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Announces

September 28 - 29, 2016, NRC **Hall D**

The workshop infers a contributed session on

Molecular Imprinted Polymers (MIPs):

Advanced techniques for recovery of targeted compounds from wastes.

29th.September, 2016

Under the auspices of

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NEWS IN PICTURES

Mission

Mission

NRC Is the largest multidisciplinary R&D centre in Egypt devoted to basic and applied research within the major fields of interest.

- NRC Possesses an impressive scientific & technological infrastructure and man power resources of 4735 research staff.
- NRC Consists of 14 divisions and 108 departments covering the major areas of industry, health, environment, agriculture, basic sciences and engineering.
- NRC Is headed by a president with ministerial status, assisted by two vice presidents, one for research and the other for technical affairs. The minister of state for Scientific Research is the higher president of NRC.

NRCVision

The NR Chas to correspond to the country's key production and services sectors through the research conducted in different areas of science and technology, scientific consultation and training as well.

NRC Mission

The NRC mission is to conduct basic and applied research within the major fields of interest in order to develop production and services sectors.

Environmental Research Division

Head Of Environmental Research Division

Prof. Dr. Amal SaadEldin Ahmad Hussein

Mission:

To bridge the gap between industrial developments and environmental conservation by supporting cost effective, environmentally recognized and internationally sounded solutions for increased production, waste reduction and environmental conservation. To deliver science based environmental analysis and consultations to support decision making through full integration of representative, precision and standard based analytical procedures. To integrate molecular genetics applications as diagnostic tools in pollution evaluation as well as therapeutic tools in studying climate change adaptation and modifications. To enhance the natural resources conservation and sustainability of use for the prosperity of the current and future generations.

Vision:

Full integration of environmental friendly solutions (blue and green solutions) based on comprehensive understanding of the environmental problems within our community to support the country efforts in mainstreaming of biodiversity conservation. Presenting a successful business model of environmental analysis in different matrices including air, water, soil, sediment and biota 3improving the quality of environmental analysis to enhance quality of life through implementation of the latest recognized analytical techniques and protocols.

We strive to promote:

- Transparency and integrity in all that we do
- Influential leadership through continuous improvements
- Supporting science-based decision making

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Professor above 60

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Main Fields:

Scientific Achievements:

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6. Dr. Mona M. Mansour, Egyptian Petroleum Research Institute, EPRI

Contributed session

Molecular Imprinted Polymers (MIPs): Advanced techniques for recovery of targeted compounds from wastes.

29th.September, 2016

Prof. Hani Ragaie **Prof. Hussien Shafi** **Dr. Hossam Sayour** **Dr. Ihab Adly**

Contributed Session board:

1. **Prof. Dr. Hussien Abdel-Shafy** Water& Wastewater Research, Technology & Pollution Control Department, National Research Center.
2. **Prof. Hani Fikry Ragai** Faculty of Engineering, Electronics and Communications Department, Ain Shams University 1, Elsarayat St., Abassia, 11517, Cairo, Egypt.
3. **Dr. Hossam E. M. Sayour**, Associate Prof. of Bioanalytical Chemistry, Biomedical Chemistry unit, Chemistry and Nutritional Deficiency Disorders Dept., Animal Health Research Institute.
4. **Dr. Ihab Adly** Ph.D. in Electronics and Communications, Department, Faculty of Engineering, British University in Egypt (BUE)
5. **Dr. Mona Mansour,** Egyptian Petroleum Research Institute (EPRI), Egypt

Introduction:

National Innovation System which holds together education, scientific research, and industry to support the local development of the nation and build a future for generations to come. The NIS includes mechanics to draw technological standards of performance, means of cooperation, and strategies for development through research groups in both sectors of education and scientific research. It sets the goal to achieve an infrastructure of state-run scientific research connected with industry, serves the local market needs and the state developmental plans. In consequence it allocates the required investments for advancing science and technology in the country. To develop Sinai, it is essential to encourage the settlement of at least 5 to 6 million inhabitants from the Nile Valley, Delta or New Valley to Sinai. The main required elements of such human settlement are Water, Sanitation and Food Production / Security (irrigation / agriculture). A key idea is to integrate water supply, wastewater treatment and reuse, minimize freshwater consumption. Cultural, climatic and technical constraints relevant for sustainable development in Sinai should be considered. Meanwhile, groundwater should be considered also at a safe and high quality degree for drinking water. Thus, tailoring Water Supply and Sanitation systems to local socio-economic, cultural and local conditions are the key of development.

Objective

The 1st Workshop on *"OPTIMIZING WATER RESOURCES AND WASTEWATER REMEDIATION IN SINAI"* is a special conference focusing on innovative treatment technologies for water, wastewater, sludge and other contaminated waters in Sinai and other remote areas. With this workshop we hope to establish a bridge to deliver technology and innovation between researchers and technical professionals to Sinai. The contributed session aim to bring wealth of information on the issues related to policy making, education and applied technology in water and wastewater practices and will be of interest to all those wishing to gain a state of the art update on such important issues in Sinai. Addressing molecular imprinting technology merits and imprinted polymers uses to capture/recognize everything from macromolecules to inorganic ions. Recognition plays an important role in biological systems and is observed in between receptor- ligand, antigen-antibody, DNA-protein, sugar-lectin, RNA-ribosome, substrate-enzyme etc. The session will highlight advanced techniques for recovery of targeted compounds from wastes and all the fundamental concepts of Water Biotechnology and reuse in Sinai and other remote areas. The overall aims of the event are dissemination, capacity building and strengthening the basic understanding of the concepts of Water / wastewater issue in Sinai.

Suggested Topics:

- Optimizing water Resources;
- Wastewater Treatment and Reuse;
- Simple Technology for wastewater treatment;

- Environmental Risk Assessment;
- Health Hazard Related to Untreated Wastewater;
- Sewage Sludge Treatment;
- Potential use of Sewage Sludge in Agriculture;
- Molecular Imprinted Polymers **(MIPs):** Advanced techniques for recovery of targeted compounds from wastes**.**
- **WSNs** Applications in Environmental Monitoring

The contributed session is the second event on molecular imprinting technology

Long ago Pharaohs believed in eternal life! For future prospects; could the molecular imprinting be the magical key towards better life? The world is living the plastic age. The answer is definitely yes. MIP's would offer smart solutions in the fields of theranostics, food safety, environmental and sensor technology. Molecular Imprinted Polymers (MIPs) have been applied as artificial antibodies, catalysts, sensors, drug assay & delivery tools, and chromatographic separations. Finally, MIP is science goes market upon business analysis based on patents. Dr. Hossam Sayour (this logo designed by Dr. Sayour and made by Eng. Nourhan Agour where new Molecular Biomimetic Research Unit MBRU will be launched in AHRI and soon Egyptian Chapter of Society Molecular Imprinting SMI may be announced too) 1st International Workshop on Biosensors Technology & Molecular Imprinted Polymers: Potential Applications of Theranostics, Food safety and Environment Cairo, Egypt (28-29 April, 2015), Ain Shams University.

Workshop Agenda

Time	Topic	
Wednesday, 28 September 2016		
Chairs	**Session (A): Wastewater Remediation** **Helmy T. El-Zanfaly** **Water Pollution Control Department, National Research Center, Dokki, Cairo, Egypt** **Prof. Dr. Sohair I. Abou-Elela** **Water Pollution Research Department, National Research Center (NRC)** **Mohamed A. El-Khateeb** **Water Pollution Control Department, Environmental Research Division**	
9:00-10:00	**Registration**	**Conference Hall D**
10:00-10:15	**Opening ceremony and welcome remarks Prof. Dr. Mohamed M. Hashim**, Vice President of National Research Center.	**Conference Hall D**
10:15-10:45	**Project achievements** **Prof. Dr. Hussien Abdel-Shafy** Water& Wastewater Research, Technology & Pollution Control Department, National Research Center	**Conference Hall D** **Conference Hall D**
10:45-11:15	**Alternative Technologies for Wastewater Treatment and Reuse in Rural Areas and Small Communities** Prof. Dr. Sohair I. Abou-Elela,Water Pollution Research Department, (NRC)	**Conference Hall D**
11:15 - 11:45	**Wastewater Reuse in Agriculture: The Way for Developing the Economies of the Arid Regions of the Developing Countries** **Prof. Dr. Helmy. T. El-Zanfaly** Water Pollution Control Department, National Research Center, Dokki, Cairo, Egypt	**Conference Hall D**
11:45-12:15	**Coffee Break**	**Reception**
12:15-12:45	**Up-flow Sponge Submerged Biofilm Reactor for Municipal Sewage Treatment**	**Conference Hall D**

	Prof. Dr. Saber A. El-Shafai; Department of Water Pollution Research, NRC	
12:45-13:15	**Low Energy Wastewater Treatment** *M.A. El-Khateeb* Water Pollution Control Department, Environmental Research Division	**Conference Hall D**
Chairs	**Session (B): Water Resources** **Prof. Dr. Helmy El-Zanfaly** Water Pollution Control Department, NRC **Prof. Dr. Hussien Abdel-Shafy** Water& Wastewater Research, Technology & Pollution Control Department, NRC	
13:15-13:45	**Applying Isotope Techniques for the Development of Water Resources in Sinai Peninsula** Prof Dr. **Wafaa Moustafa** Environmental Isotope Hydrology Egyptian Nuclear and Radiological Regulatory Authority	**Conference Hall D**
13:45-14:30	**Recirculation Model for Recovering the Backwashing as Co-Source of Water- A Novel Strategy for Water Management.** **Prof. Dr. Mohamed Shehata** **Water Research &Pollution Control Department, NRC**	**Conference Hall D**
14:30-15:00	**Lunch**	**Reception**
THURSDAY, 28 September 2016		
Chairs	**Session (C): Misalliances - Molecular Imprinted Polymers (MIPs): Advanced techniques for recovery of targeted compounds from wastes** Prof. Dr. Saber A. El-Shafai; Department of Water Pollution Research, NRC **Prof. Dr. Hussien Abdel-Shafy** Water& Wastewater Research, Technology & Pollution Control Department, NRC	
10:00-10:30	**Membrane and Wetlands Technologies for Water and Wastewater Management in Sinai** **Prof. Dr. Hussein I. Abdel-Shafy** Water Research & Pollution Control Dept., National Research Center,	**Conference Hall D**
10:30-11:00	**Benefits and Risks Associated with Urine Use as Fertilizer:**	**Conference Hall D**

	I. Nutrients and Microorganisms **Prof. Dr. Helmy El-Zanfaly** Water Pollution Control Department, NRC	
11:00-11:30	**Groundwater microbiological contamination in Sinai.** Prof Dr. **Aziza Kamel** National Research Center, Cairo, Egypt	**Conference Hall D**
11:30-12:00	**Introduction to WSN's with selected applications.** **Prof. Dr. Hani F. Ragai** Faculty of Engineering, Electronics and Communications Department, Ain Shams University 1, Elsarayat St., Abassia, 11517, Cairo, Egypt	**Conference Hall D**
12:00-12:30	**Coffee Break**	**Reception**
12:30-13:00	**Plastic catchers (artificial polymeric receptors) of pathogenic organisms** **Dr. Hossam E. M. Sayour** Associate Professor of Bioanalytical Chemistry, Biomedical Chemistry unit, Chemistry Dept., Animal Health Research Institute (AHRI)	**Conference Hall D**
13:00- 13:30	**IoT in Aquaponics** **Dr. Ihab Adly**, Ph.D. in Electronics and Communications, Department, Faculty of Engineering, British University in Egypt (BUE)	**Conference Hall D**
13:30-14:00	**Closing ceremony:** **Recommendations and conclusions** **Prof. Hussien Abdel-Shafy** **Water& Wastewater Research, Technology & Pollution Control Department, NRC**	**Conference Hall D**
14:00-14:30	**Lunch**	**Reception**

Session (A): Wastewater Remediation

Alternative Technologies for Wastewater Treatment and Reuse in Rural Areas and Small Communities

Sohair I. Abou-Elela

Water Pollution Research Department, National Research Center, Dokki, Giza, Egypt

Abstract

The problem of sanitation is one of the greatest and pressing environmental problems in developing counties, especially in rural areas and small communities. Egypt like many other developing countries suffers from lack of adequate wastewater collection systems and treatment facilities in rural areas. There are about 3170 villages along with 26540 satellites with a total population of about 40 million capita are not covered by wastewater services. Only 5% of these villages are served with efficient sanitation and hygienic acceptable systems. However, the remaining villages are served with what is called “trenches” which bottomless cesspool. Wastewater by this way is actually practiced in very poor villages causing serious environmental and health impact to human being. Disposal of such waste into surface water without treatment causes serious environmental and health impacts to human being. Accordingly, on-site low cost options or decentralized sanitation systems are now becoming interesting solutions for application and testing. In this paper two different pilots plant decentralized low cost wastewater treatment systems were designed, constructed and put into operation. The first system is an innovative hybrid anaerobic sludge blanket (P-UASP) followed by either multi stage roughing fine filtration sand (MSRFF) or biological aerated filter (BAF).Both the UASB and BAF are packed with innovated none woven polyester fabric (NWPF). The second pilot system is constructed wetland consisted of horizontal and vertical flow basins, and planted with three types of plants. Performances of the tested treatment technologies under different operating conditions were evaluated. The results indicated that all the tested systems proved to be very promising alternatives for low cost decentralized wastewater treatment. They produced a very high quality effluent satisfying the National Regulatory Standards for wastewater reuse and safe disposal. However, the choice of the appropriate technique is governed by many factors such as legal status, land availability, ease of operation, maintenance, capital and operating costs.

Keywords: wastewater treatment, water reuse, rural areas, small communities, UASB, BAF, roughing fine filtration sand

Wastewater Reuse in Agriculture: The Way for Developing the Economies of the Arid Regions of the Developing Countries

H. T. El-Zanfaly
Water Pollution Control Department, National Research Center, Dokki, Cairo, Egypt

Abstract

Choosing the most appropriate technology for wastewater treatment should be based on two issues: affordability and appropriateness that relates to the economic conditions of the community and to the environmental and social conditions, respectively. The community should be able to finance the implementation, operation and maintenance of the system. For a system to be environmentally sustainable, it should ensure the protection of environmental quality, conservation of resources, and the reuse of water. Social aspect mainly relates to factors that can affect the operation and maintenance of the system, and these include local community habits, public acceptance, life style, public health protection, government policy and regulations. The main driving forces for the selection of a treatment technology are performance requirements, site conditions, and wastewater characterization. Proper management of the system helps in protecting public health and local water resources, and avoiding expensive repairs. For widening the base of wastewater reuse in agriculture and to reach the requirements for unrestricted irrigation, there are needs for optimizing wastewater treatment plants performance with a correction program as well as the low cost technology transfer.
Many impediments and challenges concerning wastewater management in developing countries can be overcome by suitable planning and policy implementation.

Keywords*:* Wastewater reuse in developing countries, Guidelines for reuse, health impact, Selection of treatment technology, Sustainability.

Up-flow Sponge Submerged Biofilm Reactor for Municipal Sewage Treatment

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Abstract

An up-flow submerged biofilm reactor packed with sponge was investigated for sewage treatment. The reactor was operated two cycles as single aerobic (1-1 at 3.5 L/L.d HLR and 1-2 at 3.8 L/L.day HLR) and four cycles as single anaerobic/aerobic reactor; 2-1 and 2-2 at low HLR (3.7 and 3.5 L/L.day) and 2-3 and 2-4 at high HLR (5.1 and 5.4 L/L.day). During the aerobic cycles, 50% effluent recycling significantly reduces the system performance except for phosphorous. In case of the anaerobic/aerobic reactor, the effluent recycling, significantly improves system performance at low HLR while at high HLR only phosphorous removal was improved. Excess sludge production was limited to 0.133 g TSS/g COD with better sludge volume index (SVI) in case of anaerobic/aerobic cycles; (54.7 versus 58.5 ml/g).

Keywords

Aerobic, anaerobic/aerobic, Up-flow, submerged biofilm, sponge

INTRODUCTION

Research works on the application of biofilm process for wastewater treatment started by the end of nineteen's century and come in real application by installation of the first trickling filter in 1901. Currently, there is a great interest in the investigation of biofilm process containing innovated synthetic biofilm carriers. The new innovated biofilm carrier made the system more attractive for many decision makers. The aerobic biofilm reactors could be continuous activated sludge biofilm (Clifford et al., 2010) or sequential batch biofilm (Rahimi et al., 2011). The system is operated in vertical flow (Khoshfetrat et

al., 2011) and horizontal flow (Clifford et al., 2010). To enhance nitrogen removal, two integrated biofilm reactors with different ecological zones have been used (Lim and Fox 2011). Also single biofilm reactor was investigated for carbon and nitrogen removal (El-Shafai and Zahid 2013; Clifford et al., 2010). Application of sponge as support for biofilm growth has been used in down-flow hanging sponge reactor which has been used as alternate of the trickling filter (Mahmoud et al., 2011). In this study an Up-flow Sponge Submerged Biofilm (USSB) reactor containing plastic-support sponge was investigated for sewage treatment. The reactor was designed to work as single aerobic and as single anaerobic/aerobic.

MATERIAL AND METHODS

A PVC tube with 14.5 cm inner diameter was used to manufacture a lab-scale reactor with a total volume of 10.5 L. The reactor was divided into three distinctive zones using two perforated discs, Figure 1. The biofilm zone was randomly packed with plastic support sponge as biofilm carrier. Dimensions of the sponge are 1.3× 6.3×1.0 cm while the plastic support (reticulated cylinder) has 6.5 cm length and 1.5 cm diameter. Two air diffusers were used to supply oxygen from air compressor and two valves are used to select operation mode (aerobic or anaerobic/aerobic cycles). Air flow rate was fixed at 1.0-1.5 L/minute by using flow meter and the two valves. The reactor was seeded with 4.4L of activated sludge containing 6.8 g VSS/L. The reactor was continuously fed with sewage at daily Hydraulic Loading Rate of 3.43 L/L for 17 days start-up period then operated for six different operational cycles (Table 1). Influent and treated effluent were collected three times per week and subjected for laboratory analyses according to APHA (2005). Online measurement of dissolved oxygen and temperature was performed using DO meter. Daily flow rate was measured and adjusted using stopwatch and graduated cylinder. Sludge in the clarifier was sampled on disposal and analyzed for mixed liquor suspended solids, sludge volume and sludge volume index (SVI). Data was subjected to One-way ANOVA.

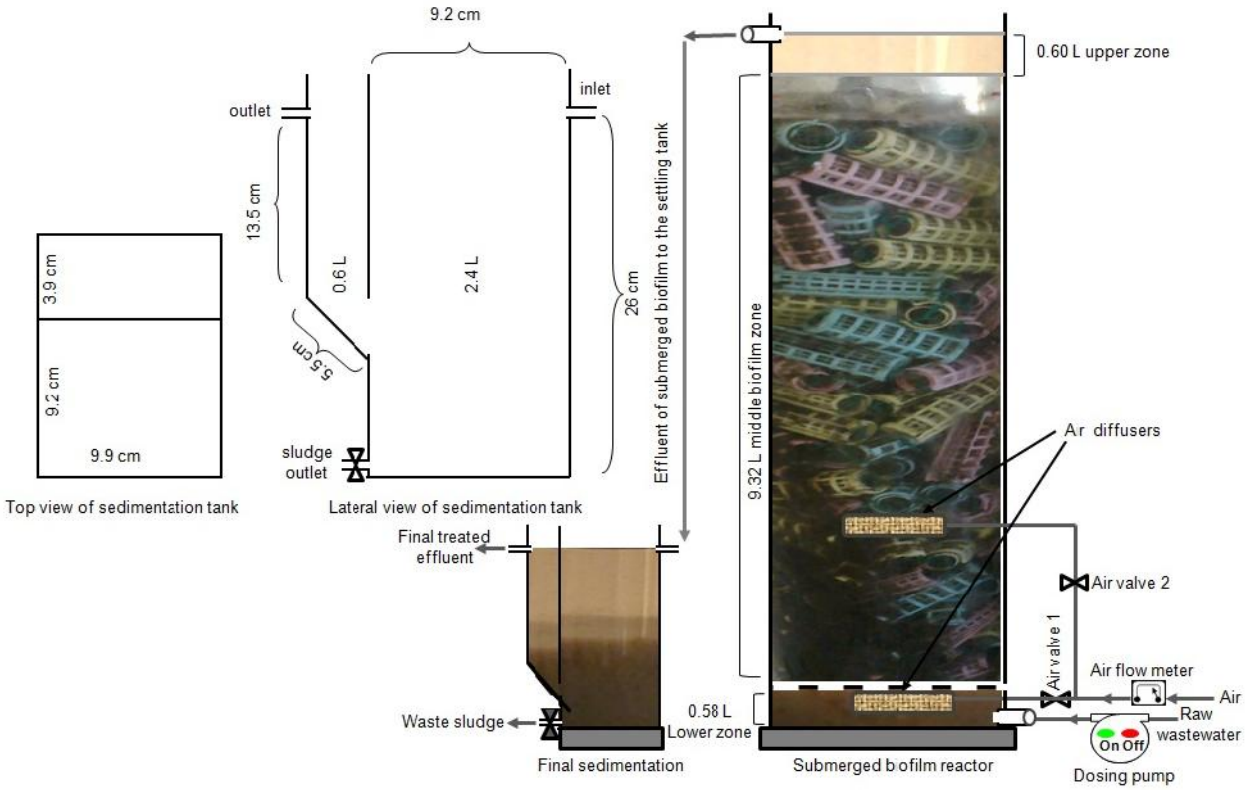

Figure 1: Schematic diagram of the treatment unit

Table 1: Operating conditions during the operational cycles

Item	Aerobic biofilm cycles		Anaerobic/aerobic biofilm cycles			
			Low HLR		High HLR	
Operational cycle	Cycle 1-1	Cycle 1-2	Cycle 2-1	Cycle 2-2	Cycle 2-3	Cycle 2-4
50% effluent recycle	No	Yes	No	Yes	Yes	No
HLR (L/L/day)	3.5±0.3	3.8±0.3	3.7 ±0.4	3.5±0.2	5.1±0.4	5.4±0.2
Theoretical HRT (hrs)	6.9	6.4	6.4	6.9	4.7	4.5
Actual HRT (hrs)	5.8	5.3	5.3	5.7	3.9	3.7
COD loading rate g/L.day	1.53±0.34	1.54±0.33	1.47±0.23	1.24±0.31	1.72±0.34	1.84±0.43
TN loading rate g/L.day	0.18±0.02	0.19±0.03	0.19±0.02	0.16±0.02	0.22±0.02	0.25±0.02

Table 2: Characteristics of the influent wastewater during the operational cycles

Parameter	Unit	Cycle1-1	Cycle1-2	Cycle2-1	Cycle2-2	Cycle2-3	Cycle2-4
Temperature	^{o}C	15-25	22-25	26-36	31-36	33-37	33-37
pH	-	7.6-8.0	7.5-7.8	7.5-7.9	7.5-8.0	7.6-8.1	7.6-7.90
COD	mgO_2/L	438±100	405±76	392±59	359±82	340±65	345±81
Turbidity	NTU	112±48	88±9	97±16	88±20	100±26	96±29
TSS	Mg/L	181±76	191±56	166±55	179±57	115±53	140±88
Ammonia N.	mgN/L	37.9±2.8	35.5±3.9	37.8±2.7	34.5±4.1	33.6±1.9	36.2±7.3
TKN	mgN/L	52.3±4.4	49.3±3.8	51.3±2.8	45.9±5.9	42.4±4.4	46.7±3.8
Total N.	mgN/L	52.4±4.4	49.5±3.8	51.4±2.8	46.0±5.9	42.6±4.4	46.9±3.8
Phosphorus	mgP/L	6.4±0.84	5.70±1.10	5.80±0.89	5.51±1.35	5.06±1.04	5.91±0.63

RESULTS AND DISCUSSION

Characteristics of influent wastewater during the operational cycles are presented in Table 2 while final effluent quality is depicted in Table 3. The effluent quality meets Saudi (Ministerial decree no 304/3, 2006, KSA) and Egyptian (Egyptian Code ECP 501-2005) reuse criteria for unrestricted irrigation. Effluent recycling during the aerobic cycles enhanced ammonification rather than denitrification (Table 3) with significant reduction of ammonia, TKN and TN removal. During the anaerobic/aerobic cycles, the system provided effluent with better quality. The effluent recycling during the anaerobic/aerobic cycles significantly enhanced the treatment performance at low HLR (Table 3) while at high HLR, it has no significant effect. The system produced low sludge with good settling properties. The range of SVI was 50-81 ml/g and 43-61 ml/g during the aerobic and anaerobic/aerobic cycles, respectively. Sludge production was 0.133 gTSS/gCOD on average which is less than the range (0.28-0.56 gTSS/gCOD) reported by Rahimi et al. (2011) and comparable with the value (0.18 g VSS/gCOD) reported by Clifford et al. (2010).

CONCLUSION

The USSB reactor provided effluent with physico-chemical characteristics meet Saudi and Egyptian reuse criteria for unrestricted irrigation. Effluent recycle in the aerobic cycles enhance ammonification while in case of anaerobic/aerobic TN removal was improved. The reactor has little problem regarding intermittent increase in nitrate in the final treated effluent with subsequent reduction in TN removal. However, application of USSB reactor for sewage treatment is potential with respect to good quality effluent and low sludge production with good settling properties.

Table 3: Treatment performance during the aerobic and anaerobic/aerobic cycles

Parameter	Unit	Cycle 1-1	Cycle 1-2	Cycle 2-1	Cycle2-2	Cycle2-3	Cycle2-4
pH	-	7.1-8.1	7.5-8.0	6.4-7.7	7.0-7.9	6.7-7.6	7.3-7.5
COD	mgO_2/L	39.5 ± 13.3^a	43.5 ± 10.2^b	53.7 ± 31.1^a	29.6 ± 12.4^d	20.8 ± 6.4^c	20.0 ± 3.7^c
Turbidity	NTU	5.0 ± 2.9^a	8.7 ± 4.7^b	4.7 ± 3.0^a	3.1 ± 2.8^d	1.7 ± 0.9^c	1.1 ± 0.1^d
TSS	mgO_2/L	6.6 ± 3.2^a	12.0 ± 5.9^b	4.9 ± 3.2^a	4.9 ± 4.0^c	2.1 ± 0.9^c	1.3 ± 0.4^d
Ammonia	mgN/L	4.7 ± 4.9^a	23.1 ± 7.7^b	4.2 ± 4.2^a	1.8 ± 2.8^d	0.4 ± 0.6^c	0.4 ± 0.3^c
Nitrite	mgN/L	4.65 ± 3.07^a	3.88 ± 2.67^b	7.21 ± 7.50^a	0.81 ± 0.87^d	0.30 ± 0.25^c	0.26 ± 0.20^c
Nitrate	mgN/L	18.6 ± 7.0^a	9.2 ± 7.7^b	23.1 ± 16.4^a	7.6 ± 1.7^d	8.0 ± 2.6^c	9.3 ± 2.5^d
TKN	mgN/L	5.9 ± 5.2^a	24.1 ± 7.7^b	5.0 ± 4.9^a	2.7 ± 1.8^d	1.6 ± 0.5^c	1.3 ± 0.5^d
TN	mgN/L	29.1 ± 12.2^a	37.2 ± 7.9^b	35.3 ± 26.9^a	11.1 ± 3.6^d	9.8 ± 3.0^c	10.9 ± 2.9^d
TP	mgP/L	4.59 ± 0.65^a	3.56 ± 0.54^b	4.39 ± 1.03^a	3.40 ± 0.86^b	3.56 ± 1.13^c	4.88 ± 0.99^d

Parameters in the same row with similar superscript letters are non significantly different (p=0.05). Aerobic versus anaerobic/aerobic (1-1 versus 2-1 and 1-2 versus 2-2), non recycling versus recycling (1-1 versus 1-2, 2-1 versus 2-2 and 2-4 versus 2-3) low HLR versus high HLR (2-1 versus 2-4, 2-2 versus 2-3).

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Low Energy Wastewater Treatment

M.A. El-Khateeb

Water Pollution Control Department, Environmental Research Division

Abstract;

Egypt is an arid country facing challenges due to its limited water resources and has reached a state where the quantity of water available is imposing limits on its national economic development. In many cases wastewater treatment plants are operated without optimized devices or measures for processes optimization. However, an optimized system consumes less electrical power, results in reduced maintenance work and increased life time of the operational units. Although, centralized plants are efficient for wastewater treatment, it produces considerable amounts of sludge and they are generally energy and land consuming techniques. Based on an average mix of energy sources, total water and wastewater energy use adds approximately 45 million tons of greenhouse gases annually to the atmosphere. Methane (CH_4) and nitrous oxide (N_2O) are also emitted from wastewater treatment facilities and are particularly harmful because these gases have a higher global warming potential. Energy efficiency improvements at water and wastewater treatment facilities can have high rates of return, and can significantly reduce costs at a facility since energy costs typically constitute 25-30% of the operations and maintenance costs at water & wastewater facilities. What is more, loads are expected to increase by 20% in the next 15 years due to population growth, tightening regulation, growth of the power sector, and in the case of drinking water facilities in certain regions, increased groundwater pumping costs. Different biological treatment processes (i.e. upflow anaerobic sludge blanket (UASB), constructed wetland (CW), etc.,) could be considered as low energy wastewater treatment. These technologies produce good effluent quality with reasonable cost.

Session (B): Water Resources

Applying Isotope Techniques for the Development of Water Resources in Sinai Peninsula

Wafaa Moustafa

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Egyptian Nuclear and Radiological Regulatory Authority

ABSTRACT

Groundwater resources become increasingly important in Egypt, since the demand for fresh water approach the limits of this vital source, especially in the newly reclaimed areas.

The historical importance of Sinai in Egypt is unequaled, beside the fact that it has been a buffer zone protecting the real habitable of Egypt. The developments of Sinai Peninsula is one of the main targets in Egyptian government plans at present by creating many centers of life and attract people to live in wilderness.

Development of the Sinai Peninsula depends on the optimum exploitation of all existing water resources, therefore groundwater in Sinai as natural resources needs a strong and good management planes for the future

The stable environmental isotopes (Oxygen-18 and deuterium) were used as natural tracer in the water cycle to define the recharge sources of groundwater and the mixing between different sources.

Selected area for discussion:-

- Wadi Gharandel lies on the southwestern part of Sinai
- North and East Center Parts of Sinai
- Wadi El-Ain & El-Saghier, Gulf of Aqaba
- Souther part of Sinai Peninsula

Recirculation Model for Recovering the Backwashing as Co-Source of Water- A Novel Strategy for Water Management.

Hussein I. Abdel-Shafy, Mohamed A. El-Khateeb and Mohamed Shehata

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Abstract

In the drinking water treatment plants, the backwashing water of the sand filters consumed about 10% of the total purified drinking water. As Sinai area suffers from stingy water resources, it was important to safe water as much as possible. The present investigation deals with backwashing water of El-Tawteen drinking water treatment plant (Et-DWTP) locates in Quantara Sharq, in Sinai. This plant receives raw water from Ismailia Canal through a huge siphon beneath the Suez Canal Pathway. The Et-DWTP was produces 70,000 m^3 /day and the backwashing water is about 7000 m^3 /day, which is wasted daily and discharged on the land nearby the plant. The wasted water forms huge shallow swamps that threaten the building and construction of the Et-DWTP.

We constructed a compact system consists of three successive units of settling tanks to treat the backwashing water, while the settled particles are to be filtered through sand filter to collect the precipitated alum.

The results of showed analysis of the supernatant of the three successive settling tanks showed remarkable removal of turbidity, suspended solids and aluminum at the rate of 90%, 95% and 23% respectively. The precipitated alum will be further studied for reuse in other purposes. The final results proved that the recovered water could be used as co-source with raw water without any restrictions. This will save about 2.56 million m^3/year of wasted water, to get ready of the small swamps around the Et-DWTP and the recycled alum residues will be additional benefits.

Keywords: Backwashing; Suspended solids*;* Management; Recycling; Recovery;

Membrane and Wetlands Technologies for Water and Wastewater Management in Sinai

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Abstract

The Mediterranean basin is one of the poorest regions in the world in terms of water resources. An increased water consumption rate for irrigation purposes along with a high urban population growth, have had an adverse effect on water resources. In the last decade, several water treatment technologies have been used in the region, but with little success in relation to pathogen removal. This significantly reduces the opportunity to use the treated water for unrestricted irrigation of higher value crops such as vegetables and medicinal plants. This will eliminate the consumption of fresh water. Meanwhile, the scarcity of water in the region stress on the stringent need for the non-conventional water resources including desalination, wastewater reclamation. Treatment of brackish water is also an important issue.

Membrane (MBR) technology has become a key component in water reclamation schemes due to the possibility of providing high quality water, e.g. as particle-free permeate from membrane bioreactors, removal of microbiological contamination and the cost-effective of reclaimed effluents that are needed to boost water recycling applications in target area but also in other regions of the world. It has been used for various specialty treatment applications for nearly 30 years. Membrane costs have declined by an order of magnitude over the past decade, successfully. The MBR process was demonstrated to be cost-effective over conventional water reclamation systems for urban irrigation and water reuse.

There are a number of benefits associated with MBRs compared to conventional wastewater treatment processes. Therefore, excellent effluent quality can be obtained generally suitable for reuse as membranes provide high removals of pathogens including bacteria, protozoa and viruses resulting in excellent physical disinfection.

Water biotechnology is another important key for the treatment of wastewater. The purpose is unrestricted water reuse for non-potable purposes. Several treatment technologies are available to transfer the manmade polluted water to be safe reuse as an additional amount to our water budget.

The objective of the present study is to represent the promising efficiency of MBR and biotechnology for the treatment of water and wastewater as a promising technique. Cleaned water production can be achieved without any hazard pollutants. On the other hand, the treated wastewater can be reused safely for non-potable purposes. A particular implementation in remote and tourism areas is very promising including Sinai area.

Keywords: water and wastewater management, membrane technology, wetlands technology, water reuse, water biotechnology, Sinai area.

Benefits and Risks Associated with Urine Use as Fertilizer:

I. Nutrients and Microorganisms

Prof. Dr. Helmy El-Zanfaly

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In arid and semi-arid areas or seasonally dry zones, irrigation requirements make up to 80-90% the entire demand on natural water resources. The water required for urban water supply is thus small in relative terms. Hence, recycling urban wastewater to urban agricultural soils may bring about a saving in the national water budget of some 10-20% at most. However, reusing urban wastewater within the urban agricultural perimeter may very well cover a substantial portion if not 100% of the local water demand of urban agriculture, and thus contribute to farm based income generation, socio-economic equity and urban food security.

Excreta are a rich source of inorganic plant nutrients such as nitrogen, phosphorus and potassium and organic matter. Each day, human excreta in the order of 30 g of carbon, 10-12 g of nitrogen, 2 g of phosphorus and 3 g of potassium. Most of the organic matter is contained in the faeces, while most of the nitrogen (70-80%) and potassium are contained in urine. Phosphorus is equally distributed between urine and faeces.

Urine can be collected and used separately-such as from urine-separating, non-mixing latrine or from the innovative systems using urine collection. Considering microbial risks, urine from healthy persons is sterile. The infective agents of two infections- *Schistosoma haematobium* and *Leptospira* are shed in urine. The highest risk for the transmission of excreted pathogens via urine probably relates to the possible cross-contamination of urine by the faeces of an infected person in the separating latrine or toilet. Bacteria die-off in urine has been found to be fairly rapid, but viruses apparently have longer survival periods. The potential health risks associated with urine also relate to the shedding of pharmaceuticals consumed by people. It is as yet unknown whether and to what extent such substances are either attenuated or accumulating in soil and whether and to what extent they might cycle back into the food chain through crop uptake.

Keywords: Agricultural value of urine, microbiological safety of urine, risks from urine application.

Groundwater microbiological contamination in Sinai.

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Groundwater plays an essential role in global drinking water supply. In Egypt, Fresh groundwater resources contribute to 20% of the total water resources potential. Egypt is an arid country, having a large hydro geologic potential, with many groundwater aquifers widely distributed throughout the country. Sinai Peninsula has two major sources of water: 1 the renewable flash or rough water from floods and 2 the non-renewable groundwater of the Nubian Aquifer. Weathering is an important natural phenomena controlling contamination of groundwater aquifers. Mineral retention of bacteria in groundwater aquifers has a significant impact on water quality. To date, a large range of bacterial strains or communities from diverse genera have been reported to be able to colonize mineral surfaces. Saprolite, bedrock weathered upper surface, harbors wide members of the division Proteobacteria including pathogenic bacteria such as, bacteria causing gastroenteritis (Escherichia coli, Salmonella, Shigella, Vibrio), other Enterobacteriaceae, soil pathogenic bacteria (Pseudomonas, Acinetobacter), as well as non-parasitic symbiotic nitrogen fixing bacteria. Poorly constructed sewage treatment plants and land uses of sewage wastewater can lead to groundwater contamination close to water supply sources.

At St. Katherine city, South Sinai, groundwater is heavily contaminated by untreated domestic wastewater from sewage. In several studies conducted here, fecal indicators (E.coli, fecal streptococci), as well as, other bacterial pathogens including Salmonella, Shigella and Vibrio species were detected in all monitored wells. Virus persistence in aquifers environment is affected by attachment to the weathered crystalline rock surfaces under favourable conditions, i.e. *p*H and ionic strength (IS) conditions. Subsequently, virus detachments due to perturbation in IS and *p*H, may lead to several outbreaks. Outbreaks due to enteric hepatitis and gastroenteritis causing viruses have been attributed to groundwater contamination from septic tanks. The present study aims to develop and apply a mathematical model to predict virus fate and transport at selected groundwater sites of Sinai, Egypt. It aims also to determine the impact of domestic wastewater percolation on groundwater pollution in Sinai.

Water samples are collected from selected regions of Sinai. Physical, chemical and microbiological characteristics including: fecal indicators (E.coli, enterococci), total coliforms and viruses are studied. The study will establish appropriate setback distances for pumping wells used for domestic and drinking purposes in Sinai. The modeled setback distances will be assessed by experimental measurements in order to ensure safe drinking water supplies from wells. This study will evaluate the minimum requirements for water treatment, in order to ensure a safe drinking water.

Introduction to Wireless Sensor Networks with Selected Applications

Hani Ragai, Mohamed Elnozahi (Fac. of Eng. – Ain Shams University) and Ihab Adly (CEO Sensiphy)

Abstract

A wireless sensor network (WSN) is a spatially distributed autonomous sensors inside a sense field to *monitor* physical or environmental parameters, such as temperature, humidity, pressure, etc. and to cooperatively pass their data through a wireless network to a main observer location. WSNs are sometimes bi-directional, i.e. they can provide *control* of the sense field parameters. Today such networks are used in many environmental, industrial and biomedical applications. Applications include industrial process monitoring and control, machine and structural health monitoring, water quality monitoring...etc. This introductory talk will give an overview on how WSNs are built, deployed and tailored for some specific applications.

Plastic catchers (artificial polymeric receptors) of pathogenic organisms

Dr. Hossam E. M. Sayour

Associate Professor of Bioanalytical Chemistry, Biomedical Chemistry unit, Chemistry Dept., Animal Health Research Institute (AHRI)

Abstract

Molecular Imprinting Polymer (MIP) attracts attention as molecular recognizing artificial polymer corresponding to natural antibodies. MIP has become an important tool in the preparation of artificial and robust recognition materials that are capable of mimicking natural systems. MIPs have been regarded as 'antibody mimics' and have shown clear advantages over real antibodies for sensor technology. 2D molecular imprinting, where the height of the self-assembled monolayer (SAM) at around 2 nm limited the maximum dimensions of the molecule can be imprinted to create template-shaped cavities with memory. In order to match the size of the imprinted molecules with the height of the SAM, we propose a model for 3D molecular imprinting, where the analyte is sequestered within a niche created by the surface roughness. The SAM is assembled on the walls of the niche, forming a 3D pattern of the analyte uniquely molded to its contour. The surfaces with multi-scale roughness was prepared by evaporation of gold onto electropolished (smooth) and unpolished (rough) Si wafers, where the native roughness was found to have a normal distribution centered around 5 and 90 nm respectively. Our studies using molecules ranging in a nanometer scale, from proteins of a few nanometers of viruses to hundreds nanometers of bacteria, showed that when the size of analyte matched the roughness range of the gold surface.

Currently, on-site diagnostic (OSD) and point-of-care (POC) biosensor development are heavily dominated by antibody-dependent immuno-sensors such as the lateral flow immuno-assay. Although antibodies exhibit a high degree of selectivity, any biological recognition element is inherently unstable with limited shelf-life, even when stored under optimum conditions. OSD and POC tests are essential for disease screening and treatment monitoring as part of emergency management. Introduced or naturally occurring pathogens can cause significant disruptions, raise panic in the population, and result in significant economic losses. Cheaper, smaller, and smarter devices for early detection of diseases ultimately lead to rapid containment and corrective action. To this end, there has been extensive research on detection platforms based on genetic or immune techniques

Finding a cure or vaccine for some of the most common or the most deadly viruses such as the influenza , the Ebola virus or FMDV has been a daunting task due to their constant mutation and adaptation to our attempts. Existing therapeutics that lose their effectiveness with time due to mutations have brought about the need to consider alternative treatment approaches. To cater to the ever-increasing demand for new antiviral strategies, a novel approach of using high affinity polymeric receptors prepared by a molecular imprinting technique to “catch” viruses is presented. After three hours of mixing with the template virus, a very significant reduction in infectivity titers was observed with the virus imprinted particles. The virucidal action of the imprinted particles was rapid, dose dependent on virus and polymer concentration and occurred due to specific adsorption. The fabricated nanoparticles displayed remarkable positive anti-viral results that significantly hindered viral infections as compared to the controls.

Surface imprinting of viruses and the novel application of such imprinted materials in infectious disease treatment. The findings represent a significant breakthrough in the field of molecular imprinting and antiviral therapy and we anticipate this work to be a starting point for path-breaking research in the near future.

IoT of Aquaponics

Ihab Adly Hani Ragai Hossam Sayour

Abstract

Experimental smart aquaponic platform was launched which is considered promotive for newly graduate recruits and inducing them for creativity. Sensor interface in fish tank; temperature, pH, dissolved oxygen (DO), ammonia, turbidity, water level, while in plant grow bed; temperature, conductivity (salinity), light. Further innovations for biomimetic sensors based on molecular imprinted polymer for pathogen recognition will be conducted in the near future. Both online web-based monitoring and remote control actuation for feeding, aeration, heater as well as light,....are progressively improved. Commercialization of innovative low cost complete solution for societal development is highest priorities of the ICL's research teams

Sponsors

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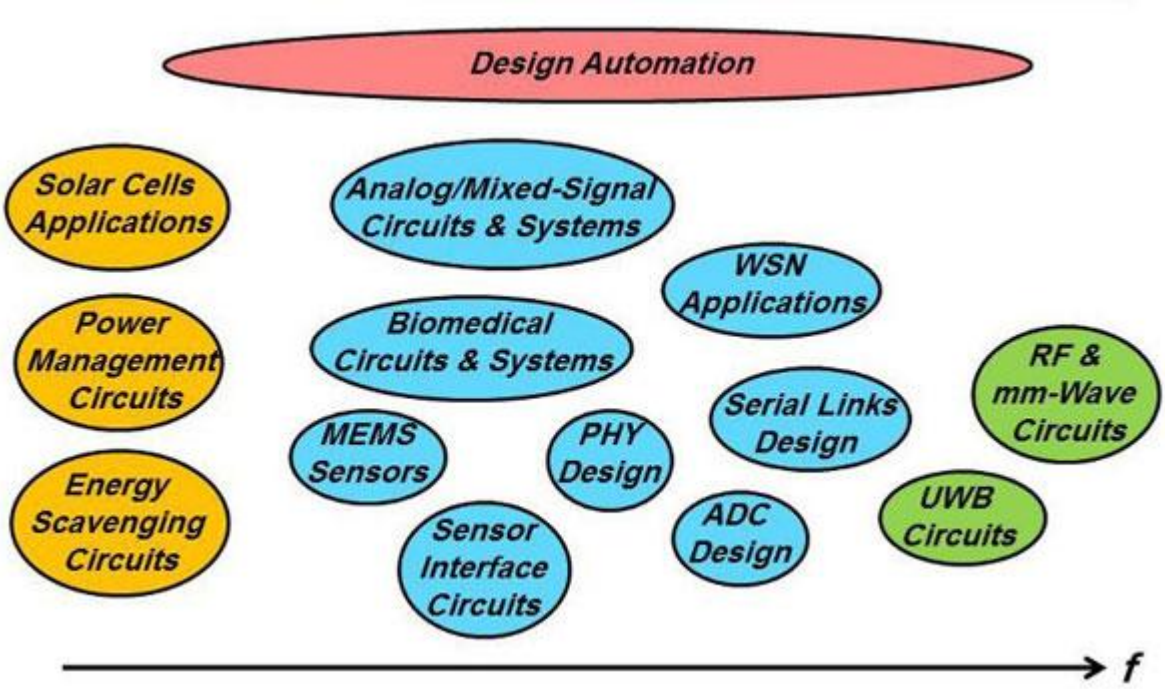
Integrated Circuits Laboratory (ICL) at Ain Shams University is the leading IC Design & Research Lab in Egypt performing advanced research in several VLSI Design and Technology areas. The Integrated Circuits Lab (ICL) was founded in 1981 as part of the Electronics and Communications Engineering Department in the Faculty of Engineering at Ain Shams University. The Integrated Circuits Laboratory fosters a rich interdisciplinary research program on the issues relating to very large scale integration (VLSI). Emphasis in the laboratory is on the VLSI implementation of both analog and digital ASICs for communication systems.

The laboratory has been successful in attracting a talented group of graduate students and in interacting with a talented group of colleagues. Membership in the laboratory is treated as a privilege and members are expected to exhibit a high degree of self- motivation, independence, and creativity. The work in the laboratory contributes actively to the advancement of both teaching and research in its areas of expertise, as can be evidenced from its publications,

courses, and recognitions. Members of the laboratory have also published widely in reputed archival journals and conference records, in addition to several books.



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List of Participating Posters:

1. **Molecular imprinted membrane based on molecular imprinted nanoparticles polymer for separation of polycyclic aromatic hydrocarbons**

H. I. Abdel-Shafy1 H. E. Sayour 2 M. S. M. Mansour

1.Water Research and Pollution Control Department, National Research Centre, Dokki, Cairo, Egypt 2.Biomedical unit, Animal Health Research Institute, Dokki, Cairo, Egypt 3.Analysis and Evaluation Department, Egyptian Petroleum Research Institute

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2. **Improved urea based phosphonte imprinted receptors for glyphosate removal**

Mona S. M. Mansour1, Sudhirkumar Shinde and Börje Sellergren

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3. **Smart Aquaponics Platform**

1.Hani Ragaie 2. Ihab Adly3. Hossam E. M.Sayour 4.Mohamed Elkhatib

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4. **Potentiometric Biomimetic Sensor Based on a Moleculry Imprinted Polymer for Imidocar Deermination in Phrmaceutical Formulation and Veterinary Drug Residue in Food.**

1 Hossam E. M. Sayour 2Rehab tony 3.M Salem.

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2.Cid company, Gizza 3. Faculty of pharmacy Helwan University

5. **Development and characterization of imprinted polymer hydrogels for molecular recognition of the O-polysaccharide of Brucella abortus and Brucella melitensis**

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