the American immigration laws, it is imperative that you enter the USA in an appropriate non-immigration status. For example, if you're a citizen of Australia, Canada or the EU, you may not need a visa to enter for the conference. If you require a visa to enter the United States, please present this letter at an American Embassy or Consulate with your non-immigrant visa application and passport.

For your submission to appear in one of our refereed ISSN-numbered publications, please format your work in line with this template http://www.internationaljournal.org/template.html. There is no limit on the number of pages. Email your properly formatted abstract/paper only to ManuscriptSubmission@gmail.com. Please make sure that it is in Microsoft Word and that the above "Research ID" is included in all your future emails' Subject line.

The registration fee does not include food and lodging.

As a professor at Central Connecticut State University, I witness firsthand the benefits of international education emanating from study abroad programs. Our conference will highlight these benefits while offering you a forum to share your specialized research with international professors.

We look forward to your presentation.

Sincerely,

Professor J.L. Bonnici, PhD, JD
IJAS Conferences Coordinator

PUBLISHING

The Combination Effect of Night Ventilation and Thermal Insulation on Passive Cooling of Buildings in Baghdad

Dheyaa Wajid Abbood and Tawfeeq Kadheem Faleh Al-Hamdi
College of Engineering, Al-Mustansiriya University-Baghdad, Iraq

Received: December 27, 2011 / Accepted: March 09, 2012 / Published: November 30, 2012.

Abstract: An experimental investigation of passive cooling buildings has been carried out for a typical summer days extended from July to December for Baghdad in Iraq. Six independent chambers were designed and constructed for different roof constructions. Night ventilation has been applied to study the possibility of reducing air temperature in buildings by testing different air changes per hour extended from 5 to 30. Measurements outside chambers including air temperature; relative humidity and solar radiation were achieved, while surface temperature and air temperature inside the chambers were recorded. The results show that the air temperature can be decreased with a range from 3 to 6 ℃ when using 50 mm polystyrene. This decrease can further be lowered by 2 to 4 ℃ if night ventilation of change per hours in buildings is allowed. The reduction in air temperature can be reduced to 5 ℃ by combination of external night ventilation and white paint.

Keywords: Passive cooling design, thermal mass, thermal insulation, polystyrene, night ventilation, Baghdad.

Journal of Environmental Science and Engineering B 1 (2012) 593-599
Formerly part of Journal of Environmental Science and Engineering, ISSN 1934-8932

Water Status in Baghdad

Dheyaa Wajid Abbood, Yasir Talib Hameed and Safaa Nasser Hassan
Environmental Department, College of Engineering, University of Al-Mustansiriya, Baghdad 00964, Iraq

Received: January 3, 2012 / Accepted: February 6, 2012 / Published: May 20, 2012.

Abstract: Water is a strategically limited natural resource, and currently Iraq is in the grip of an extended drought period. It is needed to look for alternative water sources and work towards achieving high level of sustainability. Measurements for gray water samples were carried out including pH, EC (electrical conductivity), TDS (total dissolved solids), TS (total solids), TSS (total suspended solids), DO (dissolved oxygen), BOD_5 (biochemical oxygen demand), COD (chemical oxygen demand), alkalinity, chlorides (Cl^-), calcium (Ca), sodium (Na), magnesium (Mg), potassium (K), lead (Pb), TC (total coliforms), TF (total fecal coliforms), and nitrate (NO_3^-). The goals of this study are to estimate quantities of fresh water consumption and gray water generated in typical Baghdadian households, and to investigate gray water quality (physical, chemical and biological). The major results can be summarized as follows: (1) The daily water consumption in Baghdad ranged from 75 Lpcd to 176 Lpcd with an average of 116 Lpcd; (2) the maximum daily consumption in Baghdad ranged from 124 Lpcd to 327 Lpcd with an average of 186 Lpcd; (3) the maximum hourly consumption in Baghdad ranged from 154 Lpcd to 900 Lpcd with an average of 308 Lpcd; (4) gray water generation in Baghdad ranged from 34 Lpcd to 139 Lpcd with an average of 68 Lpcd, and that gray water generated constituted 58% to 72% of total consumption.

Key words: Water saving, water quality, water consumption, Baghdad, gray water.

Journal of Environmental Science and Engineering, 5 (2011) 1389-1399

Competitive Adsorption of Phenol and Lead from Synthetic Wastewater onto Granular Activated Carbon

A.H. Sulaymon[1], D.W. Abbood[2] and A.H. Ali[2]
1. Environmental Engineering Department, College of Engineering, University of Baghdad, Baghdad 10001, Iraq
2. Environmental Engineering Department, College of Engineering, University of Al-Mustansiriya, Baghdad 10001, Iraq

Received: May 16, 2011 / Accepted: June 22, 2011 / Published: November 20, 2011.

Abstract: The equilibrium uptake of phenol and lead(II) ions, both singly and in combination, by granular activated carbon was studied in a batch system. The initial pH, temperature, mixing speed and contact time were fixed at 4, 30 ℃, 250 rpm and 6 hrs respectively. Adsorption isotherms were developed for both the single and binary component systems and expressed by ten models for single and four models for binary systems and model parameters were estimated by the non-linear regression method using STATISTICA version-6 and EXCEEL-2007 software. The maximum loading capacity (q_m) of the phenol was 66.8234, 60.4823 mg/g and 37.0370, 13.0988 mg/g for lead in single and binary systems respectively. Desorption experiments indicate that the desorption efficiency with 0.1 M NaOH, 0.1 M HCl solution reaches 97.35%, 98% for phenol and lead respectively. There was only 3.58%, 4.93% decrease in removal efficiency for phenol and lead respectively when used regenerated GAC for one cycle.

Key words: Adsorption, GAC, phenol, lead, adsorption isotherms.

Journal of Environmental Science and Engineering A 1 (2012) 150-159
Formerly part of Journal of Environmental Science and Engineering, ISSN 1934-8932

Reuse of Anaerobic Sludge for Treating Synthetic Wastewater Containing Organic and Inorganic Pollutants in Fixed Bed Adsorber

Abbas Hameed Sulaymon[1], Dheyaa Wajid Abbood[2] and Ahmed Hassoon Ali[2]

1. Environmental Engineering Department, College of Engineering, University of Baghdad, Baghdad 10001, Iraq

2. Environmental Engineering Department, College of Engineering, University of Al-Mustansiriya, Al-Mustansiriya, Baghdad 10001, Iraq

Received: July 5, 2011 / Accepted: August 31, 2011 / Published: February 20, 2012.

Abstract: Dried anaerobic granular sludge (DAGS) for removing phenol (organic) and lead (inorganic) pollutants from synthetic wastewater was examined in a fixed bed system. A general rate multi-component model has been built to predict the fixed bed breakthrough curves for single and dual-component system. This model considers both external and internal mass transfer resistances as well as axial dispersion with non-liner multi-component isotherm. The equilibrium isotherm model parameters such as isotherm model constants (q_m and b), pore diffusion coefficients (D_p) were obtained from batch experiments, while the external mass transfer coefficients and axial dispersion (k_f, D_z) were calculated from empirical correlations. The results show that the general rate multi-component model was found suitable for describing the biosorption process of the dynamic behavior of the DAGS adsorber column and that DAGS can be used efficiently to remove organic and inorganic pollutants.

Key words: DAGS, phenol, lead, biosorption, fixed bed.

Journal of Environmental Science and Engineering B 2 (2013) 183-188
Formerly part of Journal of Environmental Science and Engineering, ISSN 1934-8932

Greywater Reuse Assessments on Different Soil Types in Baghdad City

Dheyaa Wajid Abbood, Seroor Atallah Khaleefa Ali and Suha Anwer Ibrahim

Department of Civil & Environmental, Mustansiriyah University, Baghdad 14150, Iraq

Received: August 27, 2012 / Accepted: October 9, 2012 / Published: March 20, 2013.

Abstract: The effects of greywater irrigation on four commonly used agricultural soils and models were studied. Sand, sandy loam, sandy clay and light clay soils were selected as common Iraq soils. Soil's chemical and physical properties under different irrigation regimes were daily measured during period extended from February 2011 to April 2012 in Baghdad city and plant growth was monitored. A lab scale models of four acrylic columns of 100 mm diameter and 750 mm height were designed and constructed in environmental hydraulic lab at Mustansiriya University and tests were run concurrently with the characterization study to assess the effect of soil depth and loading rate on treatment efficiency. Soil samples were carried out in a site that had been drained with greywater for over 14 months. Measurements of greywater and treated greywater had been achieved which contains BOD_5, COD, pH, EC, TDS, turbidity, Cl^{-1}, SO_4^{-2}, NO_3^{-1}, Na^{+1}, Ca^{+2}, Mg^{+2}, E coli and coliform.

Key words: Greywater reuse, soil contaminated, sand, light clay, sandy loam, sandy clay.

Modification of Greywater Treatment Using Combination of Cascade Aeration and Biofiltration

Dheyaa Wajid Abbood[1], Ayad Sleibi Mustafa[2] and Rasha Azeez Joudah[3]

1. Department of Civil, College of Engineering, Mustansiriyah University, Baghdad, +964, Iraq.

2. Department of Civil, College of Engineering, Anbar University, Baghdad, +964, Iraq.

3. Department of Environment, College of Engineering, Mustansiriyah University, Baghdad, +964, Iraq.

Abstract: A combination of cascade aeration and biofiltration systems is one of the available ecological treatments to reduce the concentration of pollutants in grey water and resolve the problem of acute water crisis supply in Iraq. An experimental constructed greywater treatment system has been installed at Al- Mustansiriya University, College of Engineering during the period from January to December 2012. The performance of the treatment schemes has been evaluated by monitoring the quality of the raw greywater and effluent on these samples which are: pH, COD (Chemical Oxygen Demand), TSS (Total Suspended Solids), TDS (Total Dissolved Solids, $PO4^{-3}$ (Phosphates), $NO3^{-2}$ (Nitrates), NO^{-1} (Nitrites), Oils & grease, NH_3-N (Ammonia-Nitrogen) and some Anions and Cations. The average removal rate of COD was more than 60%, that of NH3-N, NO_3-N, NO_2-N, TDS and TSS were 55%-89%, 59%-74%, 79%-98%, 17%-52% and 51%-87%, respectively. Also the results indicated that the removal efficiency of Ions concentrations such as Ca^{+2}, Mg^{+2}, Na^{+}, K^{+} were 78%-96%, 73%-97%, 14%-47%, and 44%-64%, respectively, while for Cations such as SO_4^{-2}, Cl^{-}, and PO_4^{-3}, the removal efficiencies were 33%-79%, 27%-61%, and 81%-99%, respectively. Finally for oils & grease was 79%-88%.

Key words: Grey water, water reuse, biofiltration, cascade aeration, irrigation.

Journal of Environmental Science and Engineering B 2 (2013) 473-481
Formerly part of Journal of Environmental Science and Engineering, ISSN 1934-8932

Modification of Grey Water Treatment Using Combination of Cascade Aeration and Biofiltration

Dheyaa Wajid Abbood[1], Ayad Sleibi Mustafa[2] and Rasha Azeez Joudah[3]
1. Department of Civil, College of Engineering, Mustansiriya University, Baghdad 964, Iraq
2. Department of Civil, College of Engineering, Anbar University, Baghdad 964, Iraq
3. Department of Environment, College of Engineering, Mustansiriya University, Baghdad 964, Iraq

Received: April 29, 2013 / Accepted: June 24, 2013 / Published: August 20, 2013.

Abstract: A combination of cascade aeration and biofiltration systems is one of the available ecological treatments to reduce the concentration of pollutants in grey water and resolve the problem of acute water crisis supply in Iraq. An experimental constructed grey water treatment system has been installed at Al-Mustansiriya University, College of Engineering during the period from January to December 2012. The performance of the treatment schemes has been evaluated by monitoring the quality of the raw grey water and effluent on these samples which are: pH, COD (chemical oxygen demand), TSS (total suspended solids), TDS (total dissolved solids), PO_4^{3-} (phosphates), NO_3^{2-} (nitrates), NO^- (nitrites), oils & grease, NH_3-N (ammonia-nitrogen) and some anions and cations. The average removal rate of COD was more than 60% that of NH_3-N, NO_3-N, NO_2-N, TDS and TSS that were 55%-89%, 59%-74%, 79%-98%, 17%-52% and 51%-87%, respectively. Also the results indicate that the removal efficiency of ions concentrations such as Ca^{2+}, Mg^{2+}, Na^+, K^+ were 78%-96%, 73%-97%, 14%-47% and 44%-64%, respectively, while for cations such as SO_4^{2-}, Cl^- and PO_4^{3-}, the removal efficiencies were 33%-79%, 27%-61% and 81%-99%, respectively. Finally oils & grease was 79%-88%.

Key words: Grey water, water reuse, biofiltration, cascade aeration, irrigation.

11th World Filtration Congress - April 17-20, 2012 - Graz - Austria

Modification of biofiltration process using carbonated ceramic

D. W. Abbood*, H.A. Mehdi, H.T. Himed, Mustansiriya University Baghdad, Iraq

ABSTRACT

An activated carbon-ceramic (carbonated ceramic) was prepared by ozonation mixture of anaerobic dead sludge, Kaolin and Bentonite which was thermally treated in vacuum furnace at temperature ranged between (420 °C to 460 °C). Mix design of different volume percentages were carried out and the volume ratio of anaerobic dead sludge: Kaolin: Bentonite was selected as 12:4:1 and activation by different ozonation dosages and rates was experimented. Chemical analysis, pH measurements and FT-IR spectra were done and textural characterization was obtained from CO_2 and N_2 adsorption. The performance was measured for removing organic (phenol), inorganic and heavy metal such as Pb, Cu and Zn.

KEYWORDS: *BIOFILTERATION, INORGANIC, CERAMIC, CARBON, OZONATION*

INTERNATIONAL JOURNAL
OF ARTS AND SCIENCES

55 Farm Drive
Cumberland, Rhode Island 02864-3565
USA

DE4C471

October 22, 2014

Dheyaa Wajid Abbood
Bab Mutheem
P.O.14150
Iraq

Dear Prof. Dr. Dheyaa Wajid Abbood:

RESEARCH TITLE
Reduction of Toxic Matter from Marginal Water Using Combination of Stepped Cascade Weir with Thermostone Trickling Filter

AUTHOR/S:	Dheyaa Wajid Abbood , Eitizaz Awad Jasim & Seroor Atallah Khaleefa Ali
RESEARCH ID:	DE4C471
REGISTRATION FEE:	$365 (if one registers for the full conference); $565 (if two co-authors register)
REGISTRATION DEADLINE:	October 29, 2014

We are pleased to inform you that on the basis of your submission the reviewers have accepted the above for presentation at the *International Journal of Arts & Sciences (IJAS)* conference for academic disciplines which will be held at the Katholische Akademie der Erzdiozese Freiburg, Wintererstr 1, 79104 Freiburg, Germany. This double-blind reviewed conference will run from 2 to 5 December 2014.

The conference follows the multidisciplinary TED format at http://www.ted.com. The program from our latest conference on the Harvard University campus will give you an idea of what to expect from our Freiburg conference: http://ijas2014harvard.sched.org.

For your submission to appear in one of our refereed ISSN-numbered publications, please format your work in line with this template *http://www.internationaljournal.org/template.html*. There is no limit on the number of pages. Email your properly formatted abstract/paper only to *ManuscriptSubmission@gmail.com*. Please make sure that it is in Microsoft Word and that the above "Research ID" is included in all your future emails' Subject line.

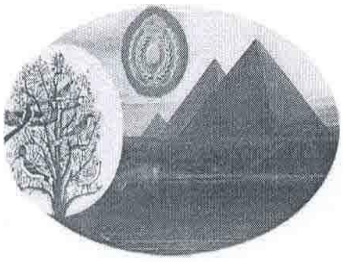
The registration fee does not include food and lodging.

As a European professor at Central Connecticut State University, I witness firsthand the benefits of international education emanating from study abroad programs. Our conference will highlight these benefits while offering you a forum to share your specialized research with international professors.

We look forward to your presentation.

Sincerely,

Professor J.L. Bonnici, PhD, JD
IJAS Conferences Coordinator



1st INTERNATIONAL CONFERENCE ON BIOLOGICAL AND ENVIRONMENTAL SCIENCES

HURGHADA, EGYPT,

March 13-16, 2008

Mailing address:
Faculty of Science,
Mansoura University,
Mansoura, Egypt
P.O. Box: 35516

Dear Dr. Dheyaa Wajid Abbood

It is our pleasure to inform you that your abstract entitled:

Effects of biomass growth on pressure drop in submerged areated bioreactors

has been accepted by the scientific committee of the first international conference on biological and environmental sciences as Oral presentation. We look forward to seeing you in Mansoura and Hurghada, Egypt.

With kind regards

Chairman of Organizing Committee

Conference Secretary
Prof. Dr. Hamed M. El-Shora

15/12/2007
Prof. Dr. H. M. El-Shora

المؤتمر الدولى
للعلوم البيولوجية و البيئية

For further information contact:

Prof. Dr. G. Edrees (Zoology Department), gamaledres600@yahoo.com Tel: 0124196625
Prof. Dr. H. M. El-Shora (Botany Department), shora@mans.edu.eg Tel: 0101109771

Environmental Science and Technology
Egypt, 2008

Dear Dr. Dheyaa W. Abbood

(1)Faculty of Engineering, Al-Mustansriya University, Bab-AL-muthem, P.O. 14150, Baghdad, Iraq. E-mail: (1)envsearch2005@yahoo.com

I would like to inform you that, your paper entitled "**Biofilm Characterization and Compositions in Fluidized Porcelanite Bioreactors: Experimental Work**"
has been accepted for oral presentation and for publication (in the abstract book and the conference CD) during the "**The 3rd International Conference under the theme of Environmental Science & Technology, Egypt 2008**", 1-3 April, 2008, which to be held in the National Research Center, Egypt.

We are looking forward to meet you in the conference.
Sincerely yours

Conference Chairman
Prof. Dr. Ahmed M. Shaban

Head of Environmental Research Division

**The conference fees are 400 Euro.

Civil and Environmental Research
ISSN 2224-5790 (Paper) ISSN 2225-0514 (Online)
Vol.6, No.8, 2014

www.iiste.org

The Effect of Hydraulic Structure on Aeration Performance Case Study: Stepped Cascade with End Sill

Prof.Dr. Dheyaa Wajid Abbood[1] Hanan Hussien Abood[2] ,
Al-Mustansiriya University , Civil Engineering Department,P.O.14150,Baghdad , Iraq
*Email:Dr.Dheyaa@gmail.com, hananhu_2006@yahoo.com

ABSTRACT

Cascade aeration has been utilized as a hydraulic structure for years which has proven to be the least costly aeration system in replenishing dissolved oxygen. The aeration performance of the cascade structure with end sill has been investigated in a large laboratory cascade structure which has been designed and constructed at Al-Mustansiriya university in environmental hydraulic .An empirical equation to predicting the oxygen transfer efficiency for different models of cascade structure with end sill was correlated. The results indicated that l/h and s/h were a significant effect on the aeration efficiency of cascade structure.

Keywords: Hydraulic structure, Stepped cascade , End sill ,Aeration, Oxygen transfer

The Fourth International Conference on Science in Society

University of California
Berkeley, USA
15 – 17 November 2012
www.ScienceinSocietyConference.com

8 January 2013

To Whom It May Concern,

This letter certifies that Prof. Dr. Dheyaa Wajid Abbood of Mustansiriya University-College of Engineering, Baghdad, Iraq, attended the Fourth International Conference on Science and Society as an in-person participant. Prof. Dr. Dheyaa Wajid Abbood presented the paper Y12P0325: A Social Survey of Greywater Reuse in Baghdad City.

Yours Sincerely,

Dr. Bill Cope
Director

Science in Society

Common Ground Publishing
University of Illinois Research Park
2001 South First Street, Suite 202
Champaign, IL 61820 USA

Phone: +1-217-328-0405
Fax: +1-217-328-0435
info@commongroundpublishing.com
commongroundpublishing.com

The Interdisciplinary Environmental Association

April 28, 2012

Prof.Dr.Dheyaa Wajid Abbood
Civil& Environmental Engineering /Mustansiriya University
Baghdad/ Iraq

Prof.Dr. Abbood:

The Paper "**Energy Challenge in Baghdad**" has been accepted for presentation at the 17th International Interdisciplinary Conference on the Environment in Kona, Hawaii June 28-July 3, 2012. The final paper submission deadline is June 1st, 2012.

Papers must not have been published, accepted, or submitted for publication elsewhere. For co-authorships please include names, affiliations, and addresses of all authors on your cover page and indicate who will serve as paper presenter. Thank you for your submission and we look forward to hearing your research in Kona.

Sincerely,

Kimberly D. S. Reiter, Ph.D
Conference Chair, IEA
Associate Professor of History
Stetson University DeLand , FL ,USA

FLORIDA INTERNATIONAL UNIVERSITY
Miami's public research university

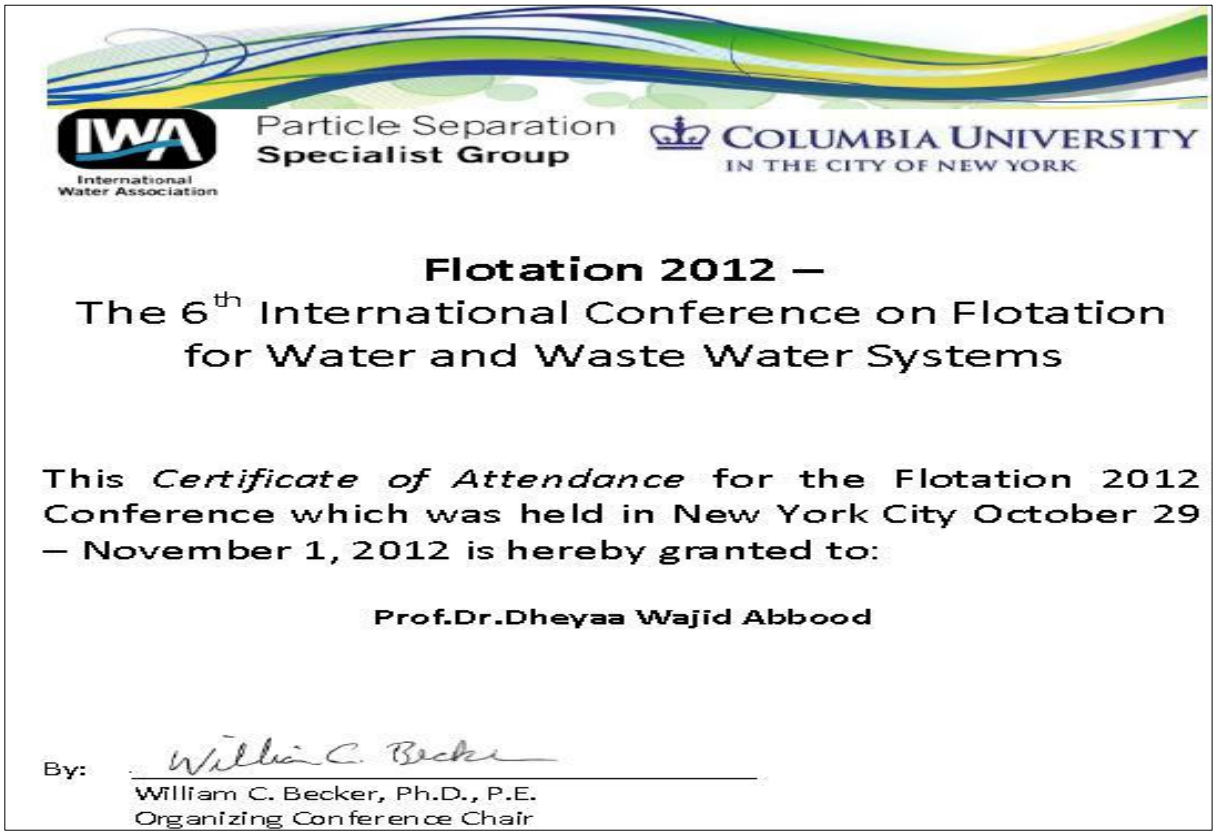
TO WHOM IT MAY CONCERN

November 14, 2012

Dear Sir or Madam:

This is to certify the attendance of ***Dr. Dheyaa Wajid Abbood*** at the 9th International Symposium on Persistent Toxic Substances (9th ISPTS). The symposium was organized by Florida International University and held at Miami Airport Marriott during October 23-27, 2012.

Yong Cai
Symposium Co-Chair
Professor, Department of Chemistry
& Biochemistry and
Southeast Environmental Research Center
Florida International University
E-mail: cai@fiu.edu1313؛



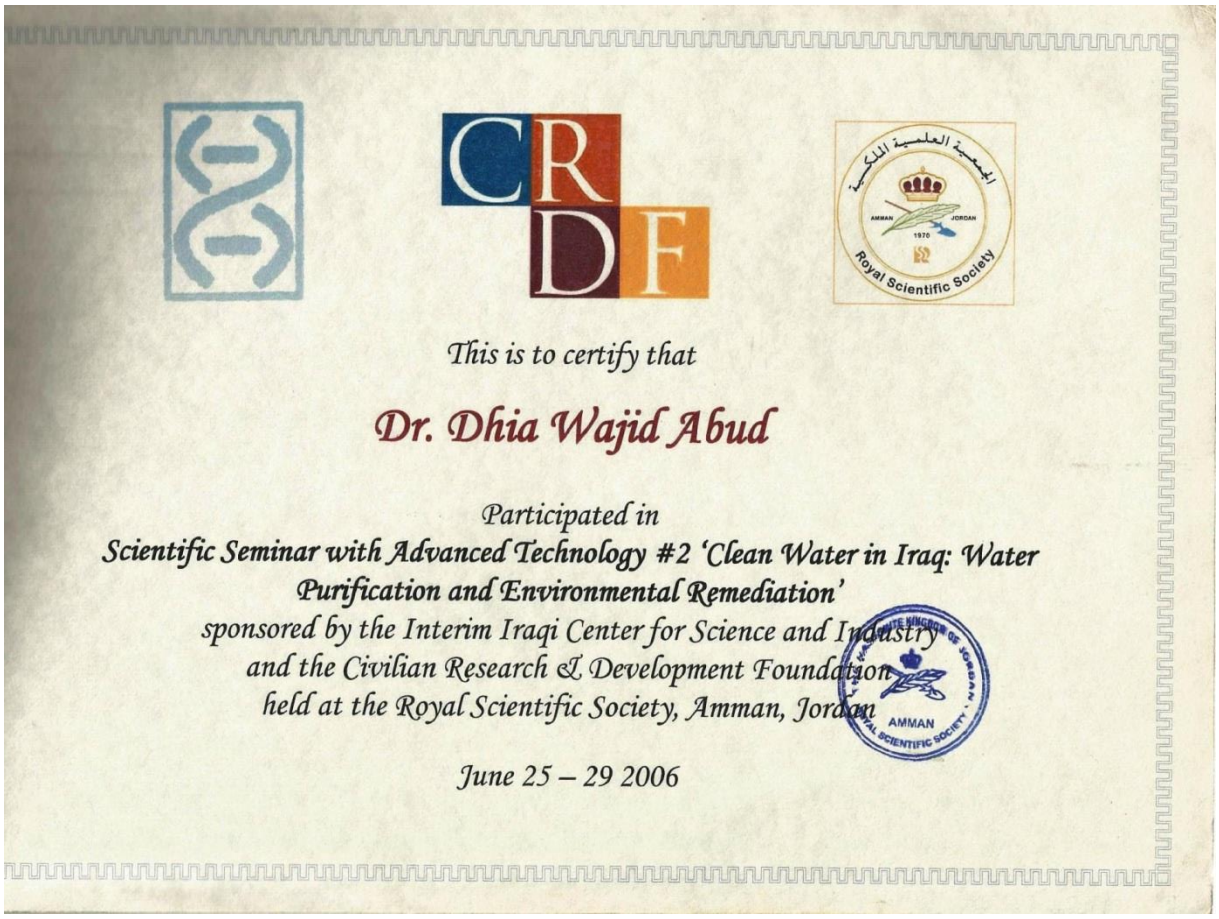
IWA International Water Association
Particle Separation Specialist Group
COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK

Flotation 2012 –
The 6th International Conference on Flotation for Water and Waste Water Systems

This *Certificate of Attendance* for the Flotation 2012 Conference which was held in New York City October 29 – November 1, 2012 is hereby granted to:

Prof.Dr.Dheyaa Wajid Abbood

By: William C. Becker
William C. Becker, Ph.D., P.E.
Organizing Conference Chair



This is to certify that

Dr. Dhia Wajid Abud

Participated in

Scientific Seminar with Advanced Technology #2 'Clean Water in Iraq: Water Purification and Environmental Remediation'

sponsored by the Interim Iraqi Center for Science and Industry and the Civilian Research & Development Foundation held at the Royal Scientific Society, Amman, Jordan

June 25 – 29 2006

Florida International University

Applied Research Center

Certificate of Completion

This is to certify that

Dr. Dheyaa Wajid Abbood

has successfully completed research on

Biological Treatment of Industrial Pollutants in Wastewater

August 8 – December 15, 2012

Dr. John R. Proni
Executive Director – ARC

Dr. Georgio Tachiev
Water Resources Project Manager

Florida International University

Applied Research Center

Certificate of Completion

This is to certify that

Dr. Dheyaa Wajid Abbood

has successfully completed research on

Use of Hydrogen Peroxide and Ferrous Sulfate to Treat Purification of Water

August 7 – December 15, 2012

Dr. John R. Proni
Executive Director – ARC

Dr. Georgio Tachiev
Water Resources Project Manager

Florida International University

Applied Research Center

Certificate of Completion

This is to certify that

Dr. Dheyaa Wajid Abbood

has successfully completed research on

Advanced Oxidation Processes for Water Treatment

August 8 – December 15, 2012

Dr. John R. Proni
Executive Director – ARC

Dr. Georgio Tachiev
Water Resources Project Manager

Florida International University

Applied Research Center

Certificate of Completion

This is to certify that

Dr. Dheyaa Wajid Abbood

has successfully completed research on

Biological Treatment of Biomedical Pollutants in Wastewater

August 7 – December 15, 2012

Dr. John R. Proni
Executive Director – ARC

Dr. Georgio Tachiev
Water Resources Project Manager

World Learning

CERTIFICATE OF COMPLETION

Presented to

DHEYAA WAJID ABBOOD ABBOOD

In recognition of outstanding achievement in the

Iraq Science Fellowship Program

August 06 – December 15, 2012

Administered by CRDF Global & World Learning

Lisa Posner Olocco
Divisional Vice President, Exchange and Training
World Learning

Eric Corens
Senior Program Specialist
World Learning