

Documents

Norazni, N.S.A.^a, Kamaruddin, N.H.M.^b, Yunus, K.N.M.^b, Poharan, A.^a, Azahar, W.N.A.W.^c

Chemical characterization of asphalt binder containing palm oil mill sludge

(2024) *IOP Conference Series: Earth and Environmental Science*, 1347 (1), art. no. 012053, .

DOI: 10.1088/1755-1315/1347/1/012053

^a Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn Malaysia, Johor, Batu Pahat, 86400, Malaysia

^b Advanced Pavement Material Focus Group, Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn Malaysia, Johor, Batu Pahat, 86400, Malaysia

^c Civil Engineering Department, International Islamic University of Malaysia, P.O. Box 10, Kuala Lumpur, 50728, Malaysia

Abstract

Modification of asphalt binder is continuously explored due to its escalating cost and increasing demand for this non-renewable material. As an alternative, the potential of waste materials was assessed for use as a modifier in asphalt binder. This study focuses on investigating the physical properties of unmodified and modified asphalt binders, with a specific emphasis on the chemical properties of palm oil mill sludge (POMS) modified asphalt binder. In this investigation, the control sample employed was PEN 60/70, while the POMS content ranged from 0% to 5% with an increment of 1%. Penetration and softening point tests were conducted on the POMS-modified binder, and Fourier Transform Infrared Spectroscopy (FTIR) tests were conducted to assess the chemical properties of both un-aged and short-term aged asphalt binders. The results revealed that the addition of POMS modified the asphalt binder by inducing a softening effect proportional to the percentage of POMS. The aging process was found to be significantly delayed in the POMS-modified binder with increasing POMS content. © 2024 Published under licence by IOP Publishing Ltd.

References

- Shahbandeh, M
(2023) *Production Volume of Palm Oil Worldwide from 2012/13 to 2022/23*, Retrieved on August 27, 2023 from
- Mosunmola, A G., Olatunde, S. K.
Palm oil mill effluent (POME) and its pollution potentials: A biodegradable prevalence
(2020) *Pollut. Eff. Control*, 8, p. 15.
- Osman, N A., Ujang, F A., Roslan, A, Ibrahim, M F., Hassan, M A.
The effect of palm oil mill effluent final discharge on the characteristics of *Pennisetum purpureum*
(2020) *Sci Rep*, 10 (1), p. 10.
- Camargo, I G. D. N., Hofko, B., Mirwald, J., Grothe, H.
Effect of thermal and oxidative aging on asphalt binders rheology and chemical composition
(2020) *Materials*, 13 (1), p. 21.
- Hofko, B, Porot, L, Cannone, A F., Paolikakos, L, Huber, L, Lu, X, Mollehauer, K, Grothe, H
FTIR spectral analysis of bituminous binders: reproducibility and impact of ageing temperature
(2018) *Mater. Struct*, 51, p. 116.
- Mahssin, Z Y., Abdul Hassan, N, Yaacob, H, Puteh, M H., Ismail, C R., Putra Jaya, R, Mohammad Zainol, M, Mahmud, M Z. H.
Converting Biomass into Bio-Asphalt-A Review
(2021) *IOP Conf Series: Earth and Environmental Science*, 682, p. 012066.
- Hainin, M R., Jaya, R P., Ali Akbar, N A., Jayanti, D S., Yusoff, N I. M.
Influence of palm oil fuel ash as a modifier on bitumen to improve aging resistance

(2014) *J. Eng. Res*, 2, pp. 34-46.

- Xin, T W. L., Han, M T., Tai, G, Hasan, M R. M., Kassim, M A., Sukiran, M A.
Characterizations of Bio-Asphalt Incorporating Palm Bio-Oil From Waste Empty Fruit Bunches
(2022) *J Oil Palm Res*, 35, pp. 45-57.
- Hofko, B, Alavi, M Z., Grothe, H, Jones, D, Harvey, J
Repeatability and sensitivity of FTIR ATR spectral analysis methods for bituminous binders
(2017) *Mater. Struct. Constr*, 50, p. 115.
- Yan, Y Y., Yang, M., Ran, X, Zou Zhou, L., Guo, M.
Application of infrared spectroscopy in prediction of asphalt aging time history and fatigue life
(2020) *Coatings*, 10 (1), p. 18.
- (2013) *Standard test method for penetration of bituminous materials West Conshohocken, PA United State ASTM International*, 1, p. 4.
- (2014) *Standard test method for softening point of bitumen (ring-and-ball apparatus) West Conshohocken PA United State: ASTM International*,
- Bowers, B F., Huang, B, Shu, X, Miller, B C.
Investigation of Reclaimed Asphalt Pavement blending efficiency through GPC and FTIR
(2014) *Constr. Build. Mater*, 50, pp. 517-523.
- Rasman, M, Hassan, N A., Hainin, M R., Putra Jaya, R, Haryati, Y, Shukry, N A. M., Abdullah, M E., Kamaruddin, N H. M.
Engineering properties of bitumen modified with bio-oil
(2018) *MATEC Web of Conferences*, 250, p. 02003.
- Alattieh, S A., Al-Khateeb, G G., Zeiada, W, Shanableh, A
Performance assessment of bio-modified asphalt binder using extracted bio oil from date seeds waste
(2020) *Int. J Syst. Assur. Eng Man*, 11, pp. 1260-1270.
- Xin, T W. L., Han, M T., Tai, G, Hasan, M R. M., Kassim, M A., Sukiran, M A.
Characterisations of Bio-Asphalt Incorporating Palm Bio-Oil From Waste Empty Fruit Bunches
(2022) *J of Oil Palm Res*, 35, pp. 45-57.
- Yu, J., Guo, Y., Peng, L., Guo, F., Yu, H.
Rejuvenating effect of soft bitumen, liquid surfactant, and bio-rejuvenator on artificial aged asphalt
(2020) *Constr. Build. Mater*, 254, p. 111.
- Hamzah, M O., Shahadan, Z
Effects of Aging on the Physical, Rheological and Chemical Properties of Virgin Bitumen Incorporating Recovered Reclaimed Asphalt Pavement Binder
(2011) *Aust. J. Basic Appl. Sci*, 5, pp. 1323-1331.

Correspondence Address

Kamaruddin N.H.M.; Advanced Pavement Material Focus Group, Johor, Malaysia; email: hidayahk@uthm.edu.my

Publisher: Institute of Physics

Conference name: 7th International Conference on Civil and Environmental Engineering for Sustainability, IConCEES 2023

Conference date: 9 October 2023 through 10 October 2023

Conference code: 201663

ISSN: 17551307

Language of Original Document: English

Abbreviated Source Title: IOP Conf. Ser. Earth Environ. Sci.

2-s2.0-85201807661

Document Type: Conference Paper

Publication Stage: Final

Source: Scopus

ELSEVIER

Copyright © 2024 Elsevier B.V. All rights reserved. Scopus® is a registered trademark of Elsevier B.V.

 **RELX Group™**