7th – 9th May 2012
Kempinski Hotel Ishtar, Dead Sea, Jordan

Jordan International Oil Shale Symposium | 2012

Economic And Environmentally Responsible Oil Shale Development

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بسم الله الرحمن الرحيم

NATURAL RESOURCES AUTHORITY

Ref.No.....

Date .....

Dear Guests,

The Hashemite Kingdom of Jordan represented by the Natural Resources Authority (NRA) along with Colorado School of Mines and the Oil Shale Companies investing in Jordan, are pleased to announce the opening of the 1st International Jordan Oil Shale Symposium, today the 7th May 2012 at the Dead Sea, Jordan.

The NRA for and on behalf of the symposium co-organisers encourage you to learn more about Jordan and use this opportunity to interact with the various professionals in the field. The symposium will lay the seeds, establish a ground for discussing and exploring technologies in the oil shale industry and get the benefit of experience of countries in the commercialization of Oil Shale as fuel and for other investment opportunities.

We extend our warm welcome to the distinguished guests and hope you have a fruitful meeting at the Symposium and also enjoy the hospitalities of the "Hashemite Kingdom of Jordan".

Best Regards,

Director General
M. Alz
Dr. Mousa Alzyoud

THE HASHEMITE KINGDOM OF JORDAN
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Jordan International Oil Shale Symposium 2012

Economic And Environmentally Responsible Oil Shale Development

Main Symposium Day 1
Monday, 7 May 2012

08.30 Registration & morning refreshments

09.30 *National anthem and reading from the Quran*

09.40 Opening remarks from the conference chairman
H.E. Dr. Hisham Khatib, Honorary Vice Chairman, **World Energy Council**, Ex-Minister of Energy, Water and Planning, Government of Jordan

09.45 Official Opening of the JIOSS 2012: welcome speech
HE. Dr. Mousa Ali Alzyoud, Director General, **Natural Resources Authority,** Jordan

09.55 Speech of guest of honor

10.00 **Opening Keynote:**
Future Energy Outlook - Oil Shale In The Energy Mix: State Of Play, Expectations And Constraints
Christoph Frei, Secretary General, **World Energy Council,** UK

10.30 **PANEL DISCUSSION: Exploring The Viability And Future Role Of Oil Shale**
Moderator:
Jim Schmidt, Principle, **PROCOM Consultants P/L**, USA
Discussion Leaders Include:
Khosrow Biglarbigi, President, **INTEK Inc.**, USA
Ziad Jebril Sabra, Director Of Alternative Energy And Energy Efficiency Department**, Ministry Of Energy And Mineral Resources**, Jordan
Hazim M. Al-Ramini, Acting Director of Petroleum & Oil Shale Directorate and Head of Policies & Contracts Division, **Natural Resources Authority**, Jordan

11.10 Morning networking break & refreshments

11.45 **Facilitating Competitive Oil Shale Utilisation Around The World: Successful Legal And Regulatory Frameworks**
Chris Nurse, Managing Director, **Hart Group**, UK

12.10 **PANEL DISCUSSION: Enabling Oil Shale: Schedule For Commercialisation**
Moderator:
Jeremy Boak, Director, Centre for Oil Shale Technology and Research, **Colorado School Of Mines**, USA
Discussion Leaders Include:
Chris Nurse, Managing Director, **Hart Group**, UK
Jamal Alali, General Manager, **Aqaba Petroleum for Oil Shale Co**, Jordan
Senior Representative, **Ministry Of Planning,** Jordan *(invited)*
Thomas Meijssen, General Manager, **Jordan Oil Shale Company B.V. (JOSCO),** Country Chair for **Shell**, Jordan
Martin Amison, Partner, **Trowers & Hamlins LLP**, UK
Harri Mikk, Member Of The Management Board, **Enefit**, Estonia

13.00 **Advance Drilling Technologies For Oil Shale Exploration And Exploitation**
Reiner Homrighausen, Chairman, **Site Group for Services & Well Drilling**, Jordan

13.15 Lunch & networking

	TRACK A	TRACK B
14.15	Opening Remarks Track Chairman: **Ruslan Salikhov** Deputy Chief Engineer Designer, **OJSC ATOMENERGOPROEKT**, Russia	Opening Remarks Track Chairman: **Harri Mikk**, Member Of The Management Board, **Enefit**, Estonia
	1. Resource Assessment	**2. Oil Shale Resources And Opportunities**
14.20	**Well Logging Methods for Oil Shale Assessment** **Jeremy Boak**, Director, Centre for Oil Shale T & R, **Colorado School Of Mines**, USA	**Potential Oil Shale Deposit in Wadi An-Nadiya-Jordan** **Jamal M Alali**, General Manager, **Aqaba Petroleum for Oil Shale Co**, Jordan
14.40	**Characterisation of Jordan's In Situ Oil Shale Resource** **Richard Terres**, Development Manager, **JOSCo**, Jordan	**Lithological Nature of the Maastrichtian Oil Shale in Central Jordan** **Väino Puura**, Professor, **University of Tartu**, Estonia
15.00	**Containment Testing and Hydrology Evaluation for Shell's ICP Oil Shale Projects** **Erik Hansen**, Senior Hydrogeologist, **Shell International Exploration & Production Inc**, USA	**Opportunities and Challenges for the Commercialisation of Oil Shale in the United States** Delivered by **Thomas A. Sladek**, Director, **Ockham Energy Services**, USA on behalf of **Glenn Vawter**, Executive Director, **National Oil Shale Association**, UAE
15.20	Afternoon networking break	
15.40	**Effect Of Oil Shale Composition On Its Calorific Value And Oil Yield** **Jamal O. Jaber**, Associate Professor, Dept. of Mechanical Engineering, **Al-Balqa' Applied University**, Jordan	**Oil-Shale Power Generation Developments In Estonia** **Raine Pajo**, Member Of The Management Board, **Enefit AS**, Estonia
	3. Environment	**4. Strategies and policies**
16.00	**Dry Disposal Of Jordanian Oil Shale Ash As A Reasonable Option To Prevent Impacts To Groundwater: Experiments And Modelling** **Erik Puura**, Director, Institute of Technology, **University of Tartu**, Estonia	**ExxonMobil's In Situ Oil Shale Technology: A Progress Report** **Michael W. Lin**, Senior Research Engineer, Unconventional Resources-Oil Shale, **ExxonMobil Upstream Research Company**, USA
16.20	**Evaluation Of Energy And Water Requirements And CO2 Production For Commercial In-Situ Conversion Process (ICP) Shale Oil Production In The Piceance Basin Of Western Colorado** **James Killen**, Unconventional Fuels Program Manager, **U.S. Department of Energy**, USA *(delivered by video)*	**Assessment Of Plans And Progress On US BLM Oil Shale RD&D Leases In The United States** **Peter M. Crawford**, Director, **INTEK, Inc.**, USA *(delivered by video)*
16.40	**CO2 Sequestration Within Spent Oil Shale From The Al-Lajjun Deposit, Jordan** **Helen Foster**, PhD Student, **University of Durham**, UK	**Can Oil Shale Development be so Hard?** **Jim Schmidt**, Principle, **PROCOM Consultants P/L**, USA
17.00	 **Technical poster gallery opening and networking session** Unveiling the exclusive poster presentations showcasing the latest oil shale solutions. Opportunity to view the posters, meet the authors and build new business contacts during this networking session.	
18.30	Close of symposium day 1	

Main Symposium Day 2, Workshop A & B
Tuesday, 8 May 2012

8.30 Registration & Morning Refreshments

	TRACK A	TRACK B
9.30	Chairman Opening Remarks: **Chris Nurse**, Managing Director, **Hart Group**, UK	Chairman Opening Remarks: **John Gordon**, Manager, Upgrading Dev, **Ceramatec**,
	5. Processing	**6. Commercialisation**
9.35	**A Comparison Of The Reactivity Of Different Jordanian Oil Shales** **Roy Jackson**, Distinguished Professor, Sir John Monash University, Australia	**The Potential For Establishing An Oil Shale Industry In Jordan** **Chris Morgan**, Chief Executive Officer, **Jordan Energy and Mining Ltd, Jordan**
09.55	**Water Use And EROI Of Production Of Upgraded Shale Oil Products Using The Enefit280 Technology** **Indrek Aarna,** Head of R&D, **Enefit,** Estonia	**An Overview Of Enefit Oil And Power Projects In Jordan** **Andres Anijalg**, Project Director, **Enefit,** Jordan
10.15	**Downstream Treatment Of Hydrocarbons Produced From Oil Shale Pyrolysis** **Pierre Allix**, Unconventional Resources R&D, Program Manager, **TOTAL SA,** France	
10.35	**The Alberta Taciuk Process (ATP) Technology For Jordan: Comprehensive Feasibility And Scale Up Factors** **Steven Odut**, Senior Process Engineer, **UMATAC Industrial Processes**, Canada	**Forming New Market Niches: Strategy For Improving The Competitiveness Of Oil Shale Products** **Ruslan Salikhov** Deputy Chief Engineer Designer, **OJSC ATOMENERGOPROEKT**, Russia
10.55	Closing Remarks From The Track Chairman: **Chris Nurse**, Managing Director, **Hart Group**, UK	Closing Remarks From The Track Chairman: **John Gordon**, Manager, Upgrading Dev, **Ceramatec**,

11.00 Morning networking break & refreshments

11.30 **PANEL DISCUSSION: Oil Shale Economics, Investment And Financing Challenges**

Moderator:

Thomas A. Sladek, Director, **Ockham Energy Services**, USA

Discussion Leaders Include:

Emad Dabbass, **Ministry Of Finance**, Jordan

Chris Morgan, CEO, **Jordan Energy and Mining**, Jordan

David Argyle, Chairman, **Global Oil Shale Holdings**, UK

Andres Anijalg, Project Director, **Jordan Oil Shale Energy (JOSE),** Jordan

12.10 **Successfully Managing Environmental & Social Issues In The Oil Shale Industry: Expectations Of The International Community**

Nicky Spooner, Partner, **Citrus Partners LLC**, UK

Mark Mackintosh, Partner, **Citrus Partners LLC**, UK

12.50 **PANEL DISCUSSION: Environmental And Social Dialogue: Aligning Stakeholders From The Off-Set**
Moderator:
Rikki Hrenko, CEO, **Enefit American Oil,** USA
Discussion Leaders Include:
Khosrow Biglarbigi, President, **INTEK, Inc.,** USA
Tamim Suyyagh, Corporate Affairs Manager, **Jordan Oil Shale Company B.V. (JOSCO),** Jordan
Izzat Ahmad Salman Abu Humra, Director, Licensing and Guidance Directorate, **Ministry of Environment,** Jordan
Ali Sobah, **Ministry of Water and Irrigation**, Jordan
HH Ms. Al Shareefa Zain Bint Al Naser, Jordan
Nicky Spooner, Partner, **Citrus Partners LLC**, UK

13.50 Closing Remarks From The Conference Chairman:
HE. Hisham Khatib, Honorary Vice Chairman, **World Energy Council**, Ex-Minister of Energy, Water and Planning, Government of Jordan

13.50 Lunch & networking

14.50 Workshop registration

14.50

WORKSHOP A

Financial Institutions And Oil Shale Development
Workshop Leader:
Khosrow Biglarbigi, President, **INTEK, Inc.,** USA
Participants:
David Argyle, Chairman, **Global Oil Shale Holdings**, UK
Hazim Ramini, Head of Policies & Contracts Division and Petroleum & Oil Shale Directorate, **Natural Resources Authority**, Jordan
Munther Akrough, Managing Director, **Jordan Energy and Mining,** Jordan

16.15 **Close of workshop A**
Afternoon refreshment and networking

17.30

WORKSHOP B

Recent R & D Achievements In Oil Shale, Commercial Petrochemicals And Chemicals Production
Workshop Leader:
Thomas A. Sladek, Director, PhD, **Ockham Energy Services**, USA
Participants:
Ruslan Salikhov Deputy Chief Engineer Designer, **ATOMENERGOPROEKT**, Russia
Jeremy Boak, Director, Center for Oil Shale Technology and Research, **Colorado School Of Mines**, USA
Nicky Spooner, Partner, **Citrus Partners LLC**, UK
Sergei Sabanov, Consultant, **SRK Consulting (UK) Ltd**, UK
Omar Al-Ayed, Associate Professor of Chemical Engineering & Oil Shale Department of Chemical Engineering Faculty of Engineering, **Al-Balqa Applied University**, Jordan
Tõnis Meriste, Environmental Dev Manager, **Eesti Energia AS,** Estonia
Rikki Hrenko, CEO, **Enefit American Oil,** USA
Jaan Habicht, Academic Mentor, **University of Tartu**, Estonia
Tom Fowler, Oil Shale Commercial & Integration Lead, **Shell International Exploration & Production, Inc,** USA

Afternoon refreshment and networking

Close of workshop B

Event Code :	A1205
Event Name :	Jordan International Oil Shale Symposium (JIOSS)
Abstract Code:	JIOSS_156305
Presentation :	Poster
Title :	Professor
First Name :	Miroslav
Last Name :	Vrvic
Job Title :	Head of the Research Group
Company :	Faculty of Chemistry of the University of Belgrade
Email :	mmvchem@sezampro.rs
Phone :	+38163392841
Country :	Country List
Address 1 :	Studentski trg 16
City :	Belgrade
Zip PO Box :	11158/51
Topic Area :	4) Processing
Abstract of presentation rationale:	BENEFICIATION OIL SHALE BY BACTERIAL DEPYRITIZATION AS POSSIBLE GREEN TECHNOLOGY: BIOPROCESSING ON LABORATORY SCALE M.M. Vrvic1-2, J.S. Milic2, V.P. Beskoski2, V. Dragutinovic3, S. Spacic2, D. Vitorovic4 1Faculty of Chemistry, University Belgrade, 2Department of Chemistry IChTM, Belgrade, 3School of Medicine, University of Belgrade, 4SASA, Belgrade-Serbia Amount of reserves of oil shale in Serbia are up to about 6 billion tons (estimated), while the largest deposit (approx. 1/3 of total quantity) for open-pit and underground exploitation is situated in the locality of Aleksinac in East Serbia (not exploited at the moment). Shale from Aleksinac is an immature Oligocene-Miocene lacustrine sediment. The average content of the organic substance in Aleksinac shale is about 20 %, with a dominant share of kerogen (the content of bitumen is less than 5 %). The mineral part comprises about 20 % carbonates, approximately 10 % pyrite and the rest are aluminosilicates. In our lab researches relating to the "quality improvement" of raw shale from Aleksinac that have been made for near 30 years, for depyritization as "non-destructive reagents" we use strains of chemolithoautotrophic thionic bacteria Acidithiobacillus ferrooxidans. In a large number of experimental variations of the "shake flask test technique" the best results have been obtained for depyritization (more than 95%). Combining AFM surface imaging and leaching analysis following bacterial colonisation of oil shale layers demonstrates that an initial attachment to the surface is necessary for the leaching and that later on, once a sufficient concentration of Fe2+ ions in the solution is achieved, cells detach to become free cells, and leaching occurs primarily by the Fe3+. Benefits of the bacterial depyritization are primarily in order to reduce aero pollution and corrosivity, and also this green process must be low cost green bio/technology for biobeneficiation of oil shale.
A short professional biography :	Born in 1952. Graduated Chemistry from the Faculty of Sciences/Chemistry (University of Belgrade, Serbia), in 1975, and received a Doctorate in Chemistry, in 1991, at the same Faculty. In 1977, he was appointed Assistant, Assistant Professor in 1992, Associate Professor in 1997, and Full Professor in 2003, all at the Faculty of Chemistry in Belgrade. Sphere of scientific-research work are biochemical and chemical activity of microorganisms on different substrates, which generated the greatest number of fundamental and applied results.

BENEFICIATION OIL SHALE BY BACTERIAL DEPYRITIZATION AS POSSIBLE GREEN TECHNOLOGY: BIOPROCESSING ON LABORATORY SCALE

Miroslav M. VRVIĆ[1,2], Jelena S. MILIĆ[2], Vladimir P. BEŠKOSKI[2], Vesna DRAGUTINOVIĆ[3], Snežana SPASIĆ[2], Dragomir VITOROVIĆ[4]

[1]Faculty of Chemistry, University of Belgrade, [2]Department of Chemistry ICHTM, University of Belgrade, [3]School of Medicine, University of Belgrade, [4]Serbian Academy of Science, Belgrade, Serbia

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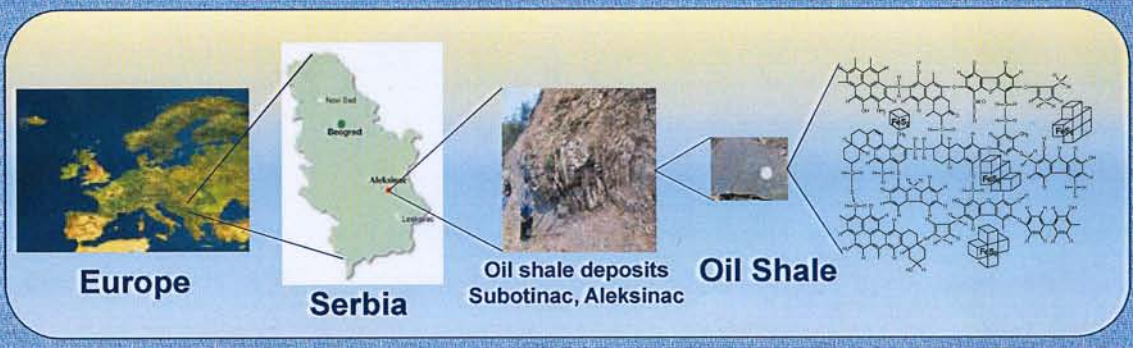
INTRODUCTION

Amount of reserves of oil shale in Serbia are up to about 6 billion tons (estimated), while the largest deposit (approx. 1/3 of total quantity) for open-pit and underground exploitation is situated in the locality of Aleksinac in East Serbia (not exploited at the moment). Shale from Aleksinac is an immature Oligocene-Miocene lacustrine sediment. The average content of the organic substance in Aleksinac shale is about 20 %, with a dominant share of kerogen (the content of bitumen is less than 5 %). The mineral part comprises about 20 % carbonates, approximately 10 % pyrite and the rest are aluminosilicates.



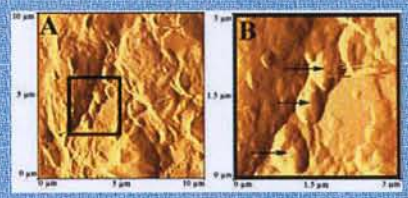
RESULTS AND DISCUSSION

In our lab researches relating to the "quality improvement" of raw shale from Aleksinac that have been made for near 30 years, for depyritization as "non-destructive reagents" we use strains of chemolithoautotrophic thionic bacteria *Acidithiobacillus ferrooxidans*. In a large number of experimental variations of the "shake flask test technique" the best results have been obtained for depyritization (more than 95%). Combining AFM surface imaging and leaching analysis following bacterial colonisation of oil shale layers demonstrates that an initial attachment to the surface is necessary for the leaching and that later on, once a sufficient concentration of Fe^{2+} ions in the solution is achieved, cells detach to become free cells, and leaching occurs primarily by the Fe^{3+}[1-6].

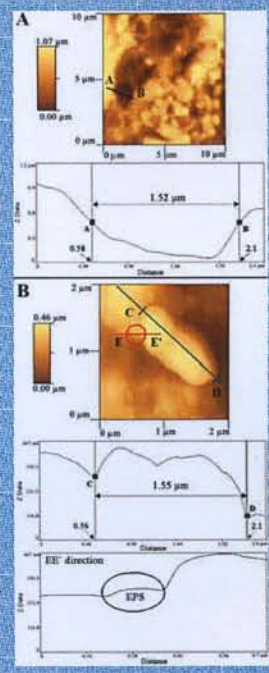
Table 1. Parameters determined at the beginning ("zero-time") and at the end of the three week's bioleaching

	Solid/liquid ratio (the density of the pulp, %[a])							
	1:10 (10)		1:12 (8.3)		1:14 (7.1)		1:17 (5.9)	
Duration of bioleaching (weeks)	0	3	0	3	0	3	0	3
Parameters determined								
pH	2.58	1.29	2.46	1.29	2.42	1.46	2.42	1.50
Biomass (cells/cm³)	10^7	10^7	10^7	10^8	10^7	10^7	10^7	10^8
Soluble iron[b] (% of initial pyrite)	0.29	81.44	0.25	90.38	0.85	75.58	0.26	76.99
Precipitated iron[b] (% of initial pyrite)	4.65	6.37	3.58	4.44	2.78	7.49	3.57	6.27
Bioleached pyrite, cumulative[c] (% of initial pyrite)	4.94	87.81	3.83	94.82	3.63	83.07	3.83	83.26
Residual pyrite in the substrate (% of initial pyrite)	87.19	4.25	95.29	1.79	93.35	3.23	79.02	1.05
Efficiency of bioleaching process[d]	1.2	5.4	1.2	6.6	1.1	5.4	1.0	5.5

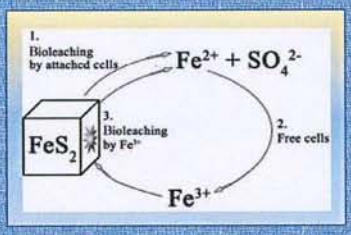
[a] Mass of substrate (g) / Volume of leaching solution (cm³) · 100.
[b] All forms of iron were calculated as pyrite.
[c] Sum of bioleached soluble and precipitated iron.
[d] Ratio of cumulative bioleached pyrite versus pyrite dissolved in the control test.



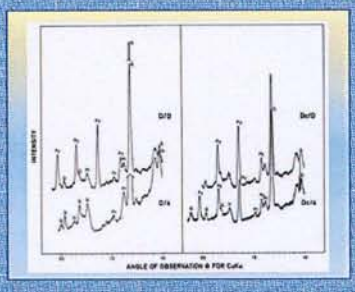
AFM images of At. ferrooxidans B cells attached to oil shale cuttings after 48 h of incubation. Vertical deflection images of AFM scans acquired by contact mode in air. Panel (A) shows an oil shale layer with cells attached to surface defects, and panel (B) represents a close-up view of one cutting, framed on panel (A). The cells are seen as convex ellipsoid shapes, such as the ones indicated by arrows in the topography image in panel (B).



AFM analysis of the oil shale surface after five days of incubation with At. ferrooxidans A. Panel (A) shows a topographic AFM image of the oil shale with one of the pits measured (cross section AB). Panel (B) shows a topographic AFM image of a single At. ferrooxidans A cell with the cell width measurement (cross section CD). In addition, AFM analysis demonstrates the existence of EPS surrounding the cell (cross section EE').



Systematic overview of pyrite bacterial leaching. 1. In the first stage, cells attach to the surface and Fe2+ ions are leached into the solution. 2. In the second stage, the number of free cells increases due to the rise in Fe2+ levels in the solution. 3. In stage 3, bioleaching by Fe3+ ion as an oxidising agent predominates.



X-ray diffraction spectra of the Aleksinac oil shale HCl concentrate, substrates obtained in the experiment with solid to liquid ratio of 1:12. D/0 denotes the inoculated substrate at "zero-time", D/4 after the 4th week; Dc/0 denotes the substrate in control test at "zero-time", Dc/4 after the 4th week. Py-pyrite; Q-quartz; Il-illite; Pl-plagioclase.

CONCLUSION

Benefits of the bacterial depyritization are primarily in order to reduce aero pollution and corrosivity, and also this green process must be low cost green bio/technology for biobeneficiation of oil shale.

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6. J.S. Milić, V.P. Beškoski, D.V. Randjelović, J. Stojanović, M.M. Vrvić, Visualisation of the interaction between *Acidithiobacillus ferrooxidans* and oil shale by atomic force microscopy, J. Min. Metall. Sect. B-Metall. **48** (2012), *DOI: 10.2298/JMMB110923016M*.