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journal homepage: [www.elsevier.com/locate/matpr](http://www.elsevier.com/locate/matpr)Prevalence of antibiotic resistance in *E. coli* in leachateNurul Syazana Azman<sup>a</sup>, Nazira Mahmud<sup>a,b</sup>, Hajar Fauzan Ahmad<sup>a,b</sup>, Mohd Fazli Farida Asras<sup>a,b</sup>, Noor Faizul Hadry Nordin<sup>c</sup>, Nurul Shakila Khalid<sup>d</sup>, Nurul 'Azyyati Sabri<sup>a,b,\*</sup><sup>a</sup> Faculty of Industrial Sciences and Technology, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang, Pahang, Malaysia<sup>b</sup> Group of Environment, Microbiology and Bioprocessing (GERMS), Lebuhraya Tun Razak, 26300 Gambang, Pahang, Malaysia<sup>c</sup> International Institute for Halal Research and Training, International Islamic University Malaysia, Jln. Gombak 53100, Selangor Darul Ehsan, Malaysia<sup>d</sup> Faculty of Architecture, Planning and Surveying, Universiti Teknologi MARA, Selangor Branch, Puncak Alam, Malaysia

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## ABSTRACT

Landfill is one of the common practices for the disposal of municipal solid waste and may include possible contaminants such as antibiotics and heavy metals. The leachate produced from landfill has the potential to become a reservoir of antibiotic residues and heavy metals, leading to the dissemination of antibiotic resistance to the nearby environment. Not only that, enteric bacteria like *Escherichia coli* (*E. coli*) may be exposed to these contaminants. *E. coli* tended to survive in such stressful conditions due to the activation of the stress response. Therefore, this study was conducted to investigate the antibiotic susceptibility of *E. coli* in leachate. The *E. coli* was isolated in a landfill in Jabor, Kuantan, Pahang from three sampling points which were garbage hill, leachate pond, and river. The concentration of heavy metals was analyzed using ICP-MS while the antibiotic susceptibility test was performed using the disc diffusion method. Four out of six parameters measured have exceeded the standard permitted range where TSS was 110–580 mg/mL, BOD was 28–176 mg/mL, COD was 447–5100 mg/mL and NH<sub>3</sub>-N was 9–22 mg/mL. There were five elements (chromium, zinc, copper, manganese, and iron) were detected in leachate where the concentration of iron was the highest (0.158 ± 0.0203–2.287 ± 0.0706 mg/mL) among all metals measured. Besides, the colonies of *E. coli* were successfully isolated from each sampling point. In this study, all isolated *E. coli* from garbage hill and leachate pond show resistance towards three antibiotics tested (sulfamethoxazole, tetracycline, and erythromycin). However, isolated *E. coli* from the river shows intermediate sensitivity to sulfamethoxazole but is resistant to tetracycline and erythromycin. Based on the results, we can conclude that the landfill has the potential to retain pollutants such as TSS, COD, BOD, NH<sub>3</sub>-N, and antibiotic resistance even though the concentration of heavy metals decreased and meet the standard permitted limit. It shows that the landfill and leachates may act as an important reservoir of heavy metals and antibiotic resistance and potentially affect the environment.

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## 1. Introduction

Landfill is one of the common practices for the disposal of municipal solid waste and may include possible contaminants such as antibiotics and heavy metals [1,19]. Globally, approximately 350 million tonnes of MSW are dumped in landfills annually, with millions of cubic metres of leachate being discharged into the surrounding area [22]. According to the report from the Malaysian

Investment Development Authority, the population in Malaysia was rapidly growing and this would generate a massive amount of solid waste which is estimated to be 38,427 metric tonnes per day where 82.5% would dispose of in landfills. By 2022, the amount of MSW collected per year would be 14 million metric tonnes. Leachate produces from the landfill usually contains a wide range of hazardous pollutants including antibiotic residues and heavy metals [23]. Poorly, these substances can contribute to the occurrences of antibiotic resistance which possibly accumulated in the environment (Wang et al., 2015a). The lack of good management of the use and disposal of antibiotics becomes a possible factor that con-

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