



MENU

Results for OPTIMIZATION ... >

Optimization of fat, oil, and grease (FOG) biodegradation using consortium ...

Free Full Text From Publisher 

Export ▾

Add To Marked List ▾

< 1 of 1 >

Optimization of fat, oil, and grease (FOG) biodegradation using consortium of bacteria

By [Alkhatib, MFR](#) (Alkhatib, M. F. R.) ^[1] ; [Nedjai, R](#) (Nedjai, R.) ^[2] ; [Kabbashi, NA](#) (Kabbashi, N. A.) ^[1] ; [Hamdaqa, NFM](#) (Hamdaqa, N. F. M.) ^[1]

Source [INTERNATIONAL JOURNAL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY](#)

[← View Journal Impact](#)

Volume: 23 Issue: 3

DOI: 10.1007/s13762-025-06948-7

Article Number 214

Published JAN 8 2026

Indexed 2026-01-13

Document Type Article

Jump to[↓ Enriched Cited References](#)**Abstract**

This study investigates the potential of a bacterial consortium isolated from palm oil mill effluent (POME) to degrade Fats, Oils, and Grease (FOG). Enrichment techniques were employed to isolate a consortium capable of degrading FOG by through the incorporation of used cooking oil (UCO) into the nutrient media. The consortium, composed of three distinct bacterial strains with FOG-degrading abilities, was screened using a lipolytic activity test on Tween 20 agar media. Results identified consortium X3X4 as the most effective consortium, displaying the highest growth and FOG degradation. Optimization experiments, used a 2-level factorial design to explore the impact of bacterial inoculum concentration (2%, 6%, 10% v/v), oil concentration (1%, 3%, 5% v/v), and pH (6, 7, 8) on FOG biodegradation. Statistical analysis revealed that both oil concentration and bacterial inoculum concentration significantly influenced degradation compared to pH. Consortium X3X4, consisting of the *Micrococcus lylae* strain DSM 20315 and *Corynebacterium aurimucosum* strain, exhibited optimal FOG degradation, achieving 82.7% degradation after 20 days of incubation. From the kinetic analysis, the consortium's μ_{max} and K_s values were calculated as 0.04 h⁻¹ and 4.86% v/v UCO, respectively. This study underscores the efficacy of the bacterial consortium, particularly consortium X3X4, in achieving substantial FOG biodegradation under optimal conditions. The study demonstrates the consortium's potential for wastewater treatment, though it is limited to laboratory-scale experiments. Practical industrial applications will require additional research to address scaling and operational constraints.

Keywords

Author Keywords: FOG; Bacterial consortium; Biodegradation; Used cooking oil

Keywords Plus: CRUDE-OIL; DEGRADATION; BIOREMEDIATION; SOIL

Author Information

Corresponding Address: Alkhatib, M. F. R. (corresponding author)

▼ Int Islamic Univ Malaysia IIUM, Fac Engn, Bioenvironm Engr Res Ctr BERC, Dept Chem Engr & Sustainabil, Kuala Lumpur, Malaysia

E-mail Addresses :
maan@iium.edu.my

Addresses :

¹ Int Islamic Univ Malaysia IIUM, Fac Engr, Bioenvironm
Engr Res Ctr BERC, Dept Chem Engr & Sustainabil, Kuala
Lumpur, Malaysia

² Badji Mokhtar Univ UBMA, Fac Sci, Dept Biol, Annaba
23000, Algeria

E-mail Addresses :

maan@iium.edu.my

Categories/
Classification

Research Areas: Environmental Sciences & Ecology

Web of Science
Categories

[Environmental Sciences](#)

Funding

✓ [View funding text](#)

Funding agency

International Foundation for Science

International Islamic University Malaysia

[+ See more data fields](#)

Journal information

INTERNATIONAL JOURNAL OF ENVIRONMENTAL SCIENCE AND
TECHNOLOGY

← [View Journal Impact](#)

ISSN 1735-1472

eISSN 1735-2630

0.54

Journal
Citation
Indicator™
(2024)

Current Publisher	SPRINGER, ONE NEW YORK PLAZA, SUITE 4600 , NEW YORK, NY 10004, UNITED STATES
Research Areas	Environmental Sciences & Ecology
Web of Science Categories	Environmental Sciences

Citation Network

In Web of Science Core Collection

0 Citations

 [Create citation alert](#)

39

Cited References

[→ View Related Records](#)

How does this document's citation performance compare to peers?

[← Open comparison metrics panel](#)

Data is from InCites Benchmarking & Analytics

Use in Web of Science

0

Last 180 Days

0

Since 2013

[Learn more →](#)

This record is from:

Web of Science Core Collection

- Science Citation Index Expanded (SCI-EXPANDED)

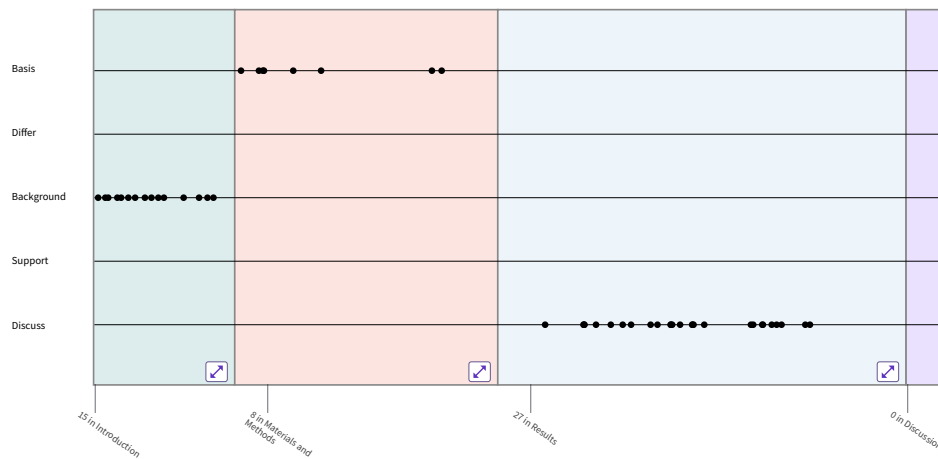
Suggest a correction

If you would like to improve the quality of the data in this record, please [Suggest a correction](#)

39 Cited References

[View as set
of results](#)

Explore



Visualization includes 1 reference(s) not mentioned in the body of the article.

Showing 39 of 39

[First appearance ▾](#)

(from Web of Science Core Collection)

1 Anaerobic co-digestion of fat, oil, and grease (FOG): A review of gas production and process limitations

280
Citations

Long, JH; Aziz, TN; (...); Ducoste, JJ
May 2012
| PROCESS SAFETY AND ENVIRONMENTAL
PROTECTION
90(3), pp.231-245

[Full Text at Publisher](#) ...

Cited in Article: 1

2 Problems, Control, and Treatment of Fat, Oil, and Grease (FOG): A Review

103
References

Husain, IAF; Alkhatib, MF; (...); Hoda, A
Aug 2014 | JOURNAL OF OLEO SCIENCE 63(8),
pp.747-752

[Related records](#)

74
Citations

43
References

[Free Full Text From Publisher](#) ...[Related records](#)

Cited in Article: 1

3 **Rapid degradation of FOG discharged from food industry wastewater by lipolytic fungi as a bioaugmentation application**

11[Citations](#)**48**[References](#)

Witharana, A; Manatunge, J; (...); Jayaweera, M
2018 | ENVIRONMENTAL TECHNOLOGY 39(16),
pp.2062-2072

[Full Text at Publisher](#) ...[Related records](#)

Cited in Article: 1

4 **Isolation of bacterial strain for biodegradation of fats, oil and grease**

7[Citations](#)**0**[References](#)

Alkhatib, MF.; Alam, MZ. and Shabana, HFM.
2015 | Malays J Anal Sci 19(1), pp.138-143

Cited in Article: 1

5 **[Not available]**

[Fan, G](#)

2014

| Biodegradation of fat, oil, and grease (FOG) in wet
wells

University of Alberta

Cited in Article: 1

1[Citation](#)**0**[References](#)

6 **Fat, oil and grease deposits in sewers: Characterisation of deposits and formation mechanisms**

126[Citations](#)**48**[References](#)[Williams, JB; Clarkson, C; \(...\); May, E](#)

Dec 1 2012 | WATER RESEARCH 46(19), pp.6319-
6328

[Full Text at Publisher](#) ...

	Cited in Article: 1	Related records
7	Grease trap construction Weber, M M 1990 U.S. Patent Cited in Article: 1	1 Citation 0 References
8	Bioremediation of Petroleum oil Contaminated Soil and Water Jain, P. K.; Gupta, V. K.; (...); Chauhan, U. K. 2011 Research Journal of Environmental Toxicology 5(1), pp.1-26 Cited in Article: 1	85 Citations 0 References
9	Crude Oil-Contaminated Soil Phytoremediation by Using <i>Cyperus brevifolius</i> (Rottb.) Hassk Basumatary, B; Bordoloi, S and Sarma, HP Jul 2012 WATER AIR AND SOIL POLLUTION 223(6), pp.3373-3383 Full Text at Publisher View Full Text on ProQuest ...	47 Citations 66 References Related records
10	Biodegradation of crude oil by individual bacterial strains and a mixed bacterial consortium Santisi, Santina; Cappello, Simone; (...); Yakimov, Michail M. 2015-06 Brazilian Journal of Microbiology 46(2), pp.377-387 Cited in Article: 1	72 Citations 47 References

- [full_text_page_WOS_link_label](#)
[Free Full Text From Publisher](#)
[View Full Text on ProQuest](#)
 ...
- Cited in Article: 1
- 11 **Characterization of aerobic oil and grease-degrading bacteria in wastewater**
- Nzila, A; Thukair, A; (...); Razzak, SA
 2017 | ENVIRONMENTAL TECHNOLOGY 38(6), pp.661-670
[Full Text at Publisher](#) ...
- Cited in Article: 2
- 12 **Biodegradation of waste grease by *Penicillium chrysogenum* for production of fatty acid**
- Kumari, A; Ahmad, R; (...); Khare, SK
 Feb 2017 | BIORESOURCE TECHNOLOGY 226, pp.31-38
[Full Text at Publisher](#) ...
- Cited in Article: 1
- 13 **Evaluation of native microorganisms for biodegradation of oil and grease in palm oil refinery effluents (From: SciELO Citation Index)**
- Evaluación de microorganismos nativos para la biodegradación de grasas y aceites en efluentes de la refinación de aceite palma**
- Agualimpia, Bayron; Otero, José Vicente and Zafra, German
 2016-03 | Biotecnología Aplicada 33(1), pp.1221-1226
[Full Text from SciELO](#) ...
- Cited in Article: 1
- [Related records](#)
- 25 Citations
- 35 References
- [Related records](#)
- 15 Citations
- 19 References
- [Related records](#)
- 1 Citation
- 37 References
- [Related records](#)

- 14 **Coagulation of Palm Oil Mill Effluent (POME) at high temperature.** 9 Citations
 Ismail, S.; Idris, I.; (...); Ahmad, A. L.
 2014 | Journal of Applied Sciences 14(12), pp.1351-1354
 Asian Network for Scientific Information, Faisalabad
 Cited in Article: 1
- 15 **Fats, roots, oils, and grease (FROG) in Centralized and decentralized systems** 3 Citations
 Ducoste, J J
 2009 | water intelligence online 8
 URL: <https://doi.org/10.2166/9781780403649>
 Cited in Article: 1
- 16 **BIODEGRADATION OF FATS, OIL AND GREASE USING MICROORGANISMS ISOLATED FROM PALM OIL MILL EFFLUENT** 2 Citations
 Al Khatib, MFR; Alqedra, F and Alam, MZ
 Jul 2023 | IIUM ENGINEERING JOURNAL 24(2), pp.1-10
★ Enriched Cited References
 Free Full Text from Publisher ... 22 References
 Cited in Article: 6 Related records
- 17 **EMULSIFICATION AND DEGRADATION OF BUNKER C FUEL OIL BY MICROORGANISMS (From: MEDLINE®)** 65 Citations
 ZAJIC, JE and SUPPLISSON, B
 1972 | BIOTECHNOLOGY AND BIOENGINEERING 14(3), pp.331-+
 Full Text at Publisher ... 12 References
 Cited in Article: 1 Related records

- 18 **Degradation of aromatic petroleum hydrocarbons (BTEX) by a solvent tolerant bacterial consortium.** [11 Citations](#)
[Payel Sarkar, Payel Sarkar; Rai, A. R.; \(...\); Ghosh, S.](#) 2013
 | Journal of Urban and Environmental Engineering (JUEE)
 7(2), pp.274-279
 University of Paraiba, Joao Pessoa
 Cited in Article: 2
[References](#)
- 19 **Towards efficient crude oil degradation by a mixed bacterial consortium** [306 Citations](#)
[Rahman, KSM; Thahira-Rahman, J; \(...\); Banat, IM](#) Dec 2002 | BIORESOURCE TECHNOLOGY 85(3), pp.257-261
[Full Text at Publisher](#)
[Free Submitted Article From Repository](#)
 ... [Related records](#)
 Cited in Article: 1
- 20 **[Not available]** [1 Citation](#)
[Tzirita, M](#) 2012
 | A characterisation of bioaugmentation products for the treatment of waste fats, oils and grease (FOG)
 237
 Cited in Article: 1
[References](#)
- 21 **Bacterial degradation of crude oil by gravimetric analysis** [27 Citations](#)
[Latha, R. and Kalaivani, R.](#) 2012 | Analysis 3(5), pp.2789-2795
 Cited in Article: 2
[References](#)

- 22 **Kinetic study of a bacterial consortium isolated from soil contaminated with crude oil.** **3**
Citations

0
References
- Husain, I. A. F.; Alkhatib, M.; (...); Muyibi, S. A.
2011
| Australian Journal of Basic and Applied Sciences
5(6), pp.925-930
INSInet Publications, Faisalabad
- Cited in Article: 4
- 23 **Strategies to Characterize Fungal Lipases for Applications in Medicine and Dairy Industry** **65**
Citations

107
References
- Gopinath, SCB; Anbu, P; (...); Hilda, A
2013 | BIOMED RESEARCH INTERNATIONAL 2013
- [Free Full Text From Publisher](#) ...
- Cited in Article: 1
- 24 **Characterization of dioxygenases and biosurfactants produced by crude oil degrading soil bacteria** **53**
Citations

43
References
- Muthukamalam, Santhakumar; Sivagangavathi, Sivalingam; (...); Sudha Rani, Sadras
2017-12 | Brazilian Journal of Microbiology 48(4), pp.637-647
- [full_text_page_WOS_link_label](#)
[Free Full Text From Publisher](#)
[View Full Text on ProQuest](#)
- ...
- Cited in Article: 2
- 25 **Microbial biosurfactants: Green alternatives and sustainable solution for augmenting pesticide remediation and management of organic waste** **19**
Citations

183
References
- Markam, SS; Raj, A; (...); Khan, ML
2024
| CURRENT RESEARCH IN MICROBIAL SCIENCES 7

- Free Full Text from Publisher ...
- 26 **Isolation and characteristics of a microbial consortium for effectively degrading phenanthrene**
- Wang, J; Xu, HK and Guo, SH
2007 | PETROLEUM SCIENCE 4(3), pp.68-75
- Free Full Text From Publisher
View Full Text on ProQuest
- ...
- 27 **Biodegradation of crude oil in soil amended with melon shell**
- Abioye, O P.
2009 | AU journal of Technol 13(1), pp.35-38
- Cited in Article: 1
- 28 **Degradation of diesel oil in a polluted soil using *Bacillus subtilis***
- Nwaogu, LA; Onyeze, GOC and Nwabueze, RN
Jun 17 2008
| AFRICAN JOURNAL OF BIOTECHNOLOGY 7(12), pp.1939-1943
- ...
- 29 **Evaluation of the ability of *Micrococcus* sp isolated from Barada river to biodegradation of vegetable oil wastes**
- Alsulaiman, A and Nizam, AA
Feb 2018
| INTERNATIONAL FOOD RESEARCH JOURNAL 25(1), pp.345-350
- Related records
- 42
Citations
- 21
References
- Related records
- 4
Citations
- 0
References
- 30
Citations
- 22
References
- Related records
- 4
Citations
- 27
References

- ...
- Cited in Article: 1
- 30 **Kinetics of indigenous isolated bacteria used for ex-situ bioremediation of petroleum contaminated soil**
- Abbassi, BE and Shquirat, WD
Jul 2008 | WATER AIR AND SOIL POLLUTION 192(1-4), pp.221-226
- Full Text at Publisher View Full Text on ProQuest
- ...
- Cited in Article: 1
- 31 **Bioremediation of crude oil contaminated soils - A black art or an engineering challenge?**
- Benyahia, F; Abdulkarim, M; (...); Hasanain, H
7th World Congress of Chemical Engineering
Jul 2005
| PROCESS SAFETY AND ENVIRONMENTAL PROTECTION
83(B4), pp.364-370
- Full Text at Publisher ...
- Cited in Article: 1
- 32 **[Not available]**
- Abubakar, M
2018
| Bioremediation of vegetable oily ballast wastewater under temperate condition using Antarctic bacteria
Universiti Putra Malaysia
- Cited in Article: 1
- 33 **Effect of glucose on biodegradation of hydrocarbons in crude-oil polluted soil undergoing bioremediation The Asia**
- Peekate Lekiah, P.; Diepiriye Anita, D. and Amadi Mishaal, C.
2023 | J Appl Microbiol 10(1), pp.61-69
- Related records
- 24
Citations
- 17
References
- Related records
- 36
Citations
- 6
References
- Related records
- 1
Citation
- 0
References
- Related records
- 1
Citation
- 0
References

Cited in Article: 1

- 34 **Assessment of crude oil biodegradation in arctic seashore sediments: effects of temperature, salinity, and crude oil concentration** 16 Citations
20 References
- Sharma, P and Schiewer, S
Aug 2016
| ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH
23(15), pp.14881-14888
Full Text at Publisher View Full Text on ProQuest
- ...
- Related records
- 35 **Enzymatic hydrolysis of waste fats, oils and greases (FOGs): Status, prospective, and process intensification alternatives** 56 Citations
178 References
- Baena, A; Orjuela, A; (...); Clark, JH
May 2022
| CHEMICAL ENGINEERING AND PROCESSING-PROCESS INTENSIFICATION
175
Free Full Text From Publisher ...
- Related records
- 36 **Transesterification of Waste Cooking Oil by an Organic Solvent-Tolerant Alkaline Lipase from *Streptomyces* sp CS273** 14 Citations
27 References
- Mander, P; Yoo, HY; (...); Yoo, JC
Feb 2014
| APPLIED BIOCHEMISTRY AND BIOTECHNOLOGY
172(3), pp.1377-1389
Full Text at Publisher View Full Text on ProQuest
- ...
- Related records
- 37 **[Not available]** 1 Citation
- Shuler, ML.; Kargi, F. and DeLisa, M.
2001 | Bioprocess engineering: basic concepts
Pearson, New York City, NY

Cited in Article: 1

0
References

38 [Not available]

Campbell, MK. and Farrell, SO.
2016 | Biochemistry
Cengage Learning

Cited in Article: 1

1
Citation

0
References

ry of marine



© 2025 Clarivate. All rights reserved.

- Legal Center

Privacy Statement

Copyright Notice
- Training Portal

Product Support

Newsletter
- Cookie Policy

Cookie Settings

Data Correction
- Accessibility Help

Terms of Use

Resources

Follow Us

